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How and why do Quality Circles work for General Practitioners - a realist approach

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Disclosure of interest

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Abstract

Objectives: To understand how and why general practitioners in quality circles (QC) reflect on and improve routine practice over time. To provide practical guidance for participants and facilitators to implement and for policy makers to organise this complex social intervention.

Design: A theory-driven mixed method

Setting: Primary health care

Method: We collected data in four stages to develop and refine the programme theory of QCs: 1) co-inquiry with Swiss and European stakeholders to develop a preliminary programme theory; 2) realist review with systematic searches in MEDLINE, Embase, PsycINFO, and CINHAL (1980-2020) to extend the preliminary programme theory; 3) programme refinement through interviews with participants, facilitators, tutors and managers of quality circles; 4) consolidation through interviews and iterative searches for theories enabling us to strengthen the programme theory.

Sources of data: The co-inquiry comprised 3 interviews and 3 focus groups with 50 European experts. From the literature search we included 108 papers to develop the literature-based programme theory. In stage 3, we used data from 40 participants gathered in 6 interviews and 2 focus groups to refine the programme theory. In stage 4, five interviewees from different health care systems consolidated our programme theory.

Result: Requirements for successful QCs are governmental trust in GPs' abilities to deliver quality improvement, training, access to educational material and performance data, protected time, and financial resources. Group dynamics strongly influence success; facilitators should ensure participants exchange knowledge and generate new concepts in a safe environment. Peer interaction promotes professional development and psychological well-being. With repetition, participants gain confidence to put their new concepts into practice.

Conclusion: QCs can improve practice, promote professional development, and psychological well-

being given adequate professional and administrative support.

Strengths and limitations of this study

- To our knowledge, this is the first published research that explains how and why general practitioners participating in quality circles may improve standard practice and their psychological well-being over time.
- The findings can be used to inform practice and policy decisions.
- The resulting theory relies on the detail and depth of the reports in the literature and the veracity and adequacy of the information participants revealed in interviews and focus groups.
- To mitigate the risk of selection bias if researchers choose underlying theories and synthesise them ad hoc, we used stakeholders' mental model and programme documentation as our framework for analysis.

Introduction

Quality circles (QCs) are made up of 6–12 health care professionals who regularly meet to reflect on and improve their standard practice. The terms Practice Based Small Group Work, Peer Review Group, Problem Based Small Group Learning, Practice Based Research Group, Quality Circle, Continuous Medical Education (CME) Group, and Continuous Professional Development (CPD) Group were used interchangeably and varied among countries. The labels suggest the basic, original intent of the group. We decided to use the umbrella term Quality Circle to describe all of them.[1] In the UK and Europe, QC are commonly used by general practitioners (GPs) for continuous professional development (CPD). The focus of discussion is usually a critical evaluation of an aspect of quality which participants themselves identify as important to them. GPs seek to improve the quality of their care by linking evidence to practice, learning to deal with uncertainty, discussing and reflecting on practice issues.[2] Participation in QCs can raise self-esteem create a sense of belonging and improve psychological well-being in GPs.[1] QCs may be especially helpful in crisis situations like the current Covid-19 pandemic, where working continuously under high pressure can undermine the professionalism and mental health of GPs.[3]

QCs can improve prescription patterns and diagnostic habits, whilst enhancing professional development and psychological well-being, but the results of randomized controlled trials are inconsistent and offer only limited behavioural explanations for these positive effects. As a complex social intervention, QCs combine didactic methods like brainstorming and reflective thinking with quality improvement (QI) techniques like audit and feedback or purposeful use of local experts. Their activities must be tailored to address local problems in primary health care (PHC) that participants want to solve.[4 5] Our understanding of QCs is incomplete, and we need to learn more about these complex social interventions and their context-dependent outcomes and effects. This study seeks to clarify the contexts in which QCs are conducted, when they change GP behaviour and improve psychological well-being and why. We intended to develop a programme theory for QCs that explains

how and why they work, with the aim of creating a common language and understanding, [6 7] to engage stakeholders in discussions about improving QC processes in a participatory way and prepare the ground for further empirical testing.[8 9] Our end goal was to develop an initial set of policy recommendations for setting up optimal QC processes and maintaining them.[10-12]

Methods

A project protocol was registered with PROSPERO (CRD42013004826) and published in 2013.[5]

We answered our research question in four stages. In stage one, we conducted a co-inquiry with stakeholders on QCs from Switzerland and other European countries, in which we narrowed the research question and provided a preliminary programme theory. In stage two, we synthesised evidence from a literature review and built a literature-based programme theory. In stage three, we collected evidence from interviews and focus groups with QC participants, facilitators, tutors, and managers and refined the programme theory. In stage four we consolidated our work, integrating interview data with participants across Europe and examining existing theories.

We conducted this research between 2013 and 2020, when the first author (AR) was completing his DPhil (PhD) project at the University of Oxford. AR's thesis research engaged key Swiss and European experts and stakeholders at all stages; these were QC participants, facilitators, tutors, managers, and policy makers. The different players shared their perspectives when we developed the research questions, methods and analysis, and when we considered the implications of the results.

Pawson and Tilley's realist logic was used to analyse the collected data because this form of analysis addressed the complexity of QCs as an intervention.[13 14] We sought to provide an in-depth explanation of QCs that showed how mutual learning in a social context improves standard practice and raises professional self-esteem, and increases well-being. The realist approach examines causal explanations of outcomes and then expresses them in their simplest form: context (C) 'triggers' or 'activates' a mechanism (M) that produces an outcome (O). These context-mechanism-outcome

(CMO) configurations are 'mini' theories situated within a programme theory.[15] As we develop CMO configurations, we can more clearly see the contexts that produce desired outcomes. Once we identify these contexts, we can more easily select activities to change a given context to match our desired outcome.

Ethics Approval

The project was approved by the Central University Research Ethics Committee in Oxford (MSD-IDREC-C1-2015-002); it fulfilled the requirements of informed consent: handling of personal information and confidentiality conformed to the operational principles of the Declaration of Helsinki and adhered to the Belmont Report principles mandating respect for persons, beneficence, and justice.

Stage one: the co-inquiry

From May to December 2013, we consulted with stakeholders and experts from Switzerland and with the European Society of Quality and Safety in Family Medicine (EQuiP). They shared their perspectives on our research questions and helped us construct a mental model of QCs function. For characteristics of participants, see supplemental material 1. We also collected information from QC programme documentation and training materials, extracting QC aims, detailed objectives, and roles. This preliminary programme theory built the framework for our realist review.

Stage two: realist review

Searching for evidence

Our search strategy was informed by an earlier scoping review that reported on the intentions and benefits, historical development, and spread of QCs.[1]. In collaboration with a librarian, we refined our search strategy, combining terminology like 'Programme', 'Quality Improvement,' and 'Group'

terms with a PHC search filter.[16] We ran the search in Medline, EMBASE, PsycINFO, and CINHAL, without language restrictions (supplemental material 2) from 1974, to reflect the emergence of QCs in 1974, at McMaster, Canada, and in 1979 at the University of Nijmegen, the Netherlands. We conducted the search in October 2013 and updated it in December 2020. We broadened the search by examining citations in reference lists and Web of Science and searched manually for closely related papers (kinship papers) that had contextual features and theoretical background similar to those found in the referring studies. [5]

Searching for theories

In principle, any theory that explained QCs was a candidate for our realist review, including those from psychology, social, or economic sciences. We first identified key components of QCs; these were theories that described groups, their dynamics within organisations, and the role of the facilitator. We searched for theories about motivation, learning, and behaviour change to inform professional development and improve quality of care. After this search we had identified 52 threads of theories across several levels. Since the overlapping theories were complex, we deviated from the original protocol and used the preliminary programme theory (stage one) as an organising framework.

Selecting articles

Criteria for inclusion were: 1) the studies focused on small group work, 2) took place in the PHC setting, and 3) had a quantitative or qualitative outcome. We managed search results in EndnoteX8. SM and JH each assessed half of the retrieved papers and AR examined them all. The authors resolved disagreements through discussion. AR updated the search and included papers published from November 2013 to December 2020. GW checked the process paper selection and interpretation of the new data.

We appraised the relevance and rigour of each paper's contribution. Data were relevant if they helped us understand a specific element or thread of theory in the larger programme theory. Threads of theory were rigorous if they met three explanatory criteria: consilience (the theory accounts for most of the data), simplicity (the theory is straightforward, without exceptions) and analogy (the theory relates to already known principles).[15 17 18]

Analysis and synthesis of the data

We created a data extraction framework from the preliminary programme theory and implemented it in Microsoft Excel. For each study, we extracted data on mechanisms, contexts, and outcomes (Table 1).[10] At least two authors (AR, SM, or JH) reviewed extracted data and all authors reviewed the analysis and interpretation.

Table 1 Data analysis process throughout the study

Step	Description of the analytical step
One	We collected data on the following key elements of QCs: ➢ Outcomes ➢ Participant characteristics: who was doing what and why? ➢ Activities: what was being done and why? ➢ Implementation context: where and how were QCs implemented? ➢ Patterns of outcomes over time or intermediate outcomes.
Two	Outcomes: each intermediate outcome, or final outcome received a new code.
Three	To identify the components of CMO configurations, we linked activities to intermediate outcomes, or final outcomes, and noted any corresponding contextual features and mechanisms that were mentioned.
Four	We linked activities to outcomes and sought explanation for when and why they had these outcomes (if the source mentioned context or underlying reasoning or mechanism) and then built CMO configurations.
Five	We categorised and ordered the CMO configurations to create a chain of outcomes and explained how CMO configurations related to each other.
Six	We compared and contrasted patterns identified in different sources.

Seven	We formulated, revised, and consolidated the programme theory foundation of quality circles.

Initially, for each paper, we extracted components of context along with descriptions of mechanisms that led to an outcome. We summarised these configurations into descriptions of interaction between context and mechanisms to either facilitate or constrain QCs. Since papers were often closely related, we grouped them based on their kinship, which helped us look for and confirm CMO configurations between papers within the same (family) study. We iteratively arranged and rearranged the CMO configurations, moving between the papers, their data, and families, and built semi-predictable patterns of outcomes (demi-regularities) to develop the programme theory (see supplemental material 3).

Stage three: refining the programme theory

AR conducted interviews and focus groups to refine and test the configuration, interpretation, and underlying mechanisms of each CMO configuration and its relative position/contribution to the programme theory.[19]

We invited a broad range of participants to participate in interviews, including experts and stakeholders from stage one, so we could capture a range of professional backgrounds and roles. Those we invited included tutors who train QC facilitators, facilitators who guide small groups, participating GPs, and QC managers.[20 21] We applied the concepts of data saturation and stopped collecting data when additional information added no further relevant evidence. None of the invited participants declined. Throughout the process, we reflected critically on assumptions that AR or participants might have made during the interviews or focus groups.[20] AR conducted six 30–60-minute interviews in Swiss German between March and May 2015. After explaining the literature-based programme theory in plain words, AR offered contrasting options for participants to discuss and then asked them to share their understanding of the underlying reasoning for QC interactions.

In April 2015, during an EQuiP conference, we held two focus group sessions with GPs from over 19 European countries. Participants were given written descriptions of the emerging programme theory, phrased as conditional clauses that did not suggest mechanisms. During the focus group, participants were asked if and how much they agreed with the statements, and then the group discussed whether and why parts of the programme would or would not work in certain contexts. We summarise the characteristics of interview and focus group participants in supplemental material 4.

Stage four: consolidating the programme theory

To consolidate the programme theory, AR invited representatives from countries with different PHC provision systems to a one-hour online interview to discuss the ways that different professional associations, institutional settings, and other contexts affect QC outcomes.[21] Participant characteristics are summarised in supplemental material 5.

We then compared and contrasted this emerging programme theory with formal theories to explain intermediate and final QC outcomes. Formal theories capture a programme theory's underlying mechanisms and explain how its threads weave into patterns across different disciplines. Programme theories that are based on formal, existing, theories may also provide better explanations of phenomena than those that are not.[7] Our candidate formal theories came from four sources: the scoping review; [5] the realist review; theories described by interviewees; and theories identified during iterative searches when we were looking for and testing possible mechanisms. We chose theories with the highest level of explanatory coherence, based on the three criteria of consilience, simplicity, and analogy.[17 18]

Results

Stage one: the co-inquiry

50 QC experts and stakeholders narrowed the research question and provided data in three interviews and three focus groups, and also provided programme documentation and training materials. The interviews and focus groups sessions took place after the meetings of professional associations (Swiss Society of General Internal Medicine). This co-inquiry resulted in the following preliminary programme: 6–12 health-care professionals meet regularly to reflect on and improve their standard practice, employing didactic methods and QI techniques to identify gaps in their knowledge. Two fundamental concepts shape QCs from the beginning. The first is the cycle of learning, or QI, and the second is the social context in which the group functions. We have described in detail the CMO configurations we developed in this stage in supplemental material 6.

Stage two: realist review

Our search strategy returned 2,812 results (Figure 1), out of which AR, JH, and SM assessed 73 papers. An update in December 2020 yielded 35 more papers.

Figure 1. Paper flow realist review

The literature mainly covered QCs in which GPs participated. We found 24 relevant articles about German QCs, 12 about Dutch QCs, and two about Swiss QC; 10 papers were about CME groups in Canada and Scotland, 6 about a QC research project in Norway, 3 about QCs on osteoporosis in Canada, and 5 about the Drug Education Project in Sweden, Norway, the Netherlands and Slovakia; 6 papers covered QC projects in England, Austria, Belgium and France; 5 other relevant papers were from South Africa, the US (Hawaii and California), New Zealand, and Australia. We categorised these papers into groups to clarify their kinship network, including an underlying trial, common themes, common contexts like geographical area, and common methods of organising QCs (e.g., papers that tested similar didactic methods or similar QI tools in QCs).

Study designs varied by research question. Our search returned 5 study protocols, 2 case series, 14 before-and-after studies, 13 controlled before-and-after studies, 9 randomised controlled trials, nine cluster randomised controlled trials, 12 surveys and 9 qualitative research papers that used data from interviews or focus groups. Few papers studied the performance of well-established QCs; data were often limited to interventions in newly formed groups. In pre-existing QCs (German, Dutch, or Norwegian trials), researchers introduced their own interventions on prescription or test-ordering patterns rather than studying interventions chosen and designed by the QC group. For full details of study characteristics, see supplemental material 7. We present the literature-based programme theory and supporting quotations from the literature in supplemental material 8. The data we retrieved from the update search did not change our CMO configurations or programme theory.

Stage three: the refined programme theory

We used data from 40 participants, collected during six interviews and two focus group sessions held at the EQuiP meeting in Fischingen, Switzerland. For each CMO configuration, we tested its configuration, interpretation, underlying mechanism, and time relationship to others. We refined the wording of six CMO configurations and added three new configurations that linked the chains of outcomes. See supplemental material 9 for the resulting intermediate programme theory and supporting quotations and data from focus group sessions.

Stage four: consolidating the programme theory

We consolidated the intermediate programme theory and explored its contextual layers during interviews with participants from five European countries. Interviewees provided rich data and detailed descriptions about what they deemed necessary preconditions for successful QCs and added an additional CMO configuration (1b 'being embedded in a QI system'). For supporting quotations during these interviews, see supplemental material 10. Figure 2 shows the final CMO configurations of the consolidated programme theory (iteratively developed from stages one to four).

To further consolidate the programme theory, we used our candidate formal theories we found during the research process. Some theories about organisational context, groups, learning, knowledge exchange, development of innovations and their implementation were relevant. Some CMO configurations fit well with, or are directly supported by, existing theories, whilst others seem to clarify how existing theories work when they are applied to QCs. Table 2 summarises the theories and their corresponding CMO configurations.

Figure 2. Consolidated programme theory on quality circles

Table 2. CMO configurations from the programme theory and their relationships to existing theories

Theory	Explanation of relationships	CMO configurations in the programme theory (Figure 2)
Receptive capacity of an organisation [22 23]	Theories about the organisational setting elucidate the mechanisms by which organisations help or hinder quality circles in their work. Quality circles should be embedded in a system that provides training in QI and promotes it by providing explicit knowledge, valuing tacit knowledge, and ensuring that groups have competent facilitators. These features are part of an organisation's receptive capacity: how well it values, integrates, and uses new external knowledge.	CMO configuration 1 b-c
The PARiHS framework (Promoting Action on Research Implementation in Health Services)[24]	The PARiHS framework suggests that three elements must be in place before quality circles can successfully implement innovations: 1) explicit or implicit knowledge, including quality circle members' interpretations of that knowledge; 2) the context, which must stimulate use and evaluation of new knowledge; and 3) facilitation, which should meet professional standards to support the process of change.	CMO configuration 1 b
Self-determination theory[25]	Self-Determination Theory suggests that GPs are motivated to participate in quality circles if they feel that the quality circle will satisfy their basic needs for competence, social bonding, and autonomy.	CMO configurations 1 a, 1 c, 2 a-c, 3 b, 4 b and 4 e
Theories about groups [26-30]	Theories about groups and facilitation describe how groups form and norm their rules, a prerequisite for building an environment of trust in which participants can exchange ideas and thoughts. The knowledge and capacity of the group may be greater than the sum of the average of each individual's capacity. When participants share their knowledge and incorporate all perspectives, they can collectively solve problems more efficiently than they could alone.	CMO configurations 2 b-d, 3 a-c, 4 c and 4 g
Social learning theory [31 32]	Social learning theory frames learning as an active cognitive process of perception and thinking in a social context like quality circles. Participants learn by observing and imitating peers. They also learn from the responses they receive, or expect to receive, when they try something new or avoid unrewarding actions. Learning depends much on individual expectations and feelings of competence to carry tasks. Organisational factors that lend support to learners, e.g., by giving access to learning material, incentives or rewards, improve the process.	CMO configuration 3 f

Adult-learning theories[33]	Adult-learning theories suggest that adults are highly motivated: they learn things that are immediately useful to them, and prefer to do so in a self-directed, task-oriented, experience-based manner.	CMO configurations 1 c, 2 b and 3 b-d
Experience-based learning[34 35]	GPs prefer experiential learning, in which experience is the starting point. Reflecting on an experience enables GPs to restructure their knowledge. They turn insights gained from experience into knowledge and transfer them to other situations. They actively experiment with the new knowledge, and then report their experiences back to the group.	CMO configurations 3 b- e
Transformative learning theory [36 37]	Transformative learning begins with cognitive dissonance, a negative emotional state triggered by conflicting perceptions. Generally, people want to reduce discordant feelings. In the safe environment of a quality circle, cognitive dissonance prompts GPs to reflect on and accept new arguments or revise their old ones to resolve their internal conflict.	CMO configurations 3 e and 4 g
Social interdependence theory [38 39]	Social interdependence theory explains why groups may work together towards a common goal. When quality circle participants realise that they will only achieve their own goals if their peers achieve theirs, this creates a positive interdependence, which encourages participants to reassure and support each other in pursuit of those goals. Positive interdependence improves psychological well-being and raises self-esteem through cooperation and mutual appreciation.	CMO configurations 4 a and 4 c
Knowledge-creation theory [40-42]	Knowledge-creation theories describe the process by which implicit knowledge becomes explicit when participants relate and combine their experiences with other explicit knowledge like evidence-based information, generating new concepts that participants integrate into their everyday clinical practice.	CMO configurations 1 b, 3 c, 4 c, e, g
Theory of planned behaviour[43 44]	The theory of planned behaviour describes how intentions can change behaviour: if the new behaviour makes sense, others approve and it feels easy enough to change.	CMO configuration 4 f
Automaticity [45]	There are theories that support the argument that quality circles are much more successful when they repeatedly implement new knowledge, giving participants the opportunity to build confidence in innovation and their quality circle skills.	CMO configurations 5 a-b

Discussion

Summary of the consolidated programme theory

The most important contextual requirements for successful QCs are governmental trust in the ability of GPs to deliver QI and appropriate professional and administrative support for QC work. Professional support includes training in QI techniques, easy access to teaching materials, and trustworthy personalised performance data. Administrative support includes providing protected time, an appropriate venue, and financial resources for meetings. If QC groups are to be successful, participants must feel that they have a say in their CPD and QI work, but the additional workload from participating in QCs must be manageable.

Several factors in QCs influence practitioner performance. QC members and their group dynamics are at the core of the process. Facilitators help participants build social bonds and mutual trust so that the QC becomes a safe environment that fosters open discussions and where participants link insights to everyday practice, manage uncertainty, and develop their professional role. Members reflect on personal experiences, add information from relevant sources, including evidence-based information and personal performance data, and then develop new ideas and concepts to improve their practice. With skilful facilitation, participants work towards a common goal and test their new ideas in the group, knowing that success depends on the individual member contributions. The QC process raises self-esteem and fosters psychological well-being. QI is cyclical, so putting innovations into practice is a continuous and repetitive process that increases participants' confidence in their innovation and QI skills with each repetition.

How the programme theory contributes to our understanding of QCs and relates to existing QC literature

Our understanding that QCs should be embedded in a system of QI that values, integrates, and uses new external knowledge aligns with the existing literature.[23 46] Health systems should provide training in QI tools and give access to trustworthy data (explicit knowledge) that help participants identify their own learning needs (CMO configuration 1 b-c and 3 e in Figure 2). [22 47-50]

Our research confirmed that well-functioning groups are essential to the QC process. The group's capacity for problem-solving surpasses the ability of individual when members share and pool their experiences and views [29 48]. Supportive facilitation in a non-threatening environment of mutual trust eases learning in the group and opens possibilities for sharing, creating and integrating new knowledge.[23 48 51-53] Trust implies that participants operate on the basis of equality and mutual respect, according to the principle of benevolence, when they take risks and participate actively in the group (CMO configurations 1 c, 2 b 3 a-c, 4 c and 4 g in Figure 2).[26 54]

We had several insights that had not been reported in current QC literature. Cognitive dissonance, like conflicting attitudes, beliefs or behaviours that create unease, is a mechanism that compels GPs to reflect on, accept, and adopt new reasoning to resolve inner conflict. According to our interview data, GPs can risk doing this in a QC group where they feel safe and confident, a process described in educational literature (CMO configurations 3 e and 4 g in Figure 2).[55-59]

Our data show that reflecting on an experience enables GPs to restructure their knowledge for transfer to other situations. When they share knowledge and experience, they can validate their clinical reasoning and thus integrate tacit and explicit knowledge and develop professional values like integrity and empathy; this process is recognised in the literature on psychology of learning as important to professional development.[60 61] Explicit knowledge can be easily expressed through

language or in writing because it is factual, e.g., evidence-based information, or a measurement of practice performance; whereas implicit or tacit knowledge is embodied in the knowledge or skills that a GP accumulates through experience but may find difficult to communicate.[62] CMO configurations 3 b-e, 4 g, and 5 a (in Figure 2) show GPs' need for tangible experiences and repeated attempts to absorb new knowledge.[37]

According to our data, the mechanism of positive interdependence explained how and why collective or social learning can flourish and create a sense of ownership in QCs. When QC participants realise that they will only achieve their own goals if their peers achieve theirs, they are encouraged to reassure and support each other. Peers create new ideas and the cooperation and mutual appreciation that results improves their psychological well-being, increases their self-esteem, and may reduce their risk of burnout (CMO configurations 4 a and 4 c, e in Figure 2).[1 39 63-65]

Participants relate and combine their experiences with other explicit knowledge and generate new concepts or improve quality of care — a process described in business literature as knowledge creation.[40-42 60 66-68] A key function of QCs is to merge familiar knowledge, local context, and personal experience with evidence-based knowledge and extend this from the micro view of single-patient care to a wider view of the whole system (CMO configurations 3 c, 4 e, 4 g and 5 g in Figure 2).

The literature, data from the realist review, and our interview data together suggest that participants may change their behaviour if it makes sense to do so, if others approve, and if change is not too demanding.[69] But to embed these behaviour changes in everyday practice, the QC processes must be repeated, especially during the phase when GPs are implementing new knowledge,[70 71] (CMO configurations 4 f, 5 a and 5 b in Figure 2).

Implications for policy and practice

Based on our findings, we summarised the recommendations for organising and performing QCs to increase the likelihood that GPs successfully improve the quality of their work (Figure 3). Each

recommendation is based on one or more CMO configurations. Not all recommendations will apply to every QC. These recommendations should be considered as a form of decision support that QCs can draw on to determine if action is needed in their specific circumstances.

Figure 3. Recommendations and principles for organising successful quality circles

The QC process and its implications are summarised as an infographic in supplemental material 11.

Limitations

These realist approaches have two major limitations. First, the resulting theory relies on the detail and depth of the reports we identified in our literature review. To ensure we searched broadly, we looked for related reports and papers (kinship papers) including qualitative papers and evaluations that discussed different aspects of the research project and proposed other possible explanations for their findings. Our results also depend on the veracity and adequacy of the information participants revealed in interviews. To check the consistency and accuracy of this data, we relied upon sequential interviews to refine and consolidate our programme theory, step-by-step, as it emerged and interviewed groups of people with different perspectives (QC participants, facilitators, tutors, organisers and managers) to ensure our CMO configurations were adequate and clear. To mitigate the risk of social desirability bias, AR carefully posed neutral interview questions and tried to avoid embedding assumptions in his questions.

Second, the realist approach carries the risk of selection bias if researchers choose underlying theories and synthesise them ad hoc. To mitigate this risk, we used stakeholders' mental model, programme documentation, and training material for facilitators to build the preliminary programme theory that served as our framework for analysis.

Future research

Future researchers can build on this programme theory to design, implement and evaluate new QC interventions. We encourage researchers to test our programme theory to confirm, refute or refine it for specific settings and/or professional groups.

Conclusion

Our consolidated programme theory explains how QCs can improve practice, foster professional development, and increase psychological well-being among participants. Group dynamics are at the core of the process. Facilitators help participants exchange knowledge in a safe environment where they generate new concepts to improve their practice. With repetition, QC participants gain confidence in their QI skills and put their innovations into practice. The requirements for successful QCs are 1) governmental trust in GPs' abilities to deliver QI and appropriate support like professional facilitation, 2) training in QI techniques, 3) access to educational material and personal performance data; 4) granting protected time, appropriate venues, and financial resources for QC group members.

Author Contributions

AR performed the research as part of formal postgraduate studies (DPhil Programme in Evidence-Based Health Care, University of Oxford, Oxford, UK). SM and JH supervised the development of the research and actively participated in the review process (eligibility, selection, data extraction followed by discussions). GW, as AR's main supervisor, provided important input regarding the methodology and supervised the whole research process. All authors critically reviewed the text, assisted with editing read and approved the final manuscript. GW, SM and JH contributed independently to this project from their academic and methodological experience.

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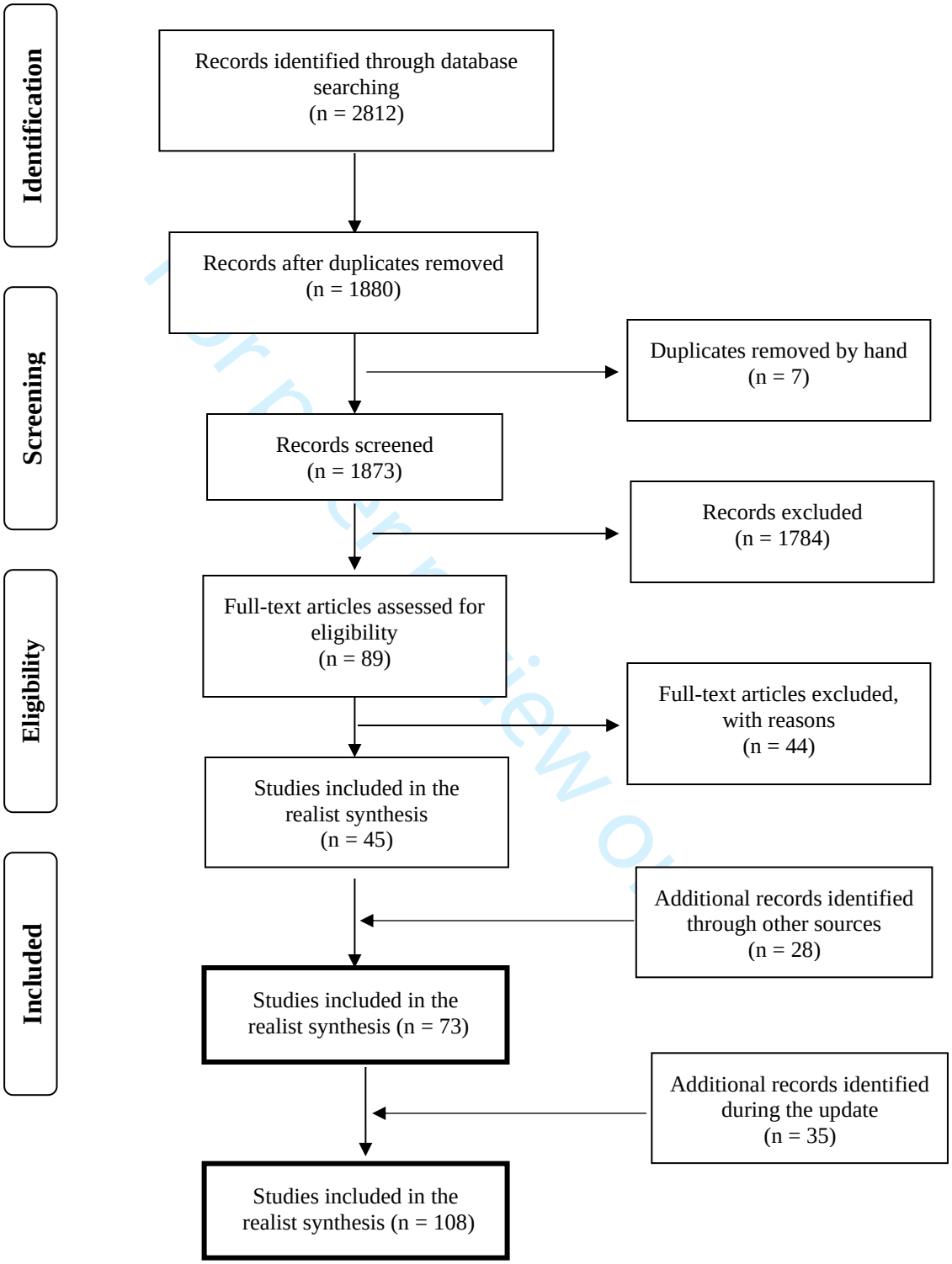

Identification
Screening
Eligibility
Included
Records identified through database searching (n = 2812)
Records after duplicates removed (n = 1880)
Duplicates removed by hand (n = 7)
Records screened (n = 1873)
Records excluded (n = 1784)
Full-text articles assessed for eligibility (n = 89)
Full-text articles excluded, with reasons (n = 44)
Studies included in the realist synthesis (n = 45)
Additional records identified through other sources (n = 28)
Studies included in the realist synthesis (n = 73)
Additional records identified during the update (n = 35)
Studies included in the realist synthesis (n = 108)

1 Preconditions

(a) 'Need for autonomy and obligation'
If the administration at national level, or at the level of health insurance companies, entrusts GPs with QI and autonomy (so they can decide how to implement it) (C), then GPs might participate in QCs (O) because they feel they can take on the responsibility and make a difference (M).

(b) 'Being embedded in a QI system'
If QCs are embedded in a QI system (an organisation that negotiates and signs contracts with governmental bodies or health insurance companies, trains and supervises facilitators, provides courses on QI in PHC and easy access to educational material, timely data on practice performance, and protects participants' time and space) (C), then participants will take on responsibility and work purposefully (O) because they feel supported, empowered, and able to meet expectations (M).

(c) 'Feeling they have a say'
If an organisation (e.g., a physician network organisation) has a decentralised policy that encourages use of local knowledge (C), then the QC takes on tasks (O) because members feel that they have a say in QI in their practice (M).

(d) 'Participants know what to expect'
If the introductory workshop teaches the principles of QI in PHC and illustrates how QCs work (C), then potential members may be more willing to join QCs (O) because they know what to expect and feel that they can meet expectations (M).

2 Establishing the group

(a) 'Sharing similar needs'
If the administration at the organisational level of QCs provides support for training facilitators, data gathering, provision of evidence-based information, and the administration protects participants' time and space and offers CME points and small financial incentives to them (C), then participants will meet in groups to exchange ideas (O) because GPs prefer learning in QCs (M). Support generates positive expectations among participants (M) and GPs believe that QC meetings with their peers will be useful (M).

(b) 'Need for relatedness'
If a regular group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g., introduces people to each other, opens discussions and clarifies and summarises statements (C), then group members will get to know each other and decide on rules that they are willing to follow, building a safe environment based on trust (O) because members want to be among and to interact with equals (M).

(c) 'Need for autonomy and control'
If the group chooses its own topics and facilitator (C), then its members will feel they own the QC (O) because their need for autonomy - a feeling of being in control of their own behaviour - is satisfied (M).

(d) 'Size of the group affects communication'
If the group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with each other and follow all conversations (M).

(e) 'Variety of characters stimulates reflection – cognitive dissonance'
If members of the group have individual character traits and describe different professional experiences but accept each other's views (C), then they can learn from each other (O) because individual attitudes and behaviours will contrast with the knowledge of their peers and cause cognitive dissonance (a negative emotional state triggered by conflicting perceptions) that makes them reflect on their way of working (M).

(f) 'strong cognitive dissonance threatens self-image'
If the cognitive dissonance individuals feel when they integrate new knowledge is too strong (C), then they may disrupt group dynamics and halt the QC process (O) because it poses a threat to their self-image and they fear losing their professional identity (M).

3 Learning environment

(a) 'Feeling safe and not vulnerable'
If participants trust each other (C), then they can describe how they work and admit what they do not know (O), because they feel safe rather than vulnerable (M).

(b) 'Need for competence and self-actualisation'
If the facilitator supports participants and encourages them to share their stories and experiences in a safe environment (e.g., by encouraging interactive responses) through discussions and by summarising statements,
(C) then participants will become involved and share their positive experiences and failures (O) because they want to improve their professional competence (M), gain professional confidence (M), and fulfil their professional potential (M).

(c) 'Previous knowledge is activated'
If participants exchange case stories and experiences whilst actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by relating their own relevant stories (O) because the process activates knowledge they already possess (M).

(d) 'Immediate relevance for the practice'
If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O) because they can connect it to their everyday work and put it to immediate use (M).

(e) 'Cognitive dissonance'
If participants discuss and reflect on their work processes (e.g., based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance that makes them reconsider their own way of working (M).

(f) 'Social learning'
If the facilitator uses purposeful didactic techniques (e.g., brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection on the work process (C), then the group will create a learning environment that promotes knowledge exchange (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

4 Adapting, creating, and testing new knowledge

(a) 'Positive interdependence between the administration at national level and GPs'
If the administration at the national level requires continuous QC activities (C), then QCs will negotiate priorities and design creative solutions (O) because the tension between autonomy and obligation spurs the group to act and negotiate to reach a common goal (M).

(b) 'Threat to professional autonomy'
If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and fear they lack autonomy in their clinical role (M).

(c) 'Positive interdependence among group members'
If participants maintain a learning environment based on trust that promotes the exchange of knowledge, assisted by facilitators who use professional techniques (e.g., contentious discussion, reaching consensus and role play) (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as similar, and so act and negotiate cooperatively to achieve a common goal (M).

(d) 'Identifying and removing barriers to change'
If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O) because participants help each other develop strategies to identify and overcome these barriers (M).

(e) 'Need for competence, autonomy and relatedness'
If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility, and stewardship (O) because their need for competence (being able to achieve specific objectives) is fulfilled (M), autonomy (a feeling of being in control of their own behaviour) (M), and relatedness (a sense of connection to a larger group) (M).

(f) 'Intention to change'
If participants announce their intention to change (C), then they are more likely to implement the change (O) because they and others in the group all think it is a good idea and believe they can carry it through (M).

(g) 'Testing new knowledge'
If participants validate and test new knowledge in a QC, moderated by a skilled facilitator in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M).

5 Repeating the process

(a) 'Gaining confidence in an innovation'
If the group repeatedly practises implementing and adjusting to an innovation (C), then its members trust their own competence and turn the innovation into a habit (O) because successful outcomes increase their confidence in their abilities (M).

(b) 'Repetition priming and automaticity' - 'practice makes perfect'
If participants build a regular group and practise using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because responses improve with repetition (M).

	Recommendation	CMO configurations in the programme theory
For the administration at a national level	Invite participants to take responsibility for their QI but let them decide what they do and how they perform QI.	CMO configuration 1 a-c, 4 b
For professional organisations or university departments	Provide information about the basic principles of QI, like the Plan-Do-Study-Act cycle (PDSA) and explain how to implement those principles in QC practice.	CMO configuration 1 b and 1 d
	Give rewards (such as CME credits) to acknowledge that QI work is further education.	CMO configuration 1 b and 2 a
	Provide facilitator training and additional coaching or supervision.	CMO configuration 1 b
	Provide access to knowledge resources like evidence-based information, clinical practice guidelines, and help with gathering practice performance data including their interpretation. Actively involve health-care professionals in collecting the local data needed to address their local priorities; this will increase their motivation and trust in the findings.	CMO configurations 1 b and 2 a
For administrative organisations	Give access to appropriate venues and help them organise meeting times.	CMO configurations 2 b and 2 a
	Integrate and use the new knowledge developed by QCs, so that GPs can see that their efforts have changed practice. Administrations must also accept local adjustments to national solutions or guidance, because QI is a local process and QCs will adapt or devise new interventions and ways of working.	CMO configuration 1 c and 4 a
	Provide protected time, so groups can work during regular working hours or at mutually agreed times. The process should not be disturbed by phone calls or urgent patient problems since these disrupt discussions.	CMO configuration 2 a, 4 a
	Accept that QCs work at different speeds, because excessive demands for rapid results often undermine QI efforts.	CMO configuration 1 c, d, 4 b
	Group size affects the level of cooperation between members. Between six and twelve members is the optimal size for communication.	CMO configuration 2 d
For facilitators	The social aspect of the group lays the ground for frank discussions. For example, eating together before starting work eases social interaction, making participants feel more comfortable. A friendly, relaxed, and non-hierarchical atmosphere encourages participants to share sensitive information and motivates their continued attendance. Agreement on group norms and removing barriers like computer screens, or arranging tables and chairs in a circle facilitates social interaction.	CMO configurations 1 c, 2 b-c and 3 a
	Create an atmosphere of openness based on trust, so that participants can interact authentically. Facilitators should open discussions, summarise, clarify statements, and raise questions.	CMO configuration 2 b
	Encourage participants to talk about their own clinical cases, because these are the basis of a learning community where participants can reflect on their current practice and compare it with educational or evidence-based material.	CMO configurations 3 a-c
	Aim at a balance between comfort and challenge that allows an appropriate degree of conflict within the group to stimulate learning.	CMO configuration 3 f
	Close meetings on time and plan future meetings by summarising progress and highlighting the goals that have been achieved.	CMO configurations 2 b, 4 c-d
	Support participants in expressing themselves since it can be hard to make implicit knowledge explicit. Participants require 'active empathy' when they struggle to express their thoughts. Active empathy is the ability of QC members to actively listen to and care for each other, even when they question each other's statements.	CMO configuration 3 b
	Promptly identify and resolve conflicts because breaking established habits may feel high-risk and even threaten selfimage. Individuals who feel this way may choose to withdraw or, worse, disrupt the group process.	CMO configuration 2 f
For participants in the group	Gaining agreement on the topic to be discussed is central in QC work. The group must have a shared understanding of the problem when it embarks on the QI process and the topic must be relevant to everyday practice and manageable. The group should agree on the need for change, or at least agree that a problem exists.	CMO configurations 2 c and 3 d
	Come to an agreement on how to address the topic and balance local expertise with wider knowledge. Once a topic is chosen, members should start with personal experiences. Discussing personal cases increases a sense of ownership and helps connect new knowledge to everyday practice.	CMO configurations 3 b d
	Develop new concepts and ideas by reflecting on members' experiences, discuss individual cases, add information from guideline and educational evidence-based material, prescription data, or invite input from a respected local opinion leader. Members should be ready to adjust their ideas about how to change and improve care, or work differently, to fit local circumstances	CMO configurations 3 ef, 4 a and 4 c
	Implementing innovation is a continuous, repetitive process. Discuss the advantages and disadvantages of new ideas or changes to practice and address barriers to change.	CMO configuration 4 d
	Debate proposals for change and agree on action plans. After testing and trying out these plans, the group may then choose to move forward with one or more of them, depending upon how sure it is that the plans will be successful.	CMO configuration 4 f
	Each time the group tests the innovation, the goal should be improving it. Members should devise plans to implement the next version based on their own practice until they feel satisfied.	CMO configurations 4 g and 5 a
	Be patient. QC groups have a learning curve and the group grows more skilled and improves performance after each QI cycle.	CMO configuration 5 b

Supplemental material 2
Purposive search strategy in OVID Medline / EMBASE / PsycInfo

PRIMARY HEALTH CARE TERMS

1. general practice/ or family practice/
2. Primary Health Care/
3. general practitioners/ or physicians, family/ or physicians, primary care/
4. community health services/ or community health nursing/ or community mental health services/
5. (family adj3 (practice or practitioner* or physician*)).ti,ab.
6. (general adj3 (practice or practitioner* or physician*)).ti,ab.
7. (primary adj3 (care or healthcare)).ti,ab.
8. practice nurs*.ti,ab.
9. (community adj2 nurs*).ti,ab.
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
11. Management Quality Circles/
12. quality circle*.ti,ab.
13. (group* adj3 (learning or work* or teaching or education*)).ti,ab.
14. (group* adj2 (intervention* or strateg* or program* or review*)).ti,ab.
15. (quality improvement* adj3 (intervention* or strateg* or program* or initiative* or tool*)).ti,ab.
16. (audit adj3 feedback).ti,ab.
17. peer review*.ti,ab.
18. reflective practice.ti,ab.
19. (learning adj3 (intervention* or strateg* or program* or initiative*)).ti,ab.
20. (education* adj3 (intervention* or strateg* or program* or initiative*)).ti,ab.
21. (continuing adj2 (education or development)).ti,ab.
22. Peer Review, Health Care/
23. medical audit/ or nursing audit/
24. exp Education, Continuing/
25. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24

TERMS for QUALITY IMPROVEMENT

26. Quality Assurance, Health Care/
27. Total Quality Management/
28. Quality Improvement/
29. "Quality of Health Care"/
30. evidence-based practice/ or evidence-based medicine/ or evidence-based nursing/
31. Physician's Practice Patterns/
32. exp Professional Competence/
33. Guideline Adherence/

34. (quality adj3 (improv* or assurance or change)).ti,ab.

35. (practice adj3 (improv* or change)).ti,ab.

36. ((care or healthcare) adj3 (improv* or change)).ti,ab.

37. ((professional or physician* or medical or clinical or nurs*) adj competenc*).ti,ab.

38. ((guideline* or guidance or standard* or protocol*) adj2 (adhere* or complian* or concord* or implement*)).ti,ab.

39. (evidence based adj2 (practice or prescrib*)).ti,ab.

40. 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39

41. Peer Groups/

42. Group Process/

43. Group Practice/

44. practice based.ti,ab.

45. 41 or 42 or 43 or 44

ADDITIONAL GROUP TERM

46. facilitator.ti,ab.

GROUP TERMS IN PRIMARY CARE

47. 10 and 46

PRIMARY CARE **AND** PROGRAM TERMS **AND** QUALITY IMPROVEMENT TERMS **AND** GROUP TERMS

48. 10 and 25 and 40 and 45

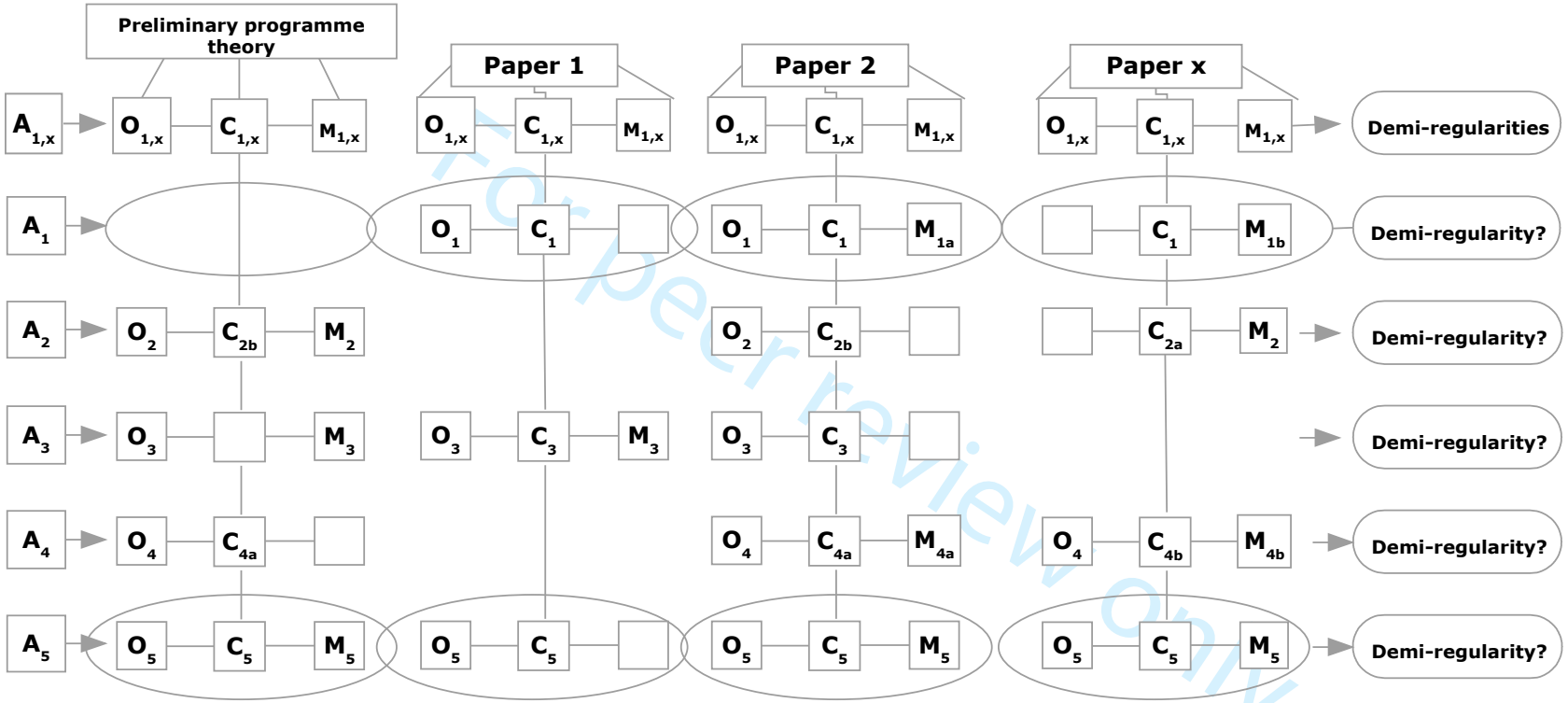
ADDING THE “QUALITY CIRCLES” **AND** “GROUP FACILITATION” IN TITEL **AND** ABSTRACT

49. 12 or 47 or 48

50. limit 49 to yr="1974 -Current"

Supplemental material 3

CMO configurations across studies and demi-regularities



Legend

A: Activity. Activities 1 to 5.

O: Outcome. Outcomes 1 to 5.

C: Context. Contexts 1 to 5, although some may be missing.

M: Mechanism. Mechanisms at different levels of activity; the same outcome may have several mechanisms; if no mechanism was mentioned, the square is blank.

Comparing groups of CMOs across studies may create a demi-regularity.

The marked demi-regularities are examples of how I built CMO configurations across the papers.

Supplemental material 5 Participants in interviews designed to consolidate the programme theory

Participant's characteristics	Country	Date of interview	Length of interview	Characteristics of the health care system
GP in a rural practice, teacher at the University of Ghent	Belgium	07/02/2018	49'	Belgium's health-care system is funded principally through social insurance contributions on a fee-for-service basis, and these fees support doctors. The mandatory insurance can be replaced by a voluntary health insurance. Self-employed doctors provide the majority of outpatient services. GPs in Belgium are paid a small capitation fee but are not gatekeepers who refer patients to specialists.
GP in a rural practice, small group educator for 18 years	Ireland	09/02/2018	64'	The Health Service Executive (HSE) funds the CME small-group network but the Irish College of General Practice (ICGP) has a governance role. The ICGP receives funds from the HSE to cover the majority of costs for tutors and group leaders, and some of the funds for group leaders come directly from the ICGP. At present, most of the funding is from the HSE. Ireland has a centrally organised PHC system which has a public and a private branch. GPs in Ireland are gatekeepers, with exceptions similar to France.
Certified facilitator in GP vocational training, active in quality improvement and patient safety	Norway	08/02/2018	71'	Norway's health-care system is mainly public; insurance is covered by a percentage of income and tax subsidies. Almost everyone is registered with a primary care physician. The GP is the first point of contact for the patients and is a gatekeeper. Only 10% of GPs are directly employed by municipalities; 90% are self-employed and are licensed by their municipality, which guarantees them a basic salary. In addition, there are capitation fees for each GP.
GP working in an urban area, facilitating a QC, researcher	France	16/02/2018	79'	Health insurance is compulsory in France. Depending on the occupational sector, workers pay a small proportion of their salary for their health insurance, with the employer paying the remainder of the cost; the amount depends on the worker's income. Immigrants and the unemployed have separate health insurance. As in Belgium, GPs in France are principally remunerated by a fee-for-service system. GPs are gatekeepers, except to paediatricians, gynaecologists and ophthalmologists.

Supplemental material 5 Participants in interviews designed to consolidate the programme theory

GP in a rural practice, teacher for GP vocational training	Croatia	07/12/2018	53’	All Croatian citizens are covered by the state health insurance fund. The health-care system is public and paid for by social security contributions. Despite financial constraints, the health-care system has expanded and covers the whole country, providing primary health care and specialised hospital-based care. GPs act as gatekeepers with certain exceptions, as in France. They are remunerated through a combination of salary, capitation fees and fee-for-service systems.

Supplemental material 6
Preliminary programme theory based on the scoping search und consultations with stakeholders

CMO configuration I: **'sharing similar needs'** If health insurance companies require QI, and physician network organisations provide protected time and space, CME points and small financial incentives for participants (C), then GPs meet in groups to exchange ideas (O), because the organisational support generates positive expectations among participants and they believe these meetings with their peers will be useful (M).
CMO configuration II: **'size of the group affects communication'** If group size exceeds 15 (C), then communication becomes difficult (O), because participants cannot keep track of so many people (M).
CMO configuration III: **'need for relatedness'** If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who e.g. introduces people to each other, opens discussions and clarifies and summarises statements (C), then group members will get to know each other and decide on rules that they are willing to follow, building a safe environment based on trust (O) because members want to be among and to interact with equals (M).
CMO configuration IV: **'need for autonomy'** If the group chooses its own topics and facilitator (C), then it has a sense of ownership (O), because this satisfies the need for autonomy and control (M).
CMO configuration V: '**need for competence and self-actualisation'** If participants can tell their stories and experiences with the facilitator's support (e.g. encouragement of interactive responses and discussions, and summary of statements) in a safe environment (C), then they are involved in exchanging experiences and failures (O), because they want to be competent, gain professional confidence and fulfil their professional potential (M).
CMO configuration VI: **'previous knowledge is activated'** If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator (C), then they will be motivated to share their knowledge through telling such relevant stories (O), because the process activates the knowledge they already possess (M).
CMO configuration VII: **'cognitive dissonance'** If participants discuss and reflect on their work processes during a professionally facilitated exchange of positive experiences or failures (C), then they become aware of knowledge gaps and identify learning needs and relevant topics (O), because conflicting attitudes and behaviours, together with differences between their own and other participants' knowledge, cause a cognitive dissonance (a negative emotional state triggered by conflicting perceptions) (M).
CMO configuration VIII: **'social learning'** If the participants know what they need to learn or know what topic they want to discuss, and if they reflect on their own and other participants' trustworthy data (their own cases, diagnostic habits or prescription patterns, or evidence-based material such as guidelines) and if the facilitator uses purposeful didactic techniques (such as brain-storming, discussions and role play) to keep the group active and to reward exploratory behaviour (C), then the group will create a learning environment that promotes knowledge exchange (O), because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).
CMO configuration IX: **'interdependence between health insurance companies and physician network organisations/QCs; tension between autonomy and obligation'**

Supplemental material 6
Preliminary programme theory based on the scoping search und consultations with stakeholders

If physician network organisations require continuous QC activities (C), then QCs will negotiate priorities and design creative solutions (O), because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M).
CMO configuration X: **'interdependence among group members'** If participants maintain a learning environment based on trust that promotes knowledge exchange, assisted by facilitators who use professional techniques (e.g. contentious discussion, reaching consensus and role play) (C), then participants will adapt and generate new knowledge for local use (O), because they see themselves as similar, and thus act and negotiate cooperatively to achieve a common goal (M).
CMO configuration XI: **'gaining confidence in QC techniques'** If the group repeatedly practises implementing and adjusting to an innovation (C), then they trust their own competence and turn the innovation into a habit (O), because successful outcomes increase their confidence in their abilities (M).
CMO configuration XII: **'repetition priming and automaticity'** If participants establish a regular group and practise using QI tools (C), then they will successfully implement new knowledge in everyday practice (O), because responses improve with repetition: 'practice makes perfect' (M).

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Norwegian papers on peer groups										
Gjelstad 2006[1]	Norway	Study protocol	PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	Reduce prescription of antibiotics for upper respiratory tract infections and prescription of inappropriate drugs for elderly. Pre-existing CME groups.	Trained tutor serving 3 CME groups, reflection on own prescription strategies, disclosure of areas for individual improvement.	Discussions, reflective thinking on individual prescription data, one-day introductory workshop, audit and feedback, group educational outreach visits, academic detailing.	After one year, improvement of prescription patterns was expected.	Norwegian QC studies on improving drug prescriptions, accompanied by a qualitative study. Brekke provided the baseline study for the trial.
Gjelstad 2013[2]	Norway	Cluster randomised controlled trial	PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	As in Gjelstad 2006 Each group acted as blind control for the other groups (Rognstad 2013).	As in Gjelstad 2006	Authors consider the key element in the study to be 'what happens to a general practitioner's prescribing behaviour when they reflect on their prescriptions'.	After one year, reduction of prescription rate of antibiotics and increase of prescription rate of penicillin compared to control groups.	
Straand 2006[3]	Norway	Study protocol	Norwe gian PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	Reduce prescription of inappropriate drugs for elderly people and prescription of antibiotics in upper respiratory tract infections. Pre-existing CME groups.	Trained tutor serving 3 CME groups, reflection on own prescription strategies, disclosure of areas for individual improvements.	As in Gjelstad 2006	After one year: reduction of inappropriate prescription patterns to elderly out-patients ≥ 70 years.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Brekke 2008[4]	Norway	Cross-sectional study	PHC	454 GPs in 80 CME groups, 85,836 patients	6 months	Baseline data of ongoing CME groups for one year	Ongoing CME groups without intervention	Ongoing CME groups	After 1 year:18.4% of the patients received at least one inappropriate prescription.	Norwegian QC studies on improving drug prescriptions, accompanied by a qualitative study. Brekke provided the baseline study for the trial.
Rogn-stad 2013[5]	Norway	Cluster randomised controlled trial	PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	As in Straand 2006 Each group acted as blind control for the other groups (Gjelstad 2013).	Training in drug treatment of elderly people, the rationale for the 13 listed inappropriate drugs, how to facilitate learning within a group setting.	Audit and feedback, tailored feedback, tailored academic detailing, discussions of own prescribing pattern.	After one year, reduction of inappropriate prescriptions for elderly people. Potentially more harmful combinations were more likely to be reduced.	
Frich 2010[6]	Norway	Qualitative study to explore experiences with academic detailing	PHC	39 GPs and 20 tutors who were also GPs, 9 focus groups	6 months: meetings once a month; the study covered 3 meetings.	Qualitative analysis of the RCTs, focusing on three meetings with the CME groups.	Groups have their own cultures; tutors perceived themselves as members of the group.	Consensus discussions, audit and feedback, academic detailing, discussions of their own cases.	Reflective thinking increased; inappropriate results upset some GPs.	
Dutch papers on peer groups										
Geboers 1999[7]	The Nether-lands	Case series	PHC	All staff of 20 general practices (each working as a group) tested the model over a period of 18 months.	18 months. Monthly quality meetings.	Evaluate the feasibility of a model for continuous quality improvement (CQI) in small practices.	Trained facilitators: practice assistants with managerial experience. Involving all staff at regular meetings.	Course on CQI: choose topic, observe practice, compare performance with targets, implement change, plan care and repeat cycle.	After 18 months, this model seemed feasible to the authors.	Dutch QC studies of a continuous quality improvement model.

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Geboers 2001[8]	The Nether-lands	Mixed methods: before-and-after study and qualitative inquiry	PHC	20 practices (each working as a group): 53 physicians and 57 medical practice assistants	18 months. Monthly quality meetings.	Measure the attitude towards CQI model in small practices before and after study.	As in Geboer, 1999	Feedback on practice assessment, introductory meeting, support for adoption of the model.	After 18 months, participants experienced perceived success and were willing to continue.	Dutch QC studies of a continuous quality improvement model.
Engels 2003[9]	The Nether-lands	Controlled before-and-after study	Mid-wives, mainly PHC	255 midwives in 28 groups	Study period 1998 to 2000	Measure CQI effect on clinical practice of midwives in PHC in a before-and-after study.	Three-day training of facilitators. Peer groups of midwives in the same geographical area. Regular group meetings.	Allocated topics with no choice, using the CQI model.	Positive effect on change of clinical practice was noted. Technical skills could not be improved.	
Engels 2006[10]	The Nether-lands	Ran-domised controlled trial	PHC	26 sites in the intervention and 23 sites as controls. Size and composition of groups unknown.	December 2001 - February 2004; inclusion October 2001 - April 2003	Examine the effects of a team-based model for CQI on primary-care practice management in small-scale practices.	Medical practice assistants as facilitators after 3 days' training.	Visitation Instrument for Practice (VIP) provided topics, CQI model with detailed oral and written feedback, monthly team meetings.	Evaluation after one year showed an increased number of CQI projects compared to control group, but the study was statistically underpowered.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Verstap-pen 2003[11]	The Nether-lands	Multicentre, randomised controlled trial	PHC	26 QCs consisting of 174 GPs.	6 months baseline followed by 6 months' interventio n.	Determine the effects of a multifaceted strategy aimed at improving test ordering patterns in existing QCs.	Discussion and comparison of feedback reports among colleagues, communication course.	3 consecutive, personal-feedback reports, comparison of results with guidelines, plans for change, discussion of Bayesian rules.	Modest improvement in test ordering when comparing the two intervention groups	Dutch QCs on improving test ordering
Verstap-pen 2004[12]	The Nether-lands	Cluster randomised controlled trial	PHC	27 QCs consisting of 194 GPs.	6 months of baseline followed by 6 months' inter-vention.	A multifaceted strategy aimed at improving test-ordering patterns in pre-existing QCs; 13 QCs followed a new strategy while 14 only received feedback.	Discussion and comparison of feedback reports among colleagues, communication training. 3 meetings.	As in Verstappen 2003	Compared to feedback, the tailored intervention decreased test ordering significantly.	
Verstap-pen 2004[13]	The Nether-lands	Cluster randomised trial	PHC	27 QCs consisting of 194 GPs. 13 QCs used a new strategy while 14 only received feedback	6 months of baseline followed by 6 months' inter-vention.	Determine the effects of a multifaceted strategy in pre-existing QCs aimed at improving test ordering patterns. 3 meetings took place.	Discussion and comparison of feedback reports among colleagues, communication course.	As in Verstappen 2003	Mean costs were reduced by cutting unnecessary tests.	Dutch QCs on improving test ordering
Verstap-pen 2004[14]	The Nether-lands	Cluster randomised trial; surveys	PHC	27 QCs consisting of 194 GPs. Mean group size was 7.4	6 months of baseline followed by 6 months'	A process evaluation of a multifaceted strategy in pre-existing QCs aimed at	Discussion and comparison of feedback reports among colleagues using feedback in pairs,	As in Verstappen 2003	Individual plans for change and group plan changes were made with a high level of	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
					inter-vention.	improving test ordering patterns.	communication course.		satisfaction.	
Smeele 1999[15]	The Nether-lands	Ran-domised controlled trial	PHC	2 QCs, 17 GPs in each group	Pre-measure-ment and post-measure-ment after one year.	Evaluate the effects of a QC programme on guideline adherence. 4 sessions for GPs and 1 session for medical practice assistants.	The group education was conducted in two small groups with 9 and 8 GPs respectively. Facilitator was a GP. Not all GPs participated in all sessions.	Lectures, role-play, skills training, peer review of performance, group consensus discussions and problem-solving of hypothetical situations involving patients.	No significant changes were found for care provided and patient outcomes compared with the control group.	Dutch QC studies on guideline adherence.
Kasje 2006[16]	The Nether-lands	Cluster randomised trial using a balanced incomplete block design.	PHC	10 peer review groups (97 GPs): chronic heart failure. 6 peer review groups (46 GPs): hypertension and diabetes mellitus type 2.	One educa-tional meeting followed by data collection after 6 months	Evaluate the effects of a QC programme on guideline adherence in pre-existing groups. One group received a programme on chronic heart failure, the other on diabetes mellitus type 2.	Facilitators adhered to a specific process.	One meeting: consensus about guideline statements, evaluation of current management of five of their own patients, listing barriers and possible solutions, formulation of personal intentions	No effect was shown. High dropout rate especially in the group dealing with diabetic patients. The programme was not implemented as intended.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Van Eijk 2001[17]	The Nether-lands	Ran-domised controlled trial with three parts: individual visits, group visits, and a control group.	GPs and phar-ma-cists in PHC	Individual approach: 70 GPs and 14 pharmacists; Group approach: 52 GPs and 9 pharmacists in five QCs; Control: 68 GPs and their pharmacists.	12 months	Comparison of individual educational visits versus group visits to improve inappropriate prescriptions for elderly people. Pre-existing groups of GPs. 3 visits at 4-month intervals.	There was no description about the process that took place in the groups or at the individual level.	First visit: guidelines about appropriate prescription of drugs for elderly. Second visit: personal prescription habits were highlighted. Third visit: short follow up	The individual and the group approach led to a reduction in the rate of starting inappropriate drugs and to an increase of prescription of appropriate drugs.	Dutch QC studies on improving drug prescriptions involving pharmacists.
Wel-schen 2004[18]	The Nether-lands	Ran-domised controlled trial.	GPs and phar-ma-cists in Dutch PHC	12 peer review groups including 100 GPs with their collaborating pharmacists.	Approx. 6 months. Evalu-ation after 9 months.	Reduce prescription of antibiotics to patients with upper respiratory tract infections in pre-existing groups.	Group education with consensus procedure. One meeting followed by individual feedback after 2 weeks and 6 months.	Group education meeting about guidelines, communication skills training, patient leaflets. After 2 weeks and 6 months, individualised feedback.	Prescription rate for antibiotics was reduced after 9 months. After 15 months, the effect was lasting. Satisfaction among patients remained high.	Dutch QC studies on improving drug prescriptions involving pharmacists.
Problem Based Small Group Learning (PBSGL) in Canada, Scotland and England										
Davis 1999[19]	Canada	Case series	PHC	54 GPs in 4 newly formed groups.	A 2.5-hour workshop	Develop and evaluate a CME programme on osteoporosis for PHC. 54 family physicians participated in 1 of 4 pilot PBSG learning sessions.	GP trained as a facilitator. The facilitator elicited interactive responses using specific predetermined prompting questions.	Practice-based case scenarios to increase awareness of risk factors for osteoporosis.	Participants' satisfaction was high. Participants increased their knowledge scores (not significant because of size of the study).	Papers about Practice Based Small Group Learning in Canada, Scotland and England

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Mc Sherry 2000[20]	Canada	Before-and-after study	PHC	544 GPs in 75 workshops with a mean of 7 GPs in each newly formed group.	A 2-hour workshop with question-naires before and after.	Pilot study to introduce PBSGL groups in PHC. Topic: a patient-centred approach to managing benign prostate problems and evaluate 'intent to change'.	Initial needs assessment, problem-based educational materials, opportunities for participants to develop implementation strategies through discussion with peers.	Educational video case studies illustrating various presentations of prostatism, a handbook with detailed information on the case studies. A toll-free telephone line was provided for scientific and technical support.	Practice behaviours were improved, especially those linked to a patient-centred approach not commonly practised before the workshops.	Papers about Practice Based Small Group Learning in Canada, Scotland and England
Peloso 2000[21]	Canada	Qualitative inquiry over three years	PHC	12–15 GPs, a facilitator and sometimes an expert.	3 years	Discuss a 3-year experience with the small-group format, comprising more than 25 sessions as either learners or facilitators. Facilitators have 20 hours of training. Monthly meetings, each session takes 1.5 to 2 hours.	Sessions took place in the evenings with a meal in a relaxed atmosphere. The group chose their topics. Presentation of own clinical cases. Experts did not lecture but answered questions.	Learner-directed agenda of topics, information from trusted peers, opportunity for feedback. Information from several sources – printed materials, peer discussion, patient questions – the perception of need for change is enhanced.	GPs can discuss topics relevant to day-to-day practice and obtain access to local experts. They compare their practice with that of others. The group and the inter-active format are fun. Experts are comfortable with the format.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Herbert 2004[22]	Canada	Ran-domised controlled trial	PHC	200 GPs in 28 pre-existing groups.	6 months, com-parison of data 6 months before and after the inter-vention.	Assess the impacts of individualised prescribing feedback. 4 groups: control, prescribing portrait only, educational module only, both portrait and educational module.	3 representative patient cases were discussed, evidence-based information to guide management. Facilitation 'as usual' in the CME group.	Histograms comparing an individual's prescribing rates with those of the group and of all GPs in the study. A succinct evidence-based message to guide future prescribing.	The group that received both the module and the portrait had the greatest increase in preferred prescriptions.	Papers about Practice Based Small Group Learning in Canada, Scotland and England
Mc Vicar 2006[23]	Scotland	Before-and-after study (pilot)	PHC	5 small groups, 7–9 GPs in each group	12 months	Assess effectiveness of the PBSG approach in developing participants' knowledge, skills and attitudes in interpreting, discussing and applying current medical evidence.	Facilitators establish and maintain a learning environment. They create a culture of openness, honesty and willingness to acknowledge unawareness as a precursor to learning.	Educational material, a tool that triggers reflection, discussion of personal experiences and acknowledge-ment of gaps between current and best practice.	The study was statistically underpowered. Participants highlighted general enjoyment, professional reassurance and personal learning.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Armson 2007[24]	Canada	Description of the programme	PHC	4–10 GPs	Meeting of around 90 minutes once or twice a month	Identify gaps between current practice and best available evidence, to encourage reflection on individual practice, and promote changes in patient care, using an educational approach.	The facilitator's tasks are to focus discussion, to encourage the group to identify barriers to the implementation of new know-ledge and to establish a safe, supportive environment for learning.	Facilitation of discussions based on educational material and a tool (log sheet) that triggers reflection. The group starts with personal experiences and reflects on and acknowledges gaps between current practice and best practice.	Groups of various compositions function effectively in this particular small group environ-ment. If the facilitator lost the group's interest, disintegration of the group was likely.	Papers about Practice Based Small Group Learning in Canada, Scotland and England
Kelly 2007[25]	Scotland	Qualitative study: semi-structured interviews	PHC	One-to-one interview to evaluate the process in 5 small pre-existing groups.	Interviews among partici-pants of the Mc Vicar 2006 study	Explore the perceptions and experiences of PBSG participants to gain an understanding of how PBSGL works.	Facilitator opens discussions, clarifies statements, summarises what was said and questions issues, creating a learning environment.	Case discussions make evidence-based material relevant to participants and stimulate reflection. Mutual learning is important. Discussing data with others stimulates reflection.	Participants joined PBSGL groups because of the need to update medical knowledge, to compare personal practice with peer practice.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Overton 2009[26]	Scotland	Qualitative approach: theory-driven framework developed by Chen and Rossi	PHC	19 GPs and practice nurses	Interviews among partici-pants of PBSGL groups	Study the experiences of GPs and practice nurses in PBSGL. Data sources: logbooks, e-mail, telephone conversations and one-to-one interviews.	Qualitative study of the process in PBSGL groups: Group cohesion grew and mutual emotional support increased. With increasing trust, open discussions were possible.	Qualitative study of the process in PBSGL groups: case discussions kept people going and different perspectives could be considered. Self-esteem increased, as did mutual respect.	Motivation for joining the groups: preferred learning style, keeping up to date, learning in multi-professional groups, group atmosphere. and increased self-esteem.	Papers about Practice Based Small Group Learning in Canada, Scotland and England
Cunning ham 2011[27]	Scotland	Qualitative study: focus group	PHC	Two focus groups of PBSGL facilitators.	Focus groups	Learn about motivators to become a facilitator in PBSGL groups.	Qualitative study of the process in PBSGL groups	Qualitative study of the process in PBSGL groups	Motivators to become a facilitator were positive past experience of group learning, the chance of career advancement. Support for facilitators after initial training.t.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Rial 2013[28]	England	Before-and-after study	Trai-nee GPs in PHC	2 newly-founded groups of seven future GPs.	After 8 months, 4 meetings	Identify whether they were supported in making the transition from trainee to independent practitioner through attending PBSGL groups.	One group member was trained as a facilitator.	Canadian PBSGL approach was used	Improved ability to identify and use evidence in practice, shifting the focus from postgraduate exams towards 'real world' practice. The PBSGL groups still meet.	
QCs in Canada										
Ioan-nidis 2007[29]	Canada	Before-and-after study (pilot)	PHC	5 QCs, 52 physicians, GPs and some osteoporosis specialists	12 months	Assess whether use of QCs could improve family physicians' adherence to osteoporosis guidelines. 3 training meetings for the facilitators, 3 meetings for participants.	QC facilitators were local family physicians recruited and trained specifically to lead study meetings.	Educational material, interactive group meetings, use of local opinion leaders, audit and feedback, reminders, multi-professional collaboration, financial incentives and information distributed to patients.	The intervention seemed to be feasible and was well received among GPs. 84% agreed that the feedback helped them understand their current practice patterns and decide on areas that needed improvement.	Papers on guideline adherence using continuous quality improvement cycles in Canada.

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Ioan-nidis 2008[30]	Canada	Before-and-after study	PHC	340 participants (GPs) in 34 QCs and local opinion leaders	1 year	Increase guideline adherence concerning osteoporosis. 5 meetings (60–90 minutes) for two years.	5 educational meetings	As in Ioannidis 2007	Physicians' awareness of osteoporosis risk factors and appropriate bone mineral density testing increased.	Papers on guideline adherence using continuous quality improvement cycles in Canada
Ioan-nidis 2009[31]	Canada	Before-and-after study	PHC	As in Ioannidis 2008	2 years	As in Ioannidis 2008	As in Ioannidis 2008	As in Ioannidis 2008	Guideline adherence increased	
German QCs										
Szecse-nyi 1994[32]	Germany	Before-and-after study	PHC	10 GPs	2 years	Observation of the initialisation and establishment of a QC. Monthly meetings.	Presentation round, discussion of possible topics, choice of a topic impacting all participants; a GP facilitates the process.	Setting priorities, analysing the situation, developing criteria for improving quality, analysis of present practice, general priorities for necessary changes, comparison with evidence-based literature, change of practice.	GPs are interested in everyday practice-related topics. The gap between existing knowledge and clinical practice is acknowledged.	Papers about establishing QCs in Germany: pilot stage.

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Gerlach 1995[33]	Germany	Survey among 138 QC participants	PHC	138 GPs taking part in QCs, 8–12 GPs in each one.	Not applicable	Evaluation of case-based QC process focussing on a topic.	GPs use their own medical records, patient data or video recordings as a basis for problem-based learning. Facilitation by a GP.	Case-based discussions may indicate a need to change everyday practice. Evidence-based material and/or local opinion leaders may contribute to the discussion and consensus finding.	79% of the GPs thought that cases from daily practice should be the starting point of QCs. The process led to locally adapted guidelines.	Papers about establishing QCs in Germany: pilot stage.
Hart-mann 1995[34]	Germany	Controlled before-and-after study	PHC	2 QCs, 10 GPs in each group compared to control group	4 months. Evalua-tion after 5 meetings	Increase guideline adherence in diabetic care. Test training modules for facilitators (GPs).	2 GPs in each group received training in facilitating small groups.	Didactic techniques as in Gerlach 1995, role play to practise patient–doctor communication.	Guideline adherence improved compared to control group.	
Murad 1998[35]	Germany	Before-and-after study	PHC	1 QC including 10 GPs	12 months	Improve guideline adherence for patients with diabetes mellitus type 2. 23 existing QCs meeting once a month.	GPs use their own medical records, patient data or video recordings as a basis for problem-based learning. Facilitation by a GP.	Use of practice data, medical records and case discussions involving a local opinion leader.	According to QC documents, improved guideline adherence.	
Tausch 1995[36]	Germany	Before-and-after study (protocol)	PHC	23 QCs, 10 GPs in each group	Evalua-tion over 18 months	Evaluate facilitators' manuals on different common diseases. 23 existing QCs met	The facilitators prompted and encouraged participants to identify common problems in their	The manual may provide a starting point for developing consensus guidelines.	Evaluation on three levels: reasons for participation in QCs, usability of the manual,	Papers about establishing QCs in Germany using manuals.

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						once a month.	practice.		assessing behaviour change.	Papers about establishing QCs in Germany using manuals.
Tausch 1996[37]	Germany	Survey	PHC	25 QCs, 246 GPs	Evalua-tion after 12 months and 10 meetings	Capture the objectives of the participants. 25 pre-existing QCs met once a month.	As above	Case vignettes, discussion of adequate diagnostic and therapeutic procedures in relation to evidence-based material.	Reasons for participating in QCs: exchange among colleagues, improved self-confidence.	
Tausch 2001[38]	Germany	Before-and-after study	PHC	23 QCs, 243 GPs	Evalua-tion after 18 months	Evaluate reasons for participation, usability of manuals and assessment of behaviour change (self-reported improvement). To expand QCs within short time.	Voluntary participation in monthly meetings, 6–12 GPs in each group, trained facilitator.	Moderator-manuals that allow self-evaluation provide information about appropriate diagnostic and therapeutic recommendations for common diseases.	Reasons for participating: exchange of experiences among colleagues, increased competence and high level of satisfaction.	
Andres 1997[39]	Germany/ Hessen	Controlled before-and-after study	PHC	32 GPs were grouped into 3 QCs promoted by the association of statutory health insurance	12 months	Evaluate the process in the groups after 10 meetings. Participating GPs exceeded average prescription costs.	Participants felt forced to join QCs to change their behaviour. They had to overcome the feeling of being controlled.	Case discussions, audit charts to analyse prescription habits, interactive learning, reflective thinking and consensus finding as to rational prescription practice.	66% reported change in behaviour. 22 of 27 wanted to continue with QCs.	Papers about establishing QCs in Germany using data on everyday practice to improve prescription patterns.

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Andres 2004[40]	Germany/ Lower Saxony	Survey among 797 QC participants	PHC	648 out of 797 participants answered the survey	Evalua-tion after 1 year	Evaluate QC participants' experiences in QCs intended to improve prescription patterns.	7–10 GPs, monthly meetings, facilitator guiding through the process, support by academic staff members if necessary.	Case discussions, peer-led academic detailing allowing comparison with colleagues, reflective thinking, consensus discussions, evidence-based material, patient information.	Main problems were initial prescribing in hospitals and communication with patients when changing drugs.	Papers about establishing QCs in Germany using data on everyday practice to improve prescription patterns.
Wen-sing 2004[41]	Germany / Saxony-Anhalt	Controlled before-and-after study	PHC	87 GPs in 10 groups of 7–12; control group: 90 GPs not participating in the intervention.	Evalua-tion after 2 years	Determine the impact of a large-scale programme of QCs on quality and costs of prescribing, 11 meetings of 2 hours, existing QCs promoted by the association of statutory health insurance.	A trained facilitator (GP) supported the group.	Structured feedback report, patient video, evidence-based material, interactive learning and reflective thinking about willingness to change.	High satisfaction with QCs. Prescriptions decreased in the intervention group while increasing in the control group. Aspects of quality of prescriptions improved.	
Andres 2004[42]	Germany /Hessen	Survey	PHC	483 out of 612 GPs (57 QCs) answered.	Evalua-tion after 2 years	Evaluate participants' experiences of existing QCs taking part in a large project.	7–10 GPs in each QC, facilitator guiding through the process, support by academic staff members.	Personal prescription data with the opportunity to compare with colleagues.	Positive effects on medical practice and increase in knowledge.	

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Fessler 2006[43]	Germany (Rhine Main)	Controlled before-and-after study	PHC	90 GPs participating in QCs were compared to non-participants in another area	Evalua-tion after 2 or 3 years	Improve prescription patterns concerning statins, antidiabetics, other drugs for cardiovascular diseases. Intervention in existing QCs.	Facilitated group work every 4–6 weeks.	QC process according to German standards; discussion of any results not in line with guidelines.	Guideline adherence increased.	Papers about establishing QCs in Germany using data on everyday practice to improve prescription patterns.
Papen-dick 2006[44]	Germany (Rhine Main)	Controlled before-and-after study	PHC	59 GPs participating in QCs compared to 52 non-participants	Evalua-tion after 12 months	Examine the development of drug costs among GPs participating in existing QCs.	Facilitated group work every 4–6 weeks.	QC process according to German standards; discussion of any results not in line with guidelines.	The cost of medical drugs and the increase in expenditure were lower compared to the control group.	
Wen-sing 2009[45]	Hesse, Lower Saxony, Saxony-Anhalt	3 controlled before-and-after studies with baseline in 2001 and follow-up in 2003	PHC	1090 GPs in the inter-vention group and 2090 in the control group.	Baseline data 3 months; evaluation using another 3 months' data after 24 months.	Determine the effectiveness of the QC process on prescribing patterns in existing and new QC groups. Data were gathered on different groups of drugs. One QC meeting a month.	8–14 physicians in a group, trained facilitator (GP)	Repeated feedback on prescribing patterns, evidence-based information, reasons for variations were discussed, case-based discussions, objectives for improvement were formulated and specific plans made.	Attendance rate 71–79%, high satisfaction >80%. Reduction of mean prescription costs per patient, increased prescription of recommended drugs compared to the control group.	

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Andres 2010[46]	Hesse, Saxony-Anhalt, Westfalen-Lippe, Schleswig-Holstein	Interrupted time series 1995–2007	PHC	1242 QCs documented 27,255 meetings. Evaluation of QCs only if they meet at regular intervals and have done so for at least one year.	12 years	Assess the quality of the structure, processes and results of existing QCs promoted by the association of statutory health insurance.	Facilitators questioned the groups and tried to detail an agreement on best practice.	A group of GPs met at regular intervals to consider their standard practice. Their work was based on personal experience, own data and was target-oriented to promote quality in their own practice.	8 and 12 meetings per year, group atmosphere was generally very good; the proposed method was actually used in the groups; consensus was often achieved.	
Beyer 1999[47]	Saxony-Anhalt, Bremen	Cross-sectional survey	PHC	2412 out of 4270 answered	Not applicable	Analysis of demands and expectations on supporting institutions	Not applicable	Not applicable	GPs reported good emotional support from colleagues, improved professional self-confidence, but also fear of control and excessive demands.	Paper about evaluation of reasons for and against participation in QCs.
Aubke 2003[48]	West-phalia-Lippe	Cross-sectional survey 1995–2001	PHC	520 QCs with 7350 participants: 3260 meetings were evaluated	5 years	Assessment of QI cycle in existing QCs using a checklist. 15 GPs in each group, meeting time 120 minutes on average	Not applicable	QCs work both continuous and topic-centred, based on documentation from own practice with the aim of promoting their quality of care.	29.6% of all QCs had implemented the PDCA cycle, 54.9% had partially implemented the characteristics.	Paper on QCs about evaluation of adherence to the PDCA cycle.

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Beyer 2003[49]	Germany and European countries	Cross-sectional survey among EQuiP delegates	Euro-pean PHC	Reports of EQuiP delegates from 26 countries	Cross-sectional	Provide an overview of QC activities across Europe.	Facilitator is usually a GP.	A consistent group of 8 to 15 health-care professionals meet at regular intervals to consider and reflect on their standard practice.	High activity of QCs (i.e. > 10% of all GPs are involved) in 9 European countries.	Paper about the spread of QCs across Europe (Update Rohrbasser 2019).
Mols 2005[50]	Germany (Black Forest region)	Controlled before-and-after study	PHC	36 GPs in QCs treated 75 patients, 25 GPs in the control group treated 51 patients	Baseline after 6 months, evaluation after 18 months.	Study the effect of existing QCs on secondary prevention of stroke.	Facilitated group work every 6 to 8 weeks.	QC process according to German standards.	QCs did not have an additional effect on secondary prevention after stroke compared to the control group.	Paper on QCs about testing guideline adherence.
Schnei-der 2007[51]	Germany	Ran-domised controlled trial	PHC	12 QCs involving 96 GPs; out of 256 partici-pants, 185 responded to the follow-up.	Evalua-tion after 1 year	Evaluate the efficacy of QCs for asthma care working with individual feedback with and without benchmarking.	Trained facilitators supported the groups in the process.	Collective discussion of evidence-based pharmacotherapy and management of patients on the basis of prescribing data.	Both groups improved their guideline adherence.	Testing the question whether benchmarking in QCs improves guideline adherence - or not.
Vollmar 2007[52]	Germany (North-Rhine West-phalia)	Protocol of a randomised controlled trial	PHC	174 GPs in approx. 20 QCs	Evalua-tion after 3 meetings (6 months)	Improve GPs knowledge and skills about people with dementia.	QCs are facilitated by a trainer rather than by a facilitator.	Study concept A: e-learning followed by case discussions in QCs. Study concept B: oral presentation of evidence-based information followed by a discussion led by a presenter.	Possible change of behaviour, use and acceptance of new learning tools.	Papers about evaluation of e-learning methods in QCs.

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Vollmar 2009[53]	Germany (North-Rhine West-phalia)	Cross-sectional survey	PHC	264 out of 449 GPs answered the questionnaire	Cross-sectional	Gain understanding of German GPs' preferences for different forms of educational methods, such as e-learning.	Not applicable	Not applicable	Approx. 70% wanted to discuss everyday practice with colleagues. Meeting experts and e-learning were not favoured.	.
Vollmar 2010[54]	Germany (North-Rhine West-phalia)	Ran-domised controlled trial	Ger-man PHC	166 GPs in 26 QCs	1 year after study start	Compare knowledge acquisition about dementia management between blended learning and QC methods alone.	QCs are facilitated by a trainer rather than by a facilitator	Study concept A: e-learning followed by case discussions in QCs. Study concept B: oral presentation of evidence-based information and its discussions in a QC.	Groups A and B improved their knowledge. A blended learning approach was not superior to the QC approach.	
Siebolds 2012[55]	Germany	Survey	PHC	83 facilitators received survey	Cross-sectional	Evaluation of training and support for facilitators by tutors.	To support facilitators, the KBV (National Association of Statutory Health Insurance) developed structured didactic handouts for the QC work.	Guidelines of the National Association of Statutory Health Insurance for Quality Assurance Procedures.	High level of satisfaction with didactic handouts (manuals) and training opportunities.	Paper about the quality of training and support for facilitators.

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Swiss QCs										
Bugnon 2004[56]	Switzer-land	Controlled before-and-after study	PHC	6–10 GPs in 1 QC.	Develop-ment over 3 years	Improve prescription patterns and reduce costs for drug prescriptions.	A pharmacist facilitated the group through the process of academic detailing. The group engaged in local networking. Group cohesion increased with time.	Evidence-based information, feedback on prescriptions including information about possible substitutions. Consensus discussions and agreement on best choices.	Improvement of prescription patterns (antibiotics, antidiabetic and antihypertensive drugs, NSAIDs); reduction of costs compared to control groups.	Papers about pharmacist-led QCs in Switzerland.
Niquille 2010[57]	Switzer-land	Controlled before-and-after study	PHC	24 GPs in 6 QCs	Develop-ment over 9 years	Improve prescription patterns and to reduce costs for drug prescriptions.	A pharmacist facilitated groups of 3–6 GPs through the process of academic detailing. Group cohesion increased with time.	As in Bugnon 2004	42% decrease in drug costs, improved adherence to prescription guidelines compared to control group.	

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Drug Education Project										
Lund-borg 1999[58]	Sweden	Ran-domised controlled trial	PHC	18 groups (104 GPs) compared with 18 groups (100 GPs), 3–10 GPs in each group	6 months	Improve the treatment of asthma and urinary tract infections. The two study groups served as controls for each other.	Pharmacists facilitated the GP groups, two meetings, each meeting 1.5 hours.	Information on their judgements of written simulated cases. Discussion of actual decisions taken on the simulated cases. Discussion of personal experience of difficult clinical cases and underlying reasons for prescriptions.	Guideline adherence increased for patients with urinary tract infections and patients with asthma.	QC study on improving drug prescriptions in Sweden, Norway, The Netherlands and Slovakia: Drug Education Project.
Lund-borg 1999[59]	Sweden	GPs' evaluation of the trial: survey	Swe-dish PHC	82 out of 104 GPs and 83 out 100 GPs responded.	6 months	Capture GPs' experiences of the trial through a questionnaire.	As above in Lundborg 1999	As above in Lundborg 1999	87% of participating GPs wanted to take part in similar CME activities for other conditions.	
Lager-lov 2000[60]	Norway	Ran-domised controlled trial	Norwe gian PHC	32 groups (199 GPs), 4–8 GPs in each group	6 months	As above in Lundborg 1999	As above in Lundborg 1999	As above in Lundborg 1999.	Guideline adherence increased.	

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Veninga 1999[61]	Sweden, Slovakia, The Nether-lands	Evaluation of a randomised controlled trial	Swe-dish, Norwe gian, Dutch and Slova-kian PHC	The Netherlands: 24 groups, 181 GPs; Sweden: 36 groups, 204 GPs; Norway: 32 groups, 199 GPs; Slovakia: 20 groups, 81 GPs.	6 months	Explore whether a specific educational approach for implementation of guidelines has a similar effect when used in different health care settings.	As above in Lundborg 1999 (Slovakia only one meeting).	As above in Lundborg 1999	Attitudes changed and prescription patterns improved.	QC study on improving drug prescriptions in Sweden, Norway, The Netherlands and Slovakia: Drug Education Project (DEP).
Veninga 2000[62]	The Nether-lands	Ran-domised controlled trial	PHC	24 groups (181 GPs)	6 months	As above in Lundborg 1999	As above in Lundborg 1999	As above in Lundborg 1999	Guideline adherence increased.	
European single studies										
Eliasson 1999[63]	Sweden	Literature review, survey and authors' reflections	PHC	5–10 GPs in each of approx. 230 groups	Meeting once to twice a month	Give an overview of CME group work in Sweden and describe its strengths and weaknesses.	Facilitated group discussions. Reflection on emotional responses was part of the group process.	Prearranged modules with short introductions and facts on a topic. Discussions based on experiences.	80% of the group members assessed the pedagogical value of the group sessions as more valuable than direct instruction.	Paper on Swedish QCs

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Watkins 2004[64]	England	Qualitative study: focus group	PHC	6 different facilitators with different backgrounds. A total of 19 GPs in four practices and one practice manager took part. 11 GPs were interviewed.	7 monthly sessions taking place at midday	Reflect on inappropriate and costly prescribing. Investigate feasibility of educational sessions for GPs: acceptability among GPs and possible barriers.	'Reflective practice' as a potential solution to high-cost prescribing. GPs felt that participation was to appease their prescribing adviser. No or little sense of ownership. Information overload was a problem.	Video-tape of a scenario, followed by brainstorming, and personal responses in the group. 'Best buy' response was selected. Identification of barriers to implementation and discussion of means to overcome barriers.	Low response for participation (4 out of 61 practices). There was friction between clinical autonomy and the experience of a top-down intervention.	Paper on English QCs (reflective groups)
Tonies 2006[65]	Austria	Survey	PHC	In 2001, 29 GPs out of 169 (17%) responded; in 2002, 46 out of 272 (27%) responded.	Evalua-tion after 4 years of offering QCs	Improve care of patients with drug replacement therapy using synthetic opioids in PHC.	A GP facilitated the group and had the support of an experienced local opinion leader.	Local opinion leaders introduced topics. Stimulation of discussions to increase self-awareness and frustration tolerance.	High level of satisfaction with the teaching. Communication skills improved. Topic-specific knowledge increased.	Topic-specific QC activities in Austria.
Riou 2007[66]	France	Controlled before-and-after study	PHC	Number of groups is not mentioned, 7–11 GPs per group, 24 participating GPs, 3–6 local pharmacists in each area.	12 months (Dec 2001 to Dec 2002)	Improve prescription patterns in three semi-rural areas of Brittany, France. Financial incentive.	4 plenary meetings with consultants lecturing on pre-specified topics. QCs every 6th week using personalised feedback.	Expert input during plenary sessions, voluntary feedback, peer review and specific recommendations for changes during QCs.	Increase in generic prescription rates and decreased prescription of drugs with no evidence-based efficacy.	French QC study on improving drug prescription patterns.

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van Driel 2007[67]	Belgium	Cluster randomised controlled trial	PHC	9 QCs (122 GPs) in the intervention and 9 QCs (134 GPs) in the control group	November 2004 to March 2005	Improve antibiotic prescribing in patients with rhinosinusitis. Existing QCs.	The group meetings were scheduled as regular QC sessions without the presence of an external expert.	Dissemination of the guidelines by e-mail; facilitators received educational material concerning antibiotics.	A single intervention in QCs did not have a significant effect on prescription patterns.	Belgian QC study on improving drug prescription.
Spiegel 2012[68]	Austria	Qualitative evaluation	PHC	445 out of 821 GPs took part in the groups, 8–10 participants in each group	2 years: 2004 and 2005	Explore GPs' perception of QCs concerning prescribing habits. Qualitative analysis was used to evaluate QC protocols.	Facilitators' duties were to schedule dates for QCs, give introductory talks on intended topics and facilitate the group process.	Use of educational material on various issues of pharmacotherapy; costs were addressed; provision of personal feedback on prescription habits.	Prescription of generic drugs increased.	Austrian QC study on improving drug prescription.
OTHER AREAS										
de Villiers 2003[69]	South Africa	Qualitative evaluation using Nominal Group Technique followed by survey	PHC	64 GPs answered (response rate 38%), 51 out of 101 responding GPs had participated in QC, 8 out of 12 facilitators responded	Evalua-tion of 9 months CME/ CPD activity	A nominal group technique was used to compose two questionnaires (for participants and facilitators)	Facilitated small-group activities	Activities built on previous experience, involved the learners, focussed on relevant problems; solutions were applicable in practice; the process followed a cycle of action-reflection and GPs acquired technical skills.	91% of the respondents indicated improved knowledge, 73% indicated improvements in their patient care and 61% improved clinical skills	South African QCs

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Rich-ards 2003[70]	New Zealand	Pilot study: retro-spective, controlled before-and-after study	PHC	52 GPs in small education groups: approx. 10 GPs in each group	After 1 and 2 years	Determine whether a QC-programme designed to promote rational GP prescribing succeeds in changing practice when added to audit and feed-back, academic detailing.	Meetings were monthly and group composition remained the same over time.	Control group: audit and feedback on prescription habits, academic detailing and educational bulletins. Intervention group: peer-led groups, monthly meetings.	Positive effect of the education strategy in groups compared to the combination of audit and feedback and academic detailing.	QCs on improving drug prescriptions in New Zealand.
Parker 2007[71]	USA (Hawaii)	Ran-domised controlled trial	PHC	4 health-care facilities of similar size participated and were randomly assigned the local or the central QI approach	Duration about 2.5 years	Compare the participatory local approach with the central expert approach to QI in depression care.	Researchers allowed teams to design their own programmes. Local QI groups had a facilitator.	The QI teams followed guidance regarding team composition and process. The central expert approach used centrally organised teams of experts.	A hybrid model (central expertise and local participation) may be the most effective approach to maintain a high level of motivation.	QCs on Hawaii compared to centrally steered options.
Som-mers 2007[72]	USA (Califor-nia)	Survey and attendance rate	PHC	Researchers invited 30 sites, 11 (103 GPs) out of 14 sites who started continued with their meetings	5 years	Introduce small-group meetings as means of managing clinical uncertainty.	A group member or an invited, external member facilitated discussions, searched for and appraised evidence and coordinated meeting logistics.	Reflection on and appraisal of one's own delivery of clinical care. Case-based discussion and reflection.	Most common themes: being with colleagues, the role of time in GP practice. Other common themes: acknowledging uncertainty, receiving validation.	Practice-Based Learning and Improvement in in California.

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Murrihy 2009[73]	Australia	Before-and-after study	PHC	6 groups of GPs (32 GPs)	6 months	Improve GPs' skills and actual use of cognitive behaviour therapy. 8 two-hour sessions.	Expert-led small-group interactive learning, and ongoing discussion of patients.	Development of mentor-type relationships, the use of interactive learning and skills-based training, discussion of ongoing patients.	GPs' knowledge, skills in and actual use of cognitive behaviour therapy increased.	QCs in Australia.
UPDATE December 2020										
Fisher 2013[74]	North East Ohio, USA	Before-and-after study and survey (qualitative data)	PHC	78 participants in 20 practices/ groups; some groups were inter-professional	1 year	The American Board of Medical Specialties' Performance and Practice initiated the project to support GPs in working in groups to improve practice.	A coach facilitated the process, led discussions, helped the team to recognise their skills, to identify the next steps and to address problems arising.	Physicians discussed their priorities for improvement, narrowed the topic, reflected on results of patient surveys and shared their view of 'best practice' using personal examples.	Introduction of QI tools into groups succeeded. Participants felt that the group activity encouraged collaboration with colleagues.	Practice-Based Learning and Improvement in the USA.
Francois 2013[75]	Isère, France	Survey	PHC	16 groups, 132 GPs	Not applicable	Review the implementation of QCs by mapping the groups, describe the perspective of participants and study how these groups work.	Facilitators helped the groups to share experiences and to discuss difficult cases and medical errors.	Case discussions, audit charts to analyse prescription habits, interactive learning, reflective thinking and consensus-finding, local opinion leaders.	6–10 GPs in each group, meetings lasted between 1 and 2.5 hrs, 6–10 meetings per year, participants had a high level of satisfaction.	Description of QC development in Isère, France.
Wilcock 2013[76]	England	Cluster randomised controlled trial	PHC	11 practices using workshops, 12 practices usual care	12 months	Test of a tailored educational intervention on the clinical management of	Facilitated small-group workshops with practice teams.	Adult learning approach to solving real-world problems, tailoring the learning need, using	The intervention did not alter the clinical management of patients with	QC-like intervention in England testing guideline adherence.

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				(NICE guidelines)		people with dementia.		workshops at the work place.	dementia.	
Andres 2015[77]	Germany	Focus group	PHC	12 health-care professionals	Not applicable	Evaluation of 20 years' QC work	Maintaining autonomy, self-determination of topics and the process in QCs ensure the practical rele-vance of topics and emotional engagement of participants.	Case-based learning among peers in a facilitated group process is key in the QC process.	Measures to support QC-work: evidence-based information and trustworthy prescription patterns.	20 years' experience of QCs in Germany
Dowling 2015[78]	Ireland	Survey	PHC	96% of GPs participating in CME groups responded (1366), 146 groups	Not applicable	Investigate whether taking part in CME groups improves GPs' clinical knowledge.	A local, small-group setting provides live peer-group interaction, peer support and reflection on practice.	Face-to-face activities, multiple exposure, the use of multi-media and multiple education techniques.	97% stated that they want to improve their clinical practice, 86.3% agreed that taking part in CME groups is key for this.	QCs in Ireland
Ver-bakel 2015[79]	The Nether-lands	A three-group cluster randomised controlled trial	PHC	10 groups in each intervention group	4 months	Assess the effect of two interventions on patient safety culture: a survey compared to adding a QC-like intervention compared to usual care.	Team-based reflection on personal practice data and team-based development of action plan.	Didactics were added to the experiential learning principles of Kolb, for example, concrete experience, reflection, conceptualisation, and experimentation.	Increased reporting of critical incidents	Dutch QC study on improving patient safety culture.

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Mahl-knecht 2016[80]	Austria (Salzburg) and Italy (Tirol)	Before-and after-study	PHC	20 GPs in regional QC groups (number of groups not mentioned)	3 years	Assess whether quality can be improved by self-auditing, benchmarking and QCs.	Facilitated, regular group meetings	Critical self-reflection, audits and feedback, benchmarking.	The mean quality score increased significantly.	Austrian–Italian study using benchmarking in QCs.
Vervloet 2016[81]	The Nether-lands	Controlled before-and-after study	PHC	4 groups (39 GPs) in the intervention and 4 groups (38 GPs) in the control group	1 year	Evaluate the effect of a multifaceted, peer-group-based intervention aiming to reduce respiratory tract related antibiotic prescriptions.	A series of regular meetings between GPs and pharmacists in the same catchment area.	Communication skills training, including communication about delayed prescribing, quarterly feedback figures for GPs.	Guideline adherence increased.	Dutch QC study on improving drug prescription involving pharmacists.
Jäger 2013[82]	Germany	Protocol of a cluster randomised controlled trial	PHC	10 QCs (40 GPs)	6 months	To implement structured medication counselling, use of medication lists and medication reviews to avoid potentially inappropriate medication.	QC meetings every three months.	Development of individual concepts of change and their presentation at QC meetings. Posters and flyers for patients. Written feedback on individual practice patterns.	The degree of implementation of the three recommendations measured at patient level.	German QC study on improving drug prescription.
Jäger 2015[83]	Germany	Description of intervention	PHC	12 GPs and 8 medical practice assistants from 8 practices participated in the workshop.	6 months	Describe the content and delivery of the tailored intervention.	No further mention of QCs in the paper.	Workshops about structured medication counselling, use of medication lists and medication reviews to avoid potentially inappropriate medication.	The workshop seemed to improve participants' knowledge of medication management.	German QC study on improving drug prescription.

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Jäger 2017[84]	Germany	A cluster randomised controlled trial	PHC	Intervention group: 10 GPs in 5 different QCs; control group: 11 GPs in 6 different QCs,	6 months	As above in Jaeger 2013	Not mentioned	Training for GPs and medical practice assistants, educational material for patients, individually developed action plans, written feedback on prescription patterns.	Little or no effect of the tailored programme on the combined primary outcome could be substantiated. Lack of statistical power to detect any effect.	
Jäger 2017[85]	Germany	Interviews	PHC	Analysis of 12 interviews, 21 question-naires, 120 documenta-tion forms.	Evalua-tion of 6 months' study	To evaluate the study Jaeger 2017 using various data sources.	Facilitation or group dynamics were not described as QCs were not used as planned.	Workshop-like atmosphere of one meeting.	Patients were not able to use the tablets provided. Participants suggested integrating the training into QCs.	
Ter Brugge 2017[86]	The Nether-lands	Mixed-methods design: question-naire about types of group meetings followed by interviews	PHC	78 out of 128 GP supervisors filled out the questionnaire; 18 GP supervisors were interviewed	Not applicable	Examine different types of group meeting and explore the use of clinical research evidence.	Little discussion on clinical applicability of evidence.	Guidelines, local opinion leaders who lecture, consensus discussion.	QCs are the type of group meeting that occur most often in PHC. They seem to be more goal-oriented than learning-oriented. The agenda was heavily influenced by health insurance companies.	Dutch QC study on improving drug prescription involving pharmacists.

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Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Trietsch 2017[87]	The Nether-lands	A cluster randomised controlled trial	PHC	21 QCs (197 GPs)	3 years	Test the effect of audit and feedback with peer review on GP' prescribing and test-ordering performance.	Facilitation by local opinion leaders (laboratory specialist or local pharmacist) who were trained in a three-hour meeting. The groups met twice for each topic.	Facilitators had written and digital evidence-based materials, individual feedback reports	The increase in total tests ordered was 3% in the intervention and 15% in the control group. The increase in prescriptions was 20% in the intervention and 66% in the control group.	Dutch QC study on improving test ordering and drug prescription.
Andres 2018[88]	Germany	Controlled before and after study	PHC	48 GPs	12 months	Test the effect of audit and feedback with peer review on quality indicators for coronary heart disease (CHD)	Classic German QC without further description	Individually presented 11 quality indicators for patients with CHD; feedback reports for each doctor's practice at two QC meetings	For three of these indicators the increase rates were higher than those in the Bavarian control group	German study of use of quality indicators in QCs
Binienda 2018[89]	USA (Ohio)	Survey	PHC	126 GPs	Not applicable	To explore the research efforts of Practice Based Research Networks (PBRN)	Not applicable	Not applicable	PBRNs currently thrive on conducting research predominantly in quality improvement and practice transformation	QI in US

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Kral 2018[90]	Czech Republic	Case study	PHC	GPs, not stated how many	6 months	Use of quality circles as a support tool in the taking over of practices by young general practitioners.	1st meeting, identification of problems; 2nd meeting, discussion of specific issues of starting to practice; 3rd meeting, analysis of the suggested measures and implementation; 4th meeting, evaluation.	Facilitated discussions	QC work offers a good platform for young GPs in starting their own practice.	QC pilot in the Czech Republic
Park 2018[91]	Scotland	Focus groups	PHC	GPs/Practice Nurses/Pharmacists	Not applicable	To determine how groups recruit new members and discern what are the important attributes of the new members.	Not applicable	Not applicable	4 themes: group formation and purpose; group culture; experience of group members; professional socialisation.	Recruitment to PBSG in Scotland
Pedersen 2018[92]	Norway	Case series	PHC	53 health care professionals PHC	12 months	to investigate what is discussed when QCs work to complete an action form as part of an audit and feedback cycle.	Insight into their own and their colleagues' practices.	Discussion of results of the audit; identification of gaps between recommendations and local practice; choice of areas for improvement; addressing local barriers and enablers; evaluation.	Acting on audit and feedback provided an opportunity to discuss practice.	QC I Norway

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Rogn-stad 2018[93]	Norway	Cluster-randomised controlled study	PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	To undertake a multifaceted, educational intervention to improve GPs' prescribing practice for patients aged ⩾ 70.	See Rognstad 2013	See Rognstad 2013	Reduction of Potentially inappropriate prescriptions.	Norwegian QC studies on improving drug prescriptions
Rogn-stad 2018[94]	Norway	Cluster-randomised controlled study	PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	To explore the characteristics of the GPs responding to QC intervention.	See Rognstad 2013	See Rognstad 2013	GPs with the lowest adherence to recommended practice at baseline improved their practice most.	Norwegian QC studies on improving drug prescriptions
Will-man 2018[95]	Scotland	Survey	PHC	Not known	Not applicable	To assess the educational impact of PBSGL.	Not applicable	Not applicable	PBSGL is an essential pillar for supporting all doctors in Defence Primary Healthcare.	Scottish PBSGL

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Cunningham 2019[96]	Scotland	Evaluation	PHC	Not applicable	Overview of 17 years	To increase clinical knowledge and to implement it.	Facilitated discussion case presentations; study of current evidence base; proposal of changes to practice.	Members are encouraged to make a commitment to change, to log these changes in a shared document, and to review changes with their colleagues.	3,400 members drawn from GPs, GP nurses, pharmacists and other professions.	Scottish PBSGL overview
Dowling 2019[97]	Ireland	Survey	PHC	1686 GPs answering the questionnaire	Not applicable	To examine whether local, accessible ongoing CME-SGL for rural GPs meets their educational needs.	Not applicable	Not applicable	87% reported that their educational needs were fully or mostly met.	Irish CME groups
Martin 2019[98]	Switzer-land	Before and after study	PHC	9 GPs	2 years	Assess status of colorectal carcinoma screening and use of shared decision when choosing screening method.	Facilitated small group work according to Swiss standards.	data-driven Plan-Do-Study-Act cycles to implement changes in practice.	Through data-driven PDSA cycles and organisational changes, GPs implemented SDM tools in their daily routine.	Swiss QC on screening of colorectal carcinoma

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Sieben-hofer 2019[99]	Germany	Cluster randomised controlled study	PHC	52 general practices	24 months	To examine whether case management reduces thromboembolic events and major bleeding events.	Training for healthcare assistants; information and quality circles for GPs; 24 months of case management.	Quality circles to discuss practical problems; case discussions.	The intervention appears to have positively influenced several process parameters under 'real-world conditions'.	German QCs on antithrombotic treatment
Armson 2020[100]	Canada	Mixed methods	PHC	139 GPs	Not apppli-cable	To assessed feasibility and effectiveness of practice-based small-group learning in academic half days; question-naire and interviews.	Participants were divided into groups of 14-16 members to discuss 12 different module topics.	Presentation of clinical cases presented in educational modules and reflection on own clinical experiences; trained peer facilitator.	Feasible approach for half day learning sessions.	Canadian PBSGL
Dowling 2020 [101]	Ireland	Before and after study using mixed methods	PHC	4 CME groups including 43 GPs	6 months	To identify whether CME-small group learning increases knowledge and changes behaviour; questionnaires, prescribing audits and qualitative focus groups.	A two-hour teaching module on deprescribing in older patients was devised and implemented.	Needs assessment; four case studies and own examples; facilitated discussion.	Learning outcomes seemed achieved; 79.9% of cases were de-prescribed; sharing experiences helped them change practice	Irish CME groups

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Mahl-knecht 2020[102]	Austria and Italy	Before and after study	PHC	56 GPs	2 years	To assess the changes in quality of life (QoL) and patient satisfaction of chronically ill patients in Tyrol and South Tyrol.	Not described	Intervention consisted of self-audit, benchmarking and QCs	The impact of the intervention was not significant within the intermediate time periods analysed in the study.	QCs in Tyrol (Austria and Italy)
Mercer 2020[103]	Scotland	Survey	PHC	4371 GPs	Not applicable	To determine GPs' views on QCs.	QC participants were asked to what extent QCs were: 1) well organised; 2) friendly; 3) well facilitated; and 4) productive	Not applicable	2456 responses were received from 4371 GPs (56.4%). QCs are in need of more support to improve quality of care	Scottish PBSGL
Plüss-Suard 2020[104]	Switzer-land	Before and after study	PHC	GPs, nurses and pharmacists	6 Years	To describe antibacterial use in long-term care facilities and to investigate the determinants of use.	Improving the enforcement of clinical guidelines within long term care facilities prescribing practices.	Benchmarking, analysis of attitudes towards guidelines, building consensus and evaluation of results.	Antibacterial use decreased from 45.6 to 35.5 DDD per 1000 beds per day.	Swiss QC on drug prescription

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Kamradt 2018[105]	Germany	Study protocol: three-armed cluster randomised trial compared to standard care	PHC	193 practices	3 years	To examine the change of the antibiotic prescription rate within three intervention arms and the comparison between the three intervention arms	Various social mechanisms influence the spread of new attitudes and behaviours	A: e-learning, QCs, data feedback B: A plus in addition, feedback tailored for practice staff C: A plus computerized support and multiprofessional QC.	Established indicators of the European Surveillance of Antimicrobial Consumption Network. Process evaluation: interviews.	German QC for rational antibiotic prescribing patterns. Effectiveness study is still pending.
Poss-Doering 2020[106]	Germany	Evaluation: interviews and surveys	PHC	76 GPs and 80 medical assistants	Not applicable	To describe the individual and organizational factors affecting the uptake of this multi-faceted program using surveys and interviews	Not applicable	Not applicable	Highest uptake gave feedback reports, background information, e-learning modules and disease-specific QCs.	
Poss-Doering 2020[107]	Germany	Evaluation: interviews	PHC	GPs, medical assistants and stakeholder representa-tives	Not applicable	To explore factors and processes attributed to the network's contribution to improving antibiotic prescribing.	Not applicable	Not applicable	Professional peer exchange, social support and reassurance contributed to behaviour change.	

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Stewart 2020[108]	Scotland	Evaluation: interviews	PHC	GPs, secondary care doctors	Not applicable	To identify the perceptions and experiences of participants in mixed groups of general practitioners and secondary care doctors	Not applicable	Not applicable	There was desire to improve working relationships; logistics of arranging further meetings seemed challenging.	Scottish PBSGL in mixed groups (GPs and secondary care doctors)

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Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

CMO configuration 1: **'participants know what to expect'**

If the introductory workshop conveys the principles of QI in PHC and the workings of QCs (social persuasion) (C), this will increase future participants' motivation to join QCs (O) because they learn what to expect and may feel that they are capable of meeting expectations (increase of self-efficacy) (M).

Surveys have revealed wide-reaching gaps in information, some of which are the cause of misunderstandings and misjudgements. In particular, the working methods and objectives of medical quality circles are apparently insufficiently known. Better general information on this subject, which contracted doctors, in particular, expect from their KV [health insurance company], is therefore urgently needed. As examples from the Netherlands and Great Britain show, active information from the target group is a basic prerequisite for quality-enhancing measures in practice [translated from German][1].

Introduction of the model … is important for understanding and helps participants during the start of the process. It was also vital to have a common and shared understanding of the problem among participants. It is worthwhile taking the time for an agreement on shared guidelines …[2].

To deal with these issues [information overload], an initial, introductory session of 'Reflective Practice' needs to be included, where GPs' experience of previous prescribing management interventions can be aired, where safe 'rules of engagement' can be agreed, and the purpose of the 'reflective practice' intervention made explicit[3].

CMO configuration 2: **'need for autonomy and obligation'**

If the administration at the national level or at the level of health insurance companies entrusts GPs with QI and autonomy (puts them in control of how do it) (C), then GPs may consider participating in QCs (O) because they feel they can take on the responsibility and make a difference (M).

In the discussion with facilitators, the QC participants expressed their desire to be self-determined and work independently. For this reason, the Federal Association of Statutory Health Insurance Physicians (KBV) and the Associations of Statutory Health Insurance Physicians (KVen) have laid down the thematic and methodological autonomy of QCs as a prerequisite in their guidelines for quality-circle work and have committed themselves to supporting them [translated from German [4].

CMO configuration 3: **'sharing similar needs'**

If the administration at the organisational level of QCs provides support (i.e. in training facilitators, data gathering, provision of evidence-based information), and the administration protects time and space and offers CME points and small financial incentives to QC participants (C), then the latter will meet in groups to exchange ideas (O) because GPs prefer learning in QCs (M); support generates positive expectations among participants (M) and GPs believe that QC meetings with their peers will be useful (M).

External staff should organise QCs as facilitators have too little time to do this [translated from German][1].

The most-cited reason for joining Problem Based Small Group Learning (PBSGL) ……. their preferred learning style. 'I find my preferred method of learning to be in small groups and case-study discussion, so this programme seems ideal for my learning needs[5].

To ensure attendance in the future, the educational sessions need to be protected by the use of a paid locum, in the same way as other practice development work is now being supported[3].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

CMO configuration 4: **'need for relatedness'**

If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g., introduces people to each other, opens discussions, clarifies and summarizes statements (C), then group members will get to know each other and norm rules that they are willing to follow and build safe environment based on trust (O), because members want to be among and to interact with equals (M).

We estimate it took three to four sessions for the group to be comfortable with this process. Open discussions and debates then came more freely, and the group continued to gel[6].

Interestingly, the stage of storming, which is characterized by interpersonal hostility and conflict, was not evident in either group[5].

The role of the facilitator has been recognised. They need to be competent at many tasks including opening the discussion, clarifying, summarising, questioning and devising strategies to improve group function[7].

GPs regard the group as a place for social support, … growth in the professional role … for protection against burnout. Although … main purpose of small-group work is exchange … of knowledge, social aspects should not be neglected because they will increase the motivation to continue with meetings …. [8].

The success of group learning between GPs within a practice depends to a large extent on the quality of relationships within the group. Where individuals feel that their management decisions are under threat from colleagues with whose judgements they are not comfortable, discussion may be abruptly curtailed [3].

CMO configuration 5: **'need for autonomy and control'**

If the group members choose their own topics and facilitator (C), then they will feel they own the QC (O) because their need for autonomy - a feeling of being in control of their own behaviour - is satisfied (M).

Tutors did not consider themselves as 'experts' but as 'one of them'. Being open about their background as GPs was an agreed-upon strategy, and tutors deliberately tried to avoid being perceived as experts. The tutors experienced that their own background was important for GPs' trust and acceptance[9].

The facilitator is selected by the group[10].

It is important for a learner to be in control of his or her learning process, to be motivated and to perceive meaningfulness[11].

… the rise of evidence-based medical guidelines probably decreases individual providers' autonomy. Physicians have raised similar concerns about threats to the autonomy of their profession …. … It is within this context, … declining perceived autonomy for … physicians, that we compare the participatory local and central expert approaches to QI[12].

CMO configuration 6: **'size of the group affects communication'**

If group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with all participants and follow their conversations (M).

All GPs participating in such peer groups, on average consisting of six to eight peers, located in southern Norway[13].

How can QCs be supported? (Table 2) Group sizes > 15 or < 5 - are problematic and participants need support [translated from German][14].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The effect of the educational asthma programme was partly modified by the group size; prescribing behaviour for [asthma] exacerbations improved more in smaller groups. The group size varied from 4 to 13…. This result is … an optimal group size of 5 to 6 group members[15].
CMO configuration 7**: 'feeling safe and not vulnerable'** If participants trust each other (C), then they can disclose how they work and also the holes in their knowledge (O), because they feel safe rather than vulnerable (M). *In time, group members develop confidence and security in the group, rendering the disclosure of ignorance and 'blind spots of knowledge' easier. Group members could either use the whole group or parts of it to assess their own learning needs*[8].
CMO configuration 8: **'need for competence and self-actualisation'** If the facilitator supports the participants and encourages them to tell their stories and share their experiences in a safe environment, e.g. by encouraging interactive responses, through discussions and by summarising statements (C), then participants will become involved and share their positive experiences and failures (O) because they want to improve their professional competence (M), gain professional confidence (M) and fulfil their professional potentials (M). *Subjects, topics and cases discussed in groups come from daily work and are highly relevant to practice. The small group will meet the demands of developing generalist knowledge as well as the expert role in general practice*[8]. *Small groups will have opportunities to discuss the 'art of medicine', founded upon context, anecdote, patient stories of illness and personal experiences. Accepting emotional responses being mirrored by other group members corresponds in some respects to the process in Balint groups*[8]. *Comparison with one's peers was important, as was the support, confidence and reassurance that some gained from being part of the group*[7]. *Exchanging experiences in QCs, GPs can work out and clarify the characteristics of general practice, which improves knowledge transfer [translated from German]*[16]. *'It [the role as a facilitator] gives you licence to play devil's advocate as well and challenge people a bit more whereas, if you were always doing that as just a group member, people might think you were just doing it to annoy them*[17].
CMO configuration 9: **'previous knowledge is activated'** If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by telling their own relevant stories (O) because the process activates knowledge they already possess (M). *The use of a case-based format encourages activation of previous knowledge, allowing better retrieval of knowledge in the clinical setting…, particularly when it involves participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases and provide feedback on performance*[10]. *During discussions at the level of relationships [case discussion], the exchange is more intense than in the exchange of pure facts; one's own behaviour is better analysed and suggestions arose for training in one's own practice [translated from German]*[18].

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Virtually everyone participates in presenting a case, asking for advice or clarification, or describing their practice patterns[6].
CMO configuration 10: **'immediate relevance for the practice'** If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O), because it relates to their everyday work and is therefore of immediate use (M). *To better support PCPs (GPs) in managing uncertainty, more meeting time should be spent on the deliberate practice of blending evidence with experience (e.g. per-case, focused analysis of guidelines/relevance) and using case follow-up insights to 'reconstruct practice' for the individual patient while appreciating implications for the clinic/office[19].* *There also must be some motivation for learning and change: this can be ensured if the issues discussed are derived from the learner's own clinical practice[6].* *The decision to focus on clinical problems instead of tests was a good choice, since it allowed the feedback and group work to be linked to national evidence-based guidelines. GPs appreciated this approach, because it was also closely related to their everyday work routine[20].* *By discussing specific cases, real problems in participants' everyday practice become the topic of discussion in QCs instead of designed problems. In systematic reconstructions [of patient situations], the experiences are made conscious, so that intuitively applied – implicit – mental guidelines can be made explicit [translated from German][21].*
CMO configuration 11: **'cognitive dissonance'** If participants discuss and reflect on their work processes (e.g. based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance (a negative emotional state triggered by conflicting perceptions) that makes them reconsider their own way of working (M). *During the meetings, the treatment of these specific patient records was discussed, especially differences between what was prescribed according to the records and what was actually dispensed[11].* *One of the key features of QCs is that working methods map the quality of care in one's own practice. First of all, this distinguishes QC work from further training in the classical style and second, it enables participants to identify real quality problems in their own practice [translated from German][14].* *The combination of the written simulated cases with actual prescribing allows the GPs to reflect on their decisions as well as the background for these decisions, and is in line with suggestions to make drug utilization studies closer to the reality of practice[11].* *Through reflection, a gap between current practice and best practice is recognized. Distinguishing this gap presents an opportunity to identify learning objectives specific to the family practice setting[10].* *Our results are in concordance with research that suggests that GPs may feel disappointment if their prescribing practice conflicts with their ideals[9].*
CMO configuration 12: **'social learning'** If the facilitator uses purposeful didactic techniques (e.g. brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection on the work

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process (C), then the group will create a learning environment that promotes knowledge exchange (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

The participating GPs experienced the CME group meetings as an important arena for learning. They reported picking up good advice from others and learning practical alternatives …. GPs said their prescription data would not mirror all learning effects: 'The whole point is to reflect more …' [9].

Once the problem is acknowledged, one must learn and understand what caused the problem and how it can be solved. For this, elucidating and discussing the decision process underlying treatment decisions may be useful. To accept new information or practice recommendations, the credibility of the source is of importance[15].

Cooperative learning can increase flexibility and joy in medical action (everyone learns from everyone) [translated from German][16].

Learning from and with colleagues is an important source of both new information and strategies for applying that information to practice[10].

Cognitive feedback is feedback on the decision process, i.e. why or how a decision is made and not on the decision itself, i.e. which decision is taken[11].

CMO configuration 13: **'positive interdependence between health insurance companies and GPs'**

If physician network organisations require continuous QC activities (C), then QCs will negotiate priorities and design creative solutions (O) because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M).

The physicians in the Rhine-Main network of physicians committed themselves to participating in QCs when they joined the contract. In QCs, they discuss prescription patterns for specific clinical situations and adapt guidelines to local conditions [translated from German][22].

The participation of German GPs in QCs is mandatory in order to be part of government-funded disease management programmes (DMPs) or to be part of pilot projects with health insurance funds[23].

CMO configuration 14: **'threat to professional autonomy'**

If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and fear they lack autonomy in their clinical role (M).

GPs and facilitators pointed to the difficulty of reaching consensus on a best buy…. Some found the term 'off-putting' because of its financial connotations. This suggests that some GPs may feel that their management decisions should be based on wider considerations than those of cost-effectiveness[3].

GPs were also unlikely to take part if they felt that the sessions would make them feel unsafe or if they felt that the sessions were yet another 'top-down' managerial intervention, where the main intention was to reduce prescribing costs[3].

The majority of respondents in both regions expected to benefit from participation in QCs but were unwilling to accept the risk that QI could be misused for control or cost reduction [translated from German][1].

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CMO configuration 15: **'positive interdependence among group members'**

If participants maintain an atmosphere of trust in a learning environment that promotes the exchange of knowledge, assisted by facilitators who use professional techniques (e.g. contentious discussion, reaching consensus and role play) (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as similar, and so act and negotiate cooperatively to reach a common goal (M).

The acquisition of new knowledge, skills, and approaches to bridge this gap follows. Often, however, access to new information alone is not sufficient. Reflection and discussion are necessary to help physicians 1) identify areas where current practice requires change and 2) develop strategies to integrate this new approach[10].

There was widespread agreement that the principal requisites for a good facilitator were experience and competence in small-group skills. One facilitator identified another skill: 'You've got to be able to hold the tension between comforting and challenging'[7].

The personal interaction and mutual influence between colleagues implicitly resulted in an individual or group contract[24].

Psychological research into group behaviour has produced an inventory of factors that influence conformity with group standards. Unanimity provides more pressure to conform, while privacy makes it easier not to[25].

CMO configuration 16: **'identifying and removing barriers to change'**

If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O) because participants help each other to develop strategies to identify and overcome these barriers (M).

Barriers within doctors relate to competence, motivation and attitudes, and personal characteristics such as learning style, whereas barriers within practices exist as doctors do not work entirely independently[26].

Within the group, members endeavour to identify specific barriers to these practice changes and to formulate implementation strategies to facilitate desired changes[10].

The implementation of new knowledge is facilitated by expressing and discussing how to overcome obstacles to its acceptance[25].

CMO configuration 17: **'need for competence, autonomy and relatedness'**

If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility and stewardship (O) because this fulfils their need for competence (being able to achieve specific objectives) (M), autonomy (a feeling of being in control of their own behaviour) (M), and relatedness (a sense of connection to a larger group) (M).

The decentralised approach at a local, internal level includes participants gathering experience from daily practice and formulating a feasible consensus solution. The advantage of this method is that GPs are actively involved in this process and therefore motivated to implement the (newly) developed guidelines. In addition, the participants involved will be more likely to accept (new knowledge) and feel committed to implement it [translated from German][16].

Potential advantages of the local approach: it promotes buy-in, maximizes fit to local culture and circumstances, maximizes the ability to work out the details associated with implementation, and produces a highly rewarding experience[12].

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CMO configuration 18: **'intention to change'**

If participants publicly announce their intention to change (C), then they are more likely to implement the change (O) because they and others in the group all think it is a good idea and believe they can carry it through (M).

I was surprised to see how willing people were to reflect on their own behaviour and practice e... and constantly make comments like: 'Well, did I really do that? I surely have to pull myself together'. Very strong will, apparently, to make changes[9].

The third was the development of individual and group plans for change, to stimulate GPs to really put their plans into daily practice[20].

Groups can be more effective in accomplishing tasks, and publicly announcing behavioural changes results in more commitment than private change[25].

… draws on 'the theory of planned behaviour' and other studies that have identified the pre-requisites of successful behaviour change in general practice reviewed by Veninga et al. 2000[3].

CMO configuration 19: **'testing new knowledge'**

If participants validate and test new knowledge in a QC, moderated by a skilled facilitator in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M).

Interactive approaches, however, can be effective, particularly when they involve participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases, provide feedback on performance, and offer opportunities for practising newly learned skills[10].

Understanding application of new knowledge. The discussions helped members to consider translating evidence into practice: 'Sometimes you can read about things but are unable to see how to put it into practice and I feel PBSGL enables you to think how you can do that'[5].

Next, they examined empirical evidence concerning the validity of these solutions. To facilitate this process, teams had access to the large resource library that the research team had assembled[12].

CMO configuration 20: **'gaining confidence in an innovation'**

If the group repeatedly practises implementing and adjusting to an innovation (C), then its members trust their own competence and turn the innovation into a habit (O) because successful outcomes increase their confidence in their abilities (M).

One meeting may not be enough to actually change treatment, although that is the usual procedure in the peer review groups. Behavioural theories stress the importance of repetition, especially for changing routine behaviour[2].

In general, GPs were excited to find in the second year that they had indeed changed in accordance with their plans, and they were then usually more motivated to implement further changes[20].

These results demonstrate the need to look at repeating/reinforcing messages at 12–24-month intervals[27].

The constant feedback on progress achieved and the further possible improvements are other success factors[28].

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The intervention comprised repeated feedback on prescribing routines and an intensive programme of educational small group sessions, as described by Bahrs et al. (2001)[29].
CMO configuration 21: **'repetition priming and automaticity'** If participants build a regular group and practise using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because responses improve with repetition: 'practice makes perfect' (M). *Practitioners develop expertise when they move from their comfort zones to examine problems 'at the upper limit of the complexity they can handle'; they learn, and iteratively gain mastery through cycles of reflecting on practice, obtaining feedback, and adjusting performance[19].* *The benefit from participation depended significantly on the frequency of the meetings. Successful projects might not only positively reinforce the introduction of continuous QI, but could also bring about a positive attitude to the other aspects of systematic and continuous quality improvement[30].* *Real improvements to performance in daily care can only occur if there is an ongoing and regular quality circle process [translated from German][31].*

In blue: changed wording

CMO configurations across papers

Context mechanism outcome configuration 1: 'participants know what to expect'

Improved wording: If the introductory workshop conveys the principles of QI in PHC and the workings of QCs (social persuasion) (C), this will increase future participants' motivation to join QCs (O) because they learn what to expect and may feel that they are capable of meeting expectations (increase of self-efficacy) (M).

The introduction strategy included a meeting with all staff in which the model was explained, a manual on theoretical and practical backgrounds of the model; support in the use of the model and the start of a first improvement project; a one-day course on quality management ….[32].

This (small projects) seems to be in accordance with previous findings where improvement of the internal structure is often seen as the first step towards the full adoption of continuous quality improvement. It is sensible therefore to advise practices to start with this kind of improvement project[32].

Our findings stress the importance of starting CQI with small, easy-to-handle projects[30].

For CQI to be introduced successfully, a positive attitude toward CQI is required from all who will be working with it[30].

(They) learned how to organise the meetings, how to guide the members of a peer group through the steps of the quality circle, and how to deal with group processes[33].

Introduction of the model … is important for understanding and helps participants during the start of the process. It was also vital to have a common and shared understanding of the problem among participants[2].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

In September 1992, 200 general practitioners and internists of a defined postal code area were contacted by the Kassel district office of the Kassenärztliche Vereinigung Hessen and invited to an information event [translated from German][34].

It might be better to provide targeted information in advance of the project at an information event. This would make it easier for potential participants to decide for or against participating in the project, since questions as well as fears and reservations can be clarified immediately [translated from German][31].

Surveys have revealed far-reaching gaps in information, some of which are the cause of misunderstandings and misjudgements. In particular, the working methods and objectives of medical quality circles are apparently insufficiently known. Better general information on this subject, which contracted doctors in particular, expect from their KV (health insurance company), is therefore urgently needed. As examples from the Netherlands and Great Britain show, active information from the target group is a basic prerequisite for quality-enhancing measures in practice [translated from German][1].

Introduction of the model … is important for understanding and helps participants during the start of the process. It was also vital to have a common and shared understanding of the problem among participants. It is worthwhile taking the time for an agreement on shared guidelines …….[2].

To deal with these issues (information overload), an initial, introductory session of 'Reflective Practice' needs to be included, where GPs' experience of previous prescribing management interventions can be aired, where safe 'rules of engagement' can be agreed, and the purpose of the 'reflective practice' intervention made explicit[3].

A more structured introductory meeting that would assess participants' learning needs, negotiate the future content of the small group meetings, seek agreement on learning agenda, dates, times and venues, establishing communication channels and explicitly discussing the educational rationale[35].

Context mechanism outcome configuration 2: 'need for autonomy and obligation''

Improved wording: If the administration at the national level or at the level of health insurance companies entrusts GPs with QI and autonomy (puts them in control of how do it) (C), then GPs may consider participating in QCs (O) because they feel they can take on the responsibility and make a difference (M).

Social Law Code has given new impetus to the obligation of the associations of statutory health insurance physicians to implement quality assurance measures. As early as 1991, the board of the Kassenärztliche Vereinigung decided to introduce nationwide quality circles as an instrument of quality assurance in outpatient care [translated from German][34].

In January 1993, the Association of Statutory Health Insurance Physicians in Southern Baden constituted an interdisciplinary working group with the aim of developing the organisational and conceptual framework for the establishment of quality circles in the Southern Baden region [translated from German][36].

The participants expressed their fears that participation in the quality circle could lead to possible regulation by KV or health insurance companies [translated from German][37].

The respondents are suspicious of an obligation for all physicians to participate in quality assurance measures. In Saxony-Anhalt in particular - as shown by the clear statements made by those surveyed - this scepticism is linked to the consideration that a commitment to quality assurance measures would be more acceptable if it also affected those colleagues who refrain from continuous medical education training [translated from German][1].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

In 1993, the health structure law ('Gesundheitsstrukturgesetz') added more specific recommendations to the existing body of rules about quality assurance with the explicit aim to stimulate quality assurance programs (quality circles) in primary and hospital care[31].

The participation of German GPs in QCs is mandatory in order to be part of government-funded disease management programs (DMPs) or to be part of pilot projects with health insurance funds[23].

Furthermore, some differences between the regions could be observed. In region 1 the impact seemed highest, which may be explained by the activities of the Association of Statutory Health Insurance ('Kassenarztliche Vereinigung') in that region regarding continuing professional education[38].

Research evidence showed that budget constraints could reduce prescribing volume and costs (14 Sturm H 2007)[38].

In the discussion with facilitators, the QC participants expressed their desire to be self-determined and work independently. For this reason, the Federal Association of Statutory Health Insurance Physicians (KBV) and the Associations of Statutory Health Insurance Physicians (KVen) have laid down the thematic and methodological autonomy of QCs as a prerequisite in their guidelines for quality circle work and have committed themselves to supporting them [translated from German][4].

Context mechanism outcome configuration 3: 'sharing similar needs'

If the administration at the organisational level of QCs provides administrative support (i.e. for training facilitators, data gathering, provision of evidence-based information), and the administration protects time and space, and offers CME points, and small financial incentives to QC participants (C), then they will meet in groups to exchange ideas (O) because GPs prefer learning in QCs (M); support generates positive expectations among participants (M) and GPs think QC meetings with their peers will be useful (M).

contextual features at the organisational level:

With a restricted although realistic budget, facilitation should be set up as efficiently and effectively as possible[32].

We have a very busy schedule most of the time, leaving little or no time for extra work[30].

It was mainly a logistics problem. We have little room in practice[30].

We already had so many meetings and we have so many tasks to fulfil. I work in a health care centre[30].

I have often postponed things knowingly. Sometimes the bucket just overflowed[30].

Staying close to the needs and expectations of the practices could be a way to introduce continuous quality improvement more effectively[32].

We also found that the available time and possibilities to plan activities well were felt to be the most important barriers to using the CQI model[30].

When there are great obstacles to change (e.g. limited time, the need to acquire a new skill), the group might decide to set aside time to specifically address strategies for overcoming these barriers[10].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

As a discussion platform, we developed special facilitator manuals according to a uniform didactic concept. It includes relevant clinical portraits (sleep disorders, back pain, upper abdominal pain, heart failure, etc.) in general practice. These materials provide the facilitators with guidance and make it possible to stimulate and supplement the problem-oriented discussion of the diagnostic and therapeutic procedure at critical points. ...In our opinion, the advantage of this approach is that it makes it easier to get started with concrete quality circle work and that quality circles can be implemented on a broad basis [translated from German][36].

External support should help with the administrative organisation of QCs, as this exceeds the time capacity of the facilitators [translated from German][1].

The majority of respondents (85%) [HB: 87.1%] want or even urgently demand support for quality circle work from their Association of Statutory Health Insurance. In Saxony-Anhalt, the vast majority of respondents want both organisational support (e.g. by making rooms available, making contacts and making those contacts available - "start-up on site" - and granting reimbursement of expenses) and content-related support (e.g. by providing materials, topic recommendations, arranging speakers). In Bremen, primarily organisational support is expected [translated from German][1].

The fact that all groups are led by recognised (i.e. trained) facilitators speaks for the existing structural quality. The high level of continuity and frequency of participation also suggests that structural conditions such as accessibility, suitable conference room and location, clear scheduling, etc. are in place [translated from German][14].

In some cases, the KVs took different approaches, for example by organising external facilitator training courses, developing special structure of QC meeting or supervision of facilitators [translated from German][4].

In addition, long-term maintenance of small groups implies a national support for CME in general practice with enough personnel and economic resources to assist all those GPs who have key roles in providing CME at the local level[8].

Participation, ..., does not come without costs. ..., it is time consuming, ... For clinicians, who often see patients continuously throughout the day, it can be especially difficult to find time to participate in QI efforts[12].

... substantial organizational resources ...., including tools that the QI teams could use to develop their programs and the costs of the local approach facilitator. ... HealthOrg covered some but not all of the time that participants spent outside of formal meetings, ...[12].

Staying close to the needs and expectations of the practices could be a way to introduce continuous quality improvement more effectively[32].

The peer groups met on a regular basis according to their needs[33].

...as a so called "clinical theme-course", which will give the participants important CME credits[13].

In Norway, specialists in general practice must renew their clinical specialty every five years. In this renewal process, participation in a number of peer CME group meetings are compulsory, in order to stimulate a continuously medical education and reflection[39].

CME group members earned CME points to renew their speciality[9].

General practitioners (GPs) favour learning environments such as reading journals, discussion with colleagues, and participation in quality circles[9].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

GP specialists have to renew their specialty every 5 years. Recertification demands participation in a number of peer CME group meetings. Typically, a peer CME group comprises seven or eight GPs who set up their own educational programme for monthly evening meetings[40].

The strategy also fts in well with the work setting of many GPs in European and non-European countries, which are often characterised by small practices, relatively isolated settings and a desire for more contacts with peers[20].

The innovative, multifaceted strategy for improving test ordering behaviour was favourably evaluated by a large GP population. All local GP groups expressed a desire for continuation of the meetings after the experiment[20].

GPs appreciate the combination of individual feedback, discussions about guidelines and small group quality improvement meetings driven by peer influence[20].

Success rates of specific strategies seem to be strongly influenced by the extent to which they fit in with the local and organizational context and the physicians' day-today work routines[24].

The first success was the easy recruitment, with practice groups eager to participate in the trial[24].

…these groups of professionals practising in the same region meet regularly to discuss treatment, pharmacotherapy, and patient management[25].

We have also arranged for CME credits, needed to fulfil the educational requirements of ongoing licensure[6].

General practitioners can discuss topics relevant to day-to-day practice. They get access to a local expert … l. Since topics come out of their own and their peers' practices, and are discussed by the expert, it is more likely that perceived and unperceived needs will be addressed[6].

…that a small group format might be more attractive than other forms of CME, since this has been our experience[6].

This learning format may meet a need for practices that have protected learning time to enable them to use multi-professional group learning to its full advantage[41].

PBSGL enabled participants to compare their practice with that of their peers, and this was mentioned frequently as a very positive motivator in joining and continuing in the groups[7].

…with surprisingly few opportunities to gauge themselves and their practice against their peers, and they have been found to value this opportunity highly[7].

The most-cited reason for joining PBSGL … as the PBSGL format matched their preferred learning style. …. Keeping up-to-date in clinical practice was the second-most mentioned reason[5].

The most significant outcome did not come from the evaluative data collected during the research; rather that both groups are continuing to meet more than six months after the pilot finished[42].

PBSG enabled participants to compare their practice with that of their peers, and this was mentioned frequently as a very positive motivator in joining and continuing in the groups. This corroborates previous work which found this to be an enhancer for translating research into practice[7].

The reasons for participation varied and ranged from overcoming the lone fighter situation in the practice, defining the image of the family doctor, possibilities and limits, to searching for practical solutions to everyday treatment problems [translated from German][34].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The most frequently mentioned motives for participating in quality circles were practical help and exchange of experience (57 and 58 mentions) [translated from German][21].

The vast majority of participants cite the collegial exchange of experience as the greatest motivating factor for working in a quality circle. The primary goal is to improve the collegial relationships. At the same time, the desire for more consensus in medical action and the improvement of skills in diagnostics and therapy is mentioned as a very important objective [translated from German][16].

The main motives for participating in quality circles were the expectation of practical help for one's own practice, inter-collegial exchange of experience, improvement of patient care and opportunities for self-reflection on one's own work as well as personal support. Competing time commitments and above all the fear of external controls were mentioned as obstacles to participation in quality circles [translated from German][1].

Quality assurance in outpatient care was considered necessary - even more so in Saxony-Anhalt than in Bremen [translated from German][1].

External staff should organise QCs as facilitators have too little time to do this [translated from German][1].

The summary makes it clear that the question of participation in a quality circle is primarily based on specific medical needs. Many physicians wish to receive practical assistance in their daily practice and wish to overcome the structurally dependent professional and emotional isolation through intercollegial exchange. The most important goal is therefore personal support [translated from German][1].

Overall, more than 86% of the participants were (very) satisfied with the work in the quality circle. In contrast, only 2.8% were dissatisfied and 0.4% very dissatisfied [translated from German][43].

For almost all participants (97.1 percent), the desire to analyse their own prescribing behaviour and to optimise it with the help of the prescription data evaluation of colleagues was at the top of the list. The exchange of experience with colleagues and the expansion and refreshing of knowledge regarding pharmacotherapy were also considered important [translated from German][44].

Data from older surveys showed that family physicians indicated colleagues most often as information sources, followed by journals and books…. The most important requirements for media in medical education as perceived by the participants were its relevancy for daily practice and dependability[23].

… we … predict that German general practitioners … favour the "classical" learning environments such as: journals, colleagues, and quality circles. journals and books. … exchange ideas and discuss actual trends with colleagues collegial and interactive rather than to meet experts …[23].

The second key area of expectation was with the promotion of collegial exchange: more than conventional further-training events, quality circles assumed that a special form of group work by doctors would be a way of overcoming isolation in the private practice [translated from German][1].

To ensure attendance in the future, the educational sessions need to be protected by the use of a paid locum, in the same way as other practice development work is now being supported[3].

The workshop was based on a provincial learning needs assessment and data from focus groups of family physicians from each of the provinces to ensure the curriculum material would meet the needs of physicians across Canada[45].

One of the strengths of the programme is its adaptation to the needs of GPs and pharmacists [translated from French][46].

GPs' participation in PPQC meetings is accredited by the association for their continuing education[28].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

when asked, GPs also express a need for drug information/education that is academic and not promotional[47].

The participants were not offered any extra incentives, except for the education itself[47].

Doctors learn best when they recognise the need for learning and when learning is self-directed[8].

Many studies have shown that small group sessions are one of the most popular and stimulating CME activities practised by doctors[8].

The idea of problem-based and self-directed learning from everyday practice, closely linked to quality improvement, seemed to appeal to many Swedish GPs and the CME programme was successively accepted by the majority of them[8].

A meeting attendance fee was paid to the GPs, €70/hour for a plenary meeting (with the consultants), €45/hour for a quality circle meeting[48].

The brief qualitative responses indicated that participants chose to join the small groups mainly because …there is a better rapport between the individuals and one gains more than just attending a lecture[35].

The importance of a needs-identification process and the involvement of the programme user group in this process have been identified as crucial factors in the success of any effective learning programme[27].

Beginning in 2005, attendees received category-I CME credit[19].

Context mechanism outcome configuration 4: 'need for relatedness'

Improved wording: If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g., introduces people to each other, opens discussions, clarifies and summarizes statements (C), then group members will get to know each other and norm rules that they are willing to follow and build safe environment based on trust (O), because members want to be among and to interact with equals (M).

The groups were different ... we thought that a group is a group and all we have to do is to run the scheme ...and then I experienced that groups have their own cultures. These groups have existed for a while, which we probably have to consider …[9].

Tutors did not consider themselves as "experts" but as "one of them"., Being open about their background as GPs was an agreed upon strategy, and tutors deliberately tried to avoid being perceived as experts: The tutors experienced that their own background was important for GPs' trust and acceptance[9].

Both tutors and GPs emphasised that a "good atmosphere" in the group, and "a sense of security" among group members was essential for an open and constructive discussion[9].

Membership in the peer review group has been stable over time because it is unusual for general practitioners (and their patients) to switch between groups[2].

CME has focused on disseminating information, but it has become increasingly clear that acquisition of knowledge is less important in changing physicians' behaviour than the social context of learning. Habit and custom, the beliefs of peers, and social norms are the major determinants[49].

Sessions are generally held in the evenings with a meal[6].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

We estimate it took three to four sessions for the group to be comfortable with this process. Open discussions and debates then came more freely, and the group continued to gel[6].

The need to maintain the appearance of competence may be more compelling than the need to learn. Several strategies …. First, we tried to create as relaxed an atmosphere as possible. We arranged tables in a circle, removed all barriers …, and held the sessions with a meal[6].

The group and the interactive format are fun[6].

Initially, problems with group functioning were anticipated, but they are … uncommon. Groups of various compositions function effectively in this particular small group environment. … heterogeneous groups might provide broader practice experiences and greater variety in potential solutions to practice problems…[10].

Participants liked the inclusive nature of the small groups and appreciated the egalitarian quality of the interaction within them[7]*. [No hierarchy]*

It didn't matter where we came from; Skye, Wick or Brora. It soon became clear that we were all in the same learning position. And those in Inverness and Aberdeen didn't have all the answers[7].

When the expert comes in, learning stops. … The use of invited experts (invariably hospital-based consultants using a traditional didactic approach to learning) was seen as an anathema to adult learning and the small-group ethos[7].

Members of both groups described the meetings as relaxed, friendly and informal. The facilitators played a crucial role in creating the atmosphere: …, it would seem that the group members also contributed to the positive climate[5].

Reasonably quickly I relaxed. Everybody was keen to make it a success. The group opened up and there was a sense of calm. The positive atmosphere enabled members to be open about knowledge gaps and to ask questions[5].

The two groups appear to be at different stages of development. Group 1 seems to have developed a strong sense of cohesion quite quickly compared to Group 2[5].

Interestingly, the stage of storming, which is characterized by interpersonal hostility and conflict, was not evident in either group[5].

Norming reflects the development of group cohesion, openness and emotional support. The positive social dimension enabled the group to perform – that is, to focus on the task at hand, with resulting effectiveness[5].

To encourage GPs' engagement, all sessions took place over lunchtime, and a sandwich lunch was provided. GPs gained PGEA accreditation for their participation[3].

…, two practices have instituted a regular morning coffee break, which was described in positive terms as a discussion: "The indigestion .. has come up, and we have a coffee break and quite often discuss clinical things and some comments have come out about that"[3].

The success of group learning between GPs within a practice depends to a large extent on the quality of relationships within the group. Where individuals feel that their management decisions are under threat from colleagues with whose judgements, they are not comfortable, discussion may be abruptly curtailed[3].

Most participants stressed the benefits of the intervention for facilitating discussion, which was implicit in the design of the educational intervention. This seemed to counteract the convention of autonomous working practices by GPs, which can lead to professional isolation, even in partnerships[3].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

(GPs) in non-academic settings have few safe and reliable forums where they can reflect and learn from the clinical dilemmas inherent in their work[19].

"Being with colleagues" ... yield four subthemes: (1) gaining renewal through reflection, (2) obtaining others' perspectives, (3) developing collegial trust, and (4) learning specific information/skills .... Over half of the respondents commented on time issues related to participation; a third saw time constraints as deterring attendance[19].

They will facilitate the discussion ..., based on the individual feedback reports, enabling participants to compare own prescription patterns ..... This will probably trigger discussion ..., aimed at critical reflection towards own prescription strategies for elderly patients and facilitating disclosure of areas where individual improvements may be desirable[39]. [Facilitation]

Facilitators .... trained .... over approximately 20 training hours. Facilitators provided ... opportunity for all participants to ask questions .... We ... encouraged participants to discuss their ...practice patterns. The facilitator ...redirected conversations that moved off topic, calmed the skeptics, and encouraged quieter participants to share their personal experiences[6]. [Facilitation]

In the mature group, the facilitator's major role is to introduce the expert to the group and the process, and to provide some closure at the end of the meeting[6].

... tasks of the facilitator are to focus discussion ... to encourage the group to identify factors that ... hinder implementation of new knowledge ... . To successfully fulfil this role, facilitators ...establish a safe, supportive environment ... identify practice gaps and encourage the discussion of sensitive ... issues[10]. [Facilitation]

The role of the facilitator has been recognised. He/she needs to be competent at many tasks including opening the discussion, clarifying, summarising, questioning, and devising strategies to improve group function[7]. [Facilitation]

There was widespread agreement that the principal requisites for a good facilitator were experience and competence in small-group skills. One facilitator identified another skill: 'You've got to be able to hold the tension between comforting and challenging[7]. [Facilitation]

The facilitators were also skilled in encouraging participation[5]. [Facilitation]

'I think you need a facilitator certainly need it for the donkey work of the, arranging the meeting and making sure everybody has the module[17]. [Facilitation]

'It gives you licence to play devil's advocate as well and challenge people a bit more whereas if you were always doing that as just a group member, people might think you were just doing it to annoy them[17]. [Facilitation]

Participants considered that one-to-one mentorship with an experienced or established PBSGL facilitator would be very beneficial. This was also suggested as a method to encourage members of existing groups to train as facilitators[17]. [Facilitation]

Any anxieties that potential facilitators may feel, mainly the concern that a new group will be hard to form, or will be dysfunctional, – need to be discussed with potential facilitators before and during the initial training. Facilitators of such groups will need the most support ...[17]. [Facilitation]

In countries using PBSGL, national networks provide training for facilitators and supporting material for the groups[10]. [Facilitation].

The facilitator is selected by the group[10]. [Facilitation]

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The reasons for participation varied and ranged from overcoming the lone fighter situation in the practice, defining the image of the family doctor, possibilities and limits, to searching for practical solutions to everyday treatment problems [translated from German][34]. [Facilitation]

Our group prepared the facilitators for their task in two one-day training sessions. They had to conduct a model quality circle and critically discuss their role based on a pre-developed manual. In the second training course, we taught them important basic knowledge of group dynamics and basic didactic skills for their role as a facilitator [translated from German][36]. [Facilitation]

The vast majority of participants cite the collegial exchange of experience as the greatest motivating factor for working in a quality circle. The primary goal is to improve the collegial relationships. At the same time, the desire for more consensus in medical action and the improvement of skills in diagnostics and therapy is mentioned as a very important objective [translated from German][16].

The summary makes it clear that the question of participation in a quality circle is primarily based on specific medical needs. Many physicians wish to receive practical assistance in their daily practice and wish to overcome the structurally dependent professional and emotional isolation through intercollegial exchange. The most important goal is therefore personal support [translated from German][1].

1-2 doctors from each group took on the task of the facilitation. AQUA employees trained and supported them during the course of the project. They also prepared facilitation materials and provided organisational support [translated from German][43]. [Facilitation]

The groups were moderated by a primary care physician, who had had a 2-day training on moderation of quality circles and who received supervision in about two sessions per year. One session per 1 or 2 months was planned[38]. [Facilitation]

For this purpose (tutor system to support the moderators) 50 experienced facilitators were trained as quality circle tutors, who have been responsible for the training and further training of facilitators since 2001. In 2002 the KV Westfalen-Lippe followed this concept and trained 30 tutors. The encouraging experiences from both projects led to the KBV introducing the concept at a federal level in 2003. Since then it has trained 116 tutors [translated from German][4]. [Facilitation]

In order to support the facilitators in the design of circle meetings, the KBV has developed structured didactic handouts for circle work, so-called quality circle manuals.... The materials are to be understood as recommendations.... [translated from German][4]. [Facilitation]

The (facilitator) training usually lasts two days, i.e. between eight and 16 hours, usually twelve hours. ... In all twelve KVs, the trainers use the Quality Circle Handbook and their manuals. Further training for facilitators usually takes place in one day and lasts between three and ten hours [translated from German][4]. [Facilitation]

The CQC facilitators were local family physicians recruited and trained specifically to lead study meetings. They were chosen by the CQC steering committee for their skills in facilitating small-group activities, their known interest in chronic disease management, and their involvement in continuing professional development[45]. [Facilitation]

Before the meetings, train-the-trainer workshops were conducted to assist facilitators in their role as group leaders[45]. [Facilitation]

Facilitators were local family physicians recruited to lead and initiate discussion at study meetings and were chosen because of their skills in small group facilitation and involvement in continuing professional development and were selected by the study's steering committee[50]. [Facilitation]

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

... facilitation skills and aptitude were ... important … …. As one of the GPs commented …: "I think the person's much more important than their background." A facilitators' ability to manage a group successfully was central. ... a good facilitator should "... whipping us into line"[3]. [Facilitation]

The ability of the facilitator to manage group discussions, … to create an atmosphere that was non-threatening and supportive. … willing to challenge the group when members colluded with one another to evade potentially contentious issues[3]. [Facilitation]

The respect of the group for the facilitator was crucial to the success of the intervention. Facilitators needed to be grounded in a sound knowledge of prescribed medicines, but also needed to have group facilitation skills[3]. [Facilitation]

Context mechanism outcome configuration 5: 'need for autonomy and control'

If the group chooses its own topics and facilitator (C), then they will feel they own the QC (O) because their need for autonomy is satisfied (a feeling of being in control of their own behaviour) (M).

Tutors did not consider themselves as "experts" but as "one of them". Being open about their background as GPs was an agreed-upon strategy, and tutors deliberately tried to avoid being perceived as experts. The tutors experienced that their own background was important for GPs' trust and acceptance[9].

The extra benefits gained by using GPs instead of non-physicians as (facilitators) have also been reported in a Dutch study[40].

A final limitation, caused by the study design is the fact that the peer groups did not have the opportunity to choose their own topics, …. After reading and discussing the content of the workbooks the peer-review groups defined self-selected change objectives[33].

A bottom-up approach to CQI stands central, along with an active role for the practice team and the application of a clearly structured, stepwise problem-solving method to develop and implement the improvement plans[51].

it is crucial to the model that practice teams formulate goals for improvement and attempt to achieve these goals in small scale[32].

Reasons that were reported most often included "the subject chosen was felt to be a problem or a bottleneck in practice management", "the practice wanted to implement the national guidelines (on that specific topic)", and "the outcomes of the audit report"[32].

As practices were free to select their own topics for improvement and set their own objectives, the fact that the intervention group met a significantly greater number of self-defined improvement objectives than the control group is an important finding[51].

it consists of involving all staff, holding regular meetings on quality, designating a quality coordinator, and writing annual plans and reports on quality improvement[32].

…. were willing to continue using the model, but were less positive about the quality cycle and preparing an annual report[30].

(many physicians) …. felt that activities not directly related to practice work[30].

The groups themselves generate topics for modules, with the subsequent module being authored by a GP[10].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Each group decided the frequency, timing and location of the meetings at the first introductory meeting. Each group also decided their preferred method for module selection[41].

The facilitator is selected by the group[10].

The same publication points out that GPs – due to the lack of therapeutic consequences – do not seriously wish to diagnose the illness[52].

The group established common criteria for carrying out an inventory of needs using a standardised form of documentation of the QC process [translated from German][34].

This (negative) assessment (of QC work) could be an expression of resistance and reservations regarding the background of the project and gaining participants, and thus an implicit plea for voluntariness and self-determination as the most important characteristic of medical QC [translated from German][37].

The main focus of our analysis is on the characteristics of successful quality circle work that can be derived from theory, as they are also laid down in the above mentioned quality assurance guideline: group constancy and continuity, experience-based work on self-chosen topics, collegial group climate and goal orientation towards quality promotion in one's own practice [translated from German][14].

The participants of the circle determine the questions concerning the content themselves [translated from German][4].

It is important for a learner to be in control of his or her learning process, to be motivated, and to perceive meaningfulness[11].

At the beginning … GPs were induced to attend … with criticism. At first, … GPs participated somewhat reluctantly 'in order to avoid trouble', but over time most of them began to look forward to regular attendance and enjoyed … opportunity for an exchange … in a relaxed setting[53].

The rise of evidenced-based medical guidelines … decreases individual providers' autonomy. Physicians have raised similar concerns about threats to the autonomy of their profession …. It is within this context, … declining perceived autonomy for …. physicians, … we compare the participatory local and central expert approaches to QI[12].

Topic identification is collaborative, end-user driven and uses local data, literature review and input from small group members Groups are peer-led and membership is ...[27].

Context mechanism outcome configuration 6: 'size of the group affects communication'

Improved wording: If group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with all participants and follow their conversations (M).

All GPs participating in such peer groups, on average consisting of six to eight peers, located in southern Norway[13].

The mean group size was 7.4 ± 2.7[20].

Our group usually has 12 to 15 participants, an expert, and a facilitator. We are primarily composed of generalists and family physicians, but regularly invite a pharmacist and a representative from the sponsoring pharmaceutical company[6].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Groups of 4 to 10 family physicians form a PBSG in their own communities, meeting for an average of 90 minutes once or twice a month at an agreed upon time and place, allowing time off for holidays and summer vacations[10].

How can QCs be supported? (Table 2) Group sizes > 15 or < 5 - are problematic and participants need support [translated from German][14].

A maximum of 15 physicians in each geographical area were enrolled into each circle in the study[50].

Thus, it is a stable and voluntary group of five to eight doctors who meet about five times a year with a pharmacist, expert and facilitator, in a context of interdisciplinary continuing education [translated from French][46].

A quality circle is a stable group of 3–10 GPs with … 1 trained pharmacist. Pharmacists volunteer as facilitators and are responsible for motivating local GPs to participate. They … organize the practical … (e.g., rooms, agenda) and get the prescribing profiles of the participating GPs)[28].

GPs had to join as groups; c) groups had to be pre-existing; d) the preferred group size was three to six[11].

The effect of the educational asthma programme was partly modified by the group size; prescribing behaviour for (asthma) exacerbations improved more in smaller groups. The group size varied from 4 to 13 ……. This result is ……. an optimal group size of 5 to 6 group members[15].

Although the optimum number of participants for quality circles is between eight and 10, when necessary, up to 16 per circle were allowed[53].

These are groups of ~10 GPs who meet monthly to discuss topics related to clinical practice. Group membership was constant and members of the same practice were grouped together where possible[27].

Context mechanism outcome configuration 7: 'feeling safe and not vulnerable'

Improved wording: If participants trust each other (C), then they can disclose how they work and also the holes in their knowledge (O), because they feel safe rather than vulnerable (M).

I was surprised to see how willing people were to reflect on their own behaviour and practice ... and constantly comment like: "Well, did I really do that? I surely have to pull myself together". Very strong will, apparently, to make changes[9].

GPs generally experienced the CME group as a safe setting to present and discuss their feedback reports: It would have been more embarrassing if it had been in a large lecture hall or a large seminar[9].

A shared understanding of the complex decision-making involved in prescribing in general practice was reported by both GPs and tutors as essential for an open discussion in the CME groups[9].

GPs generally experienced the CME group as a safe setting to present and discuss their feedback reports[9].

After a while, it may become less needed, because participants may then feel more safe about discussing their own behaviour within the group as a whole[20].

…greater insights into and discussion of the physicians' own performance in a safe group of respected colleagues would be a powerful instrument to improve the quality of test ordering[24].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

What have you gained from participating in this practice-based small group learning project? small group support: the group works effectively together and as time progressed, I was able to participate more effectively as my confidence grew[41].

…. particularly when they involve participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases and provide feedback on performance[10].

In time, group members develop confidence and security in the group, rendering the disclosure of ignorance and ''blind spots of knowledge'' easier. Group members could either use the whole group or parts of it to assess their own learning needs[8].

It became evident that the only environment in which this intervention could flourish was one that was safe and interesting … [3].

GPs were also unlikely to take part if they felt that the sessions would make them feel unsafe[3].

Context mechanism outcome configuration 8: 'need for competence and self-actualisation'

If the facilitator supports participants and encourages them to tell their stories and share their experiences in a safe environment, e.g., by encouraging interactive responses, through discussions and by summarising statements, (C) then participants will be involved and share their positive experiences and failures (O) because they want to improve their professional competence, (M), gain professional confidence (M) and fulfil their professional potential (M).

…. that an improvement in prescription behaviour could be obtained in a group setting where the participants knew each other well and were used to discussing challenging topics related to their own clinical practices[54].

Both GPs and tutors experienced that sharing the experience of being a GP contributed to an open and constructive discussion[9].

Reflective thinking increased among GPs; they were able to reflect their individual prescription habits in the CME group. Inappropriate results could put some GPs in distress in front of the group (Frich et al., 2010)[9].

Another important topic of debate was how to deal with the frequent requests by patients to have inappropriate tests performed[55].

The decision to focus on clinical problems instead of tests was a good choice, since it allowed the feedback and group work to be linked to national evidence-based guidelines. GPs appreciated this approach, because it was also closely related to their everyday work routine[20].

There is some empirical evidence that participating in quality circles may increase GPs' job satisfaction[20].

Various members expressed a desire to keep up to date …. Others wanted to compare what they were doing with their peers, to confirm that they were practising safely …. Participants …stated that they wanted to be able to examine current evidence and to improve their critical appraisal skills[7].

The need to maintain the appearance of competence may be more compelling than the need to learn. Several strategies …. First, we tried to create as relaxed an atmosphere as possible. We arranged tables in a circle, removed all barriers …, and held the sessions with a meal[6].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The facilitator elicited interactive responses … with the aid of specific predetermined prompting questions and responses. The program participants resolved practice-based problems …. The best practices were determined by the group as a whole and conflict resolution was achieved with the mediation of the content expert, if required[56].

The cases were regarded as not only appropriate but also reflecting practical problems in office practice[56].

...the success of this format depends on availability of course material that reflects practice based clinical problems and on the important roles of specially trained facilitator[56].

The ability to change practice is enhanced if skills are endorsed by trusted colleagues and supported by published literature, and there is opportunity for practice and feedback[6].

The ability to change practice is enhanced if skills are endorsed by trusted colleagues and supported by published literature, and there is opportunity for practice and feedback[6].

An interactive small group can prompt moderately large changes in physician practice[10].

..comparison with one's peers was important, as was the support, confidence and reassurance that some gained from being part of the group[7].

I've gained more confidence because of spending time with these people. To go in [to PBSGL meetings], be with these fellow professionals, but it was completely calm, completely non-judgemental[5].

We recognize that many personal, professional, and social forces affect attendance at CME beyond the format itself[6].

Network (SIGN) on a variety of clinical and non-clinical topics. 'Modules are much better than SIGN guidelines because they are patient based and make you think about your own practice[7].

…discussion of personal stories might help participants tackle any doubts they may have on individual cases, and it might also enable attitudes to be highlighted and perhaps modified, through hearing the views and beliefs of others. …, the group members and the facilitator may …. offered each other educational support[7].

Comparison with one's peers was important, as was the support, confidence and reassurance that some gained from being part of the group[7].

Specific assistance and solutions for actual problems in their own practice are sought and willingly accepted. Finally, a decisive factor for the motivation to work in the case-oriented QZ is the emotional relief reported by all participants [translated from German][21].

It became clear that one's own actions are influenced less by the appropriate clinical knowledge than by one's own experiences, attitudes, and interaction with patients [translated from German][34].

Each participant described his or her own case of how a family doctor deals with their own sore throats or family members' complaints [translated from German][34].

The possibility of overcoming isolation in one's own practice, a way out of isolation, as well as the experience that others have similar problems structurally and they are not different from anybody else, seems an emotional relief. Even more, the reawakening that medical action (e.g. active listening to blood pressure measurement) can be helpful and positive [translated from German][21].

Exchanging experiences in QCs, GPs can work out and clarify the characteristics of the general practice, which improves knowledge transfer [translated from German][36].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

By working within a QC, I have received more emotional support for my daily practice. The QC work should offer help with disputes/arguments and emotional relief when, comes to, for instance, very expensive therapies [translated from German][37].

The basic message was that quality circles are necessary because they promote collegial cohesion more intensively than normal training events. It is extremely important for the individual to know that their colleagues share the same problems or experiences that he or she has [translated from German][18].

....it would be easier to conduct a conversation (e.g. when dealing with desired prescriptions); a topic that is always relevant for different indication areas and where many people seem to have benefited from the exchange of experiences and the group discussion. Probably, they felt strengthened by the support from colleagues and the enhanced self-image as GPs [translated from German][43].

....in the sense of a continuous, systematic, goal-oriented, facilitated exchange of experience on the basis of specific everyday actions in practice [translated from German][14].

At the first meeting the GPs discussed in groups how they diagnose the illness, and the underlying reasons they find important when deciding on treatment[57].

Subjects, topics and cases discussed in groups come from daily work and are highly relevant to practice. The small group will meet the demands of developing generalist knowledge as well as the expert role in general practice[8].

Small groups will have opportunities to discuss the ''art of medicine'', founded upon context, anecdote, patient stories of illness and personal experiences. Accepting emotional responses being mirrored by other group members corresponds in some respects to the process in Balint groups[8].

The group should act as a forum where its members can reflect freely upon all problems that bind them together in their profession[8].

…GPs regard the group as a place for social support, …., growth in the professional role …for protection against burnout. Although … main purpose of small group work is exchange …… of knowledge, social aspects should not be neglected because they will increase the motivation to continue with meetings[8].

The desire to be more competent and ''pride in performance'' are other key forces for change, while regulatory measures have little impact[8].

In addition, small group members have unique opportunities to discuss the way the individual patient experiences his or her illness through narratives, retold by the doctor[8].

The ways in which groups worked together in sessions seemed to be key to their success. …, group members sometimes seemed to strive to demonstrate their personal high standards of patient care. … the group challenged one such statement as unrealistic …[3].

Their expectations were mostly met as they found the time to ask questions and learn from both specialist and colleagues' opinions and knowledge. They found the time spent on clarifications, discussions and questions very useful[35].

Relevant factors identified in effective training initiatives include: the use of distributed practice techniques; the development of mentor-type relationships; the use of interactive learning and skills-based training, and the use of a format which enables doctors to discuss ongoing patients[58].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

With the collaborative learning of residency training no longer available, clinicians often adopt idiosyncratic approaches when they encounter patient-care situations that cause them to question the limits of their own knowledge, … how to distinguish between their own knowledge limits and that of the medical canon—…, clinical uncertainty[19].

Social constructivist learning theorists, medical educators, and primary care researchers identify the problematic patient case as a powerful professional learning opportunity. Whether and how one decides to take on these problems in the "swampy lowlands" of practice become, according to Guest, decisions about "deliberate practice"[19].

Context mechanism outcome configuration 9: 'previous knowledge is activated'

If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by telling their own relevant stories (O) because the process activates knowledge they already possess (M).

...an important element is the focus on daily, clinical GP problems. In our study GPs preferred to talk about clinical problems and tests linked to these problems, rather than to discuss abstract phenomena like total test ordering volume or the ordering of specific tests[20].

The improvement strategy concentrated on 3 specific clinical topics (cardiovascular conditions, upper abdominal complaints, and lower abdominal complaints) and the tests used for these clinical problems, because it was believed that the physicians would prefer to discuss specific clinical topics rather than specific tests[24].

The use of a case-based format encourages activation of previous knowledge, allowing better retrieval of knowledge in the clinical setting……. particularly when it involves participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases and provides feedback on performance[10].

11/2- to 2-hour discussion period follows, in which one or two of our GP learners will present a case from their practice on the topic[6].

Group members prepare cases from their office and present them in 3 to 4 minutes, to set the stage for discussion. …, we actively solicited group participation throughout the session. This encouragement was a major function of the facilitator early on[6].

Participants were encouraged to bring their own cases in relation to the topic. In this group, members were given tasks at the end of the meeting and fed back on these at the next meeting[41].

The theoretical basis for changing practice begins with the individual physician's experience of patient care[10].

PBSG modules are designed to engage family physicians "in learning activities that are self-directed and related to authentic practice problems.... The cases, linked with important information, are the keys to stimulating discussion around patient care issues[10].

The aim is not to solve the presented problems, rather the problems should act as a stimulus to encourage the group members to identify, discuss and address cases from their own experience too[7].

Virtually everyone participates in presenting a case, asking for advice or clarification, or describing their practice patterns[6].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

During discussions at the level of relationships (case discussion), the exchange is more intense than in the exchange of pure facts; one's own behaviour is better analysed and suggestions for training in one's own practice came up [translated from German][18].

In each session, a colleague presented a difficult clinical case, which was discussed in the group according to a clearly structured manual, they sought solutions together and in the final phase, the group suggested a new treatment plan, which the presenting colleague had to try to implement in his practice [translated from German][18].

By dealing with actual clinical cases, real difficulties in the participants' everyday practice become the subject of discussion in the quality circle instead of constructed problems. In systematic reconstruction, participants make the experiences conscious, so that intuitively applied - implicit guidelines can be made explicit [translated from German][21].

Case discussions were by far the most popular agendas in groups[8].

Group work is built on sharing and improving ''collective'' knowledge and well-functioning groups provide this in an atmosphere of joy and curiosity[8].

Context mechanism outcome configuration 10: 'immediate relevance for the practice'

Improved wording: If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O), because it relates to their everyday work and is therefore of immediate use (M).

...an important element is the focus on daily, clinical GP problems. In our study GPs preferred to talk about clinical problems and tests linked to these problems, rather than to discuss abstract phenomena like total test ordering volume or the ordering of specific tests[20].

The improvement strategy concentrated on 3 specific clinical topics (cardiovascular conditions, upper abdominal complaints, and lower abdominal complaints) and the tests used for these clinical problems, because it was believed that the physicians would prefer to discuss specific clinical topics rather than specific tests[24].

The use of a case-based format encourages activation of previous knowledge, allowing better retrieval of knowledge in the clinical setting.... particularly when it involves participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases and provides feedback on performance[10].

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In each session, a colleague presented a difficult clinical case, which was discussed in the group according to a clearly structured manual, they sought solutions together and in the final phase, the group suggested a new treatment plan, which the presenting colleague had to try to implement in his practice [translated from German][18].

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Case discussions were by far the most popular agendas in groups[8].

Group work is built on sharing and improving ''collective'' knowledge and well-functioning groups provide this in an atmosphere of joy and curiosity[8].

Context mechanism outcome configuration 11: 'cognitive dissonance'

If participants discuss and reflect on their work processes (e.g., based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance a negative emotional state triggered by conflicting perceptions that makes them reconsider their own way of working (M).

The identification of suboptimal pharmacological treatments to be targeted in this study, was based on previous research and active reflection and discussions based on own clinical experience from general practice[13].

In the continuing medical education group setting, each participant was confronted with, and had to reflect on, the baseline report on their own prescription practice. We believe that this was a key component for obtaining improved prescription habits[54].

We consider the key element in our study to be ''What happens to a general practitioner's prescribing behaviour when he or she reflects on his/her prescriptions?''[54].

Our intervention required general practitioners to expose their own antibiotic prescribing data in their continuing medical education group by using a structured pedagogical method, critically reflecting on the need for change together with an active listener[54].

Academic detailing involves educational outreach visits and incorporates external audit and supervision, and has a larger effect on prescribing than dissemination of educational materials, audit or feedback alone[9].

Peer group academic detailing was experienced as a suitable method to learn more about pharmacotherapy, though there were participants who argued that the scheme was time-consuming[9].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

GPs' "hits" for inappropriate prescriptions in the elderly, or an unfavourable antibiotic prescription profile, was the starting point for group discussions at the second meeting. Tutors reported that GPs tried to justify and explain their practice[9].

Our results are in concordance with research that suggests that GPs may feel disappointment if their prescribing practice conflict with their ideals[9].

One important outcome for the GPs was an experience of being more reflective in decision-making about prescriptions[9].

The older … were silent, because they had a prescription profile … far from … recommended. The young … dominated the discussion, and they were much more familiar with the guidelines … … the old felt distress when disclosing their profiles … have repeated their errors for … decades[9].

GPs were generally more embarrassed if they had hits they knew they should have avoided, such as prescribing flunitrazepam to elderly patients, compared to potentially harmful drug combinations that had not been highlighted in the recommendations[9].

The findings underscore that tutors have an important role in managing distress and contributing to an informal and relaxed atmosphere in peer academic detailing groups[9].

….and how to facilitate learning within a group setting[40].

Social interactions were used as an important motivator for change, as physicians learned how colleagues were handling test ordering problems and as they obtained information about the consequences of medical decision making in daily practice[55].

Personalized graphical feedback, including a comparison of each physician's own data with those of colleagues; dissemination of national, evidence-based guidelines, and regular meetings on quality improvement in small groups. The strategy focused on specific clinical problems and the diagnostic tests used for these problems[55].

The first was mutual personal feedback by peers, who worked in pairs at the start of the meeting. This was assumed to be a safe method of peer review[20]

A second important element is the fact that GPs are prepared to discuss personal, transparent data openly in a group of colleagues[20].

Compared with only disseminating comparative feedback reports to primary care physicians, the new strategy of involving peer interaction and social influence improved the physicians' test-ordering behavior. To be effective, feedback needs to be integrated in an interactive, educational environment[24].

90-minute standardized small-group quality improvement meeting about 2 weeks later at which one of the clinical problems was discussed based on the feedback reports and the guidelines … In these meetings social influence, which was an important vehicle to reach improvement on test ordering[24].

The second component was an interactive group education of national guidelines, to enable participants to relate their own and each other's test ordering behaviour with them[20].

The new strategy utilised peer influence among GPs, and gave GPs the opportunity to openly discuss their test ordering behaviour with colleagues[20].

They stated that this type of feedback definitely had added value, because comparison with colleagues made them more conscious of their own behaviour and motivated them to change. Their main criticism was the validity of the numbers of tests in the feedback and the absence of patient-related data[20].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Participants were shown the overall data on prescribing of antidepressants in the past year to illustrate that most anticholinergic antidepressants are prescribed to people aged over 60…. During the second visit a graph was provided showing personal performance[25].

…all doctors received a summary of their group's guidelines by mail, and two months after the intervention they received the results of the baseline measurement (see outcome variables) to reinforce the consensus reached[2].

Of the 40 GPs that reported having received individual feedback, 37 rated it as useful[2].

The purpose is to enable the transfer of evidence into practice through the use of facilitated small groups, using presented cases to encourage reflection on individual practice[7].

…it provides an opportunity to measure one's practice against that of one's peers. Direct, extended interaction with a local recognized... [6].

It is a relaxed, enjoyable evening in a friendly environment. …. This exchange allows for clarifications and redirections, leading to learning for both GP and expert. It is also an opportunity for the expert to learn of the tremendous competence that exists within GP practice[6].

Of greatest importance to GPs is the opportunity to measure their current practice patterns against that of their peers[6].

Individualized feedback with specific recommendations, especially when combined with education, generally have been more effective than single intervention[59].

One objective of the PBSG program is to encourage physician members to reflect on their individual practices and identify any gaps between current practice and the best available evidence. This is accomplished through discussion of real-life medical and patient problems in small groups of peers[10].

Through reflection, a gap between current practice and best practice is recognized. Distinguishing this gap presents an opportunity to identify learning objectives specific to the family practice setting[10].

Physicians who received feedback about personal prescribing or who used the PBSG process to discuss hypertension were more likely to change their prescribing than physicians in PBSG who reviewed a different condition. When feedback about personal prescribing was combined with the PBSG process, the effect … was even greater[10].

One of the key features of QCs is that working methods map the quality of care in one's own practice. First of all, this distinguishes QC work from further training in the classical style and second, it enables participants to identify real quality problems in their own practice [Translated from German][14].

A systematic procedure …: data in the feedback report were studied …, reasons for variation were discussed, … prices of drugs, evidence underlying drug treatment was considered, typical patient cases from practice were analysed and finally objectives for improvement were formulated, and specific plans for improvement were made[38].

With regard to taking a practical assessment of their own actions, some participants feared that they would only be burdened with additional work, but on the other hand they were also very curious to see what we were doing [translated from German][34].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

A case-related approach offers the opportunity to confront learned normative expertise and concrete actual action in one's own practice.....By comparing one's own perceptions and the viewpoints of other circle members, as well as by confronting assumed and real actions, e.g. by analysing video recordings, individual and collective defence strategies can become conscious. The deviations from one's own normative expertise and thus the problem of the implementation of existing theoretical knowledge into everyday practice become accessible for analysis [translated from German][21].

A basic problem of continuing medical education is the well-known mismatch between individual, existing specialist knowledge and putting this knowledge into everyday practice.....Quality circles as a form of QI, which among other things also serves the purpose of continuing medical education, can improve this situation [translated from German][21].

On the basis of documentation of one's own activities in daily practice (e.g., in the form of index card evaluations, video recordings, EDP extracts, documents that one has created oneself, etc.), it is possible to learn from your own actions [translated from German][21].

They (the modules) are didactically structured in a way that allow comparisons of systematic processes with the actual procedures in practice. This stimulates the participants and the principle of cooperative learning can be realised.... The participants should identify, name and document deviations from their medical actions. This also includes checking whether documentation and data material is available [translated from German][16].

The aim of the project was to make doctors' own prescription behaviour transparent and to highlight problem areas [translated from German][37].

Presentation of these predefined guidelines was meant to encourage the participating doctors to assess their own performance and to foster discussion and refinement of the moderator-manuals[31]

GPs see QCs on pharmacotherapy as a sensible and useful measure for optimizing their own prescription methods. They regard part 1 of the prescription mirror as the most important instrument of the quality circle work (i.e.: the feedback of one's own, specially prepared prescription data with the possibility to compare oneself with colleagues of the project group as well as a GP control group without intervention) [translated from German][43].

Quality circles comprise a practice-base strategy to improve professional performance, which is based on meetings in small groups of health professionals, provision of evidence-based information, written feedback on professional performance and exchange of best practices in improving patient care[38].

The intervention comprised of quality circles of primary care physicians, including repeated feedback on prescribing patterns … nine small group sessions in which the feedback, guidelines on appropriate prescribing and exchange of best practices in changing performance were discussed…… The report included evidence-based information on prescribing in targeted conditions[38].

What sources of information were used? Still considered a "classic", the oral case presentation was by far the most frequently used source of information in 56.2% (=15,313 meetings). Other methods such as index cards, note sheets, data from electronic medical records were used significantly less frequently (20%) [Translated from German][4].

Following the training meeting, CQC members collected baseline data on patients from their practices using the CQC-form to ascertain how they currently diagnosed and treated osteoporosis…. These profiles, displayed graphically with brief text summaries, permitted anonymous comparisons of individual circle members' practices[45].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Physician profiles were displayed graphically with a brief text summary. The profiles permitted anonymous comparisons of individual circle member data with their peers in their circle and with all the participating physicians in the project[50].

Based on the questionnaire responses, physician profiles were generated that showed how individual physicians treated patients …. The profiles permitted anonymous comparisons of individual circle member data with their peers … and with all the participating physicians …. The physicians' profiles were than compared to the Osteoporosis Canada guidelines[60].

The PPQC process includes a combination of several elements (e.g., local networking, feedback, interdisciplinary continuing education) that facilitate changes in prescribing practice GPs[28].

The pharmacist compares individual prescribing habits with treatment recommendations (clinical guidelines) and with the most up-to-date information on the efficacy of the medication [translated from French][46].

The GPs were asked to bring copies of the records for these patients to the meeting. During the meetings, the treatment of these specific patients was discussed, especially differences between what was prescribed according to the records and what was actually dispensed[11].

The combination of the written simulated cases with actual prescribing allows the GPs to reflect on their decisions as well as the background for these decisions, and is in line with suggestions to make drug utilization studies closer to the reality of practice[11].

.. their perception of a gap between their current knowledge and skills and those needed. … Cognitive feedback is feedback on the decision process, i.e., why or how a decision is made and not on the decision itself, i.e., which decision is taken (outcome)[11].

.. feedback regarding the written simulated case. ...feedback on actual decisions taken ..., the extent of use of the information factors ... and the agreement on decisions between individual members within the group[11].

Feedback was given on actual decisions… and factors taken into account when these decisions were made—so-called cognitive feedback—in our case, clinical judgment analysis (CJA)[47].

When looking at knowledge and attitudes, the largest improvements were indeed seen when the baseline performance was low[26].

… overview of the recommendations given in the guidelines. The major component … was to discuss individualized feedback on the decision process underlying treatment decisions, …. Using series of 18 case vignettes, factors triggering specific treatment decisions were identified …. The case vignettes were constructed to represent real patients ….[15].

Doctors may, during this active process, discover the consequences of new knowledge in relation to their own behaviour[57].

… to introduce independent information about polymedications, …. During these meetings, public health consultants also provided feedback information about prescribing patterns and cost. Quality circles (two in each area) met every 6 weeks and some GPs were trained and given documentation[48].

The current programme was multifaceted and included expert input, voluntary feedback, peer review, and specific recommendations for changes: all features generally associated with the successful implementation of changes in general practice[48].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

As GPs had previously found its provision of diagnostic and therapeutic guidelines feasible and effective, the steering group .. prepared educational material …. In addition to prescribing behaviour, costs of drugs prescribed and the use of generics in primary care, … were addressed[53].

They supplied statistics on all drugs prescribed by GPs under contract and the costs involved, so that the intervention provided a repeated written feedback to participants on their personal prescribing behaviour[53].

Most surprising was the reaction to the presence of these texts (clinical evidence) during the educational sessions. The researcher observed that GPs seized on the books with gusto when the facilitator brought them into view[3].

Context mechanism outcome configuration 12: 'social learning'

If the facilitator uses purposeful didactic techniques (e.g., brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection on the work process (C), then the group will create a learning environment that promotes knowledge exchange (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

The identification of suboptimal practice is, however, only the first step for quality improvements. Several educational strategies have been used to improve doctors' clinical practice, but substantial effects are only rarely reported[13].

… found evidence that educational intervention consisting of passive dissemination of clinical practice guidelines had little or no effect on practice. This corresponds with later reports … More active strategies, like educational outreach visits and multifaceted interventions, are more effective, but require more resources[39].

The elements of the intervention are discussions within the peer group, collection of individual prescription data, audit based on individual feedback reports, as well as a one-day regional work-shop[39].

The participating GPs experienced the CME group meetings as an important arena for learning. They reported picking up good advice from others and learning practical alternatives …. GPs said their prescription data would not mirror all learning effects: 'The whole point is to reflect more, ... '[9].

Peer group academic detailing was experienced as a suitable method to learn more about pharmacotherapy, though there were participants who argued that the scheme was time-consuming[9].

The participating GPs experienced the CME group meetings as an important arena for learning. They reported picking up good advice from others and learning practical alternatives …. GPs said their prescription data would not mirror all learning effects: 'The whole point is to reflect more, ... '[9].

GPs said that the feedback on their prescription profile motivated them for reflection, learning, and change. Critical reflections on own strategies help change attitude and behaviour[9].

…. facilitated the discussion within the CME group, where each GP exposed their own prescription patterns as presented in his or her report and potentials for improvements were discussed within the group[40].

The systematic approach of the quality cycle was used reasonably well, although practices did have some difficulties in gathering data and evaluating progress in the improvement projects[32].

An intensive small group education and peer review programme, which combined various strategies, was proved to influence aspects of knowledge, skills, opinions, and the presence of equipment according to the guidelines but on its own no significant influence on the provided care[30].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

It should be noted that a new skill is required for the recommended technique. It is possible that many midwives have not as yet learnt these skills. Small group CQI is not sufficient for the teaching of new techniques[33].

we found that small peer group CQI had a positive effect on changing clinical practice when no new skills had to be learnt, when the recommendations were considered to have more advantages than disadvantages, and when there was no 'ceiling effect' at baseline[33].

... of a strategy that combines a traditional feedback strategy with a multifaceted strategy, including feedback, dissemination of and group education on evidence-based guidelines, and small group quality improvement meetings in a local primary care physicians' group, using social influence as an important motivator for change[61].

A multifaceted strategy combining comparative feedback on tests ordered, group education on guidelines, and small group quality improvement meetings in a local GP group, with social influence as an important motivator for change, was expected to offer good prospects[20].

Compared with only disseminating comparative feedback reports to primary care physicians, the new strategy of involving peer interaction and social influence improved the physicians' test-ordering behavior. To be effective, feedback needs to be integrated in an interactive, educational environment[24].

At these meetings, test-ordering behavior and changes in routines were discussed, using social influence and peer influence as important motivators for change. Social influence from respected colleagues or opinion leaders seems to have a greater effect on practice routines than do traditional medical education activities ...[24].

Many test-ordering problems that physicians encounter in everyday practice, such as demands for tests by patients and changing guidelines, can be discussed and may be solved in an open and respectful discussion among colleagues[24].

Our intervention—which included a group education meeting with a consensus procedure and communication skills training[2].

...various strategies for implementing the guidelines were used: lectures, role playing, skills training, peer review of performance, group consensus discussions, and problem solving of hypothetical situations involving patients. The group education and review was done in two small groups ……..) and was supervised by an experienced GP[62].

An intensive small group education and peer review programme, which combined various strategies, was proved to influence aspects of knowledge, skills, opinions, and the presence of equipment according to the guidelines[62].

Either the facilitator or the expert is asked to recommend one or two relevant articles to follow up the discussion. The expert has frequently selected an article in advance, from knowledge of frequently asked questions in prior learning environments[6].

The group selects topics, directs the agenda, points out inappropriate comments or inappropriate practices in a constructive manner, and also leads group members back on topic. The conversation is free-flowing and highly interactive[6].

The group encourages other points of view to establish practice norms. This allows individual GPs to see where they may deviate from usual standards of care[6].

What have you gained from participating in this practice-based small group learning project – learning from colleagues: the group discussion allowed us to share our experience and management of various problems[41].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Group discussion allows for sharing of experiences and of thoughts about strategies for implementing practice changes and about overcoming anticipated barriers (Armson et al., 2007)[10].

Learning from and with colleagues is an important source of both new information and strategies for applying that information to practice[10].

Most GPs and PNs valued learning together. Several GPs from Group 1 said that they were consistently satisfied with the learning that took place in their group[5].

I think there is a mutual keenness to learn from each other[5].

A ''mutual keenness'' to learn from and about each other emerges as a crucial ingredient for learners to feel that their learning needs were being met given the multi-professional context[5].

'Learning from colleagues' (three comments) 'Has been very constructive and helpful[42].

....to work through cases together and massively furthered my learning.' 'Really useful (secondly) discussion with colleagues/peers regarding management of conditions in real practice[42].

This should not be done schematically according to a fixed schedule, but rather with the help of various methods that reflect the reality of everyday practice (e.g., case discussions, file card analysis, documentation with a study character, video, etc.). They can also be used in parallel [translated from German][34].

At the same time, our concept leaves room for case-related and problem-oriented learning using our own patient examples from practice [translated from German][36].

They (the modules) are didactically structured in a way that allows comparison of theoretical approaches with the actual procedure in practice and so the principle of cooperative learning can be realised [translated from German][16].

The principle of cooperative learning in the quality circle (everyone learns from everyone else) leads to increased flexibility and more pleasure in practice [translated from German][16].

Almost 73 % of the participants thus confirm that the intercollegial exchange in the Pharmacotherapy Quality Circle - as in all other quality circles (10-12) - can be regarded as one of the fundamental mechanisms of action [translated from German][43].

They particularly appreciate the opportunity to compare their own prescribing behaviour with that of their colleagues and to discuss it in the familiar setting of a small group. In addition to this intrinsic principle of quality circles of intercollegial, equal and non-hierarchical exchange in a familiar group (of so-called "peers"), the feedback of one's own prescription data with the possibility of comparing oneself with other colleagues and to measuring one's own progress in the context of a before-and-after comparison (evaluation) contributes significantly to the success of the project [translated from German][43].

Especially the expectation of a successful collegial exchange of experiences, which was most frequently mentioned at the beginning of the project, seems to have been fulfilled: The vast majority of participants emphasised that they had received helpful tips from colleagues who had helped them to implement changes [translated from German][44].

Regular ... reflection on common practice with other colleagues. ... individual feedback, ... discussed in the group under the guidance of a moderator ... benchmark activities... The core element of these circles is the conjoint discussion of evidence-... and management of patients on the basis of prescribing data....[63].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

... impact of physicians' views on the use of performance feedback, indicators and price comparisons. This set of views reflects both a willingness to reflect critically on one's professional performance and a positive attitude regarding the ideal of evidence-based medicine[38].

... an important component of the improvement strategy is an individual learning activity: reading and reflecting on the written feedback reports. This is consistent with insights from educational research, which showed that .... learning activity is an important predictor of the effectiveness of any educational programme for professionals[38].

It involved practice audits, feedback on performance by peers ..., interactive discussion of evidence, small-group educational workshops led by ... facilitators and supported by local osteoporosis specialists, diagnosis and treatment reminders (CQC-forms), and making personal plans for improving clinical management of osteoporosis in accordance with the OC 2002 guidelines[45].

The educational intervention consisted of eight key components: 1) audit and feedback, ...; 2) interactive small group discussions ...; 3) use of opinion leaders ...; 4) reminders, ...; 5) multi-professional collaboration and community building ...[50].

Our educational intervention consisted of eight key components and consisted of 1) audit and feedback, 2) interactive small group discussions 3) use of opinion leaders, 4) remainders, 5) multiprofessional collaboration with osteoporosis specialists, 6) nominal financial reimbursement to circle members, 7) patient medicated interventions 8) and educational material[60].

The key elements are local networking; feedback of comparative and detailed data regarding costs, drug choice, and volume of medical prescriptions; as well as interdisciplinary continuing education adapted to primary care needs[28].

(GPs)... depend less on factual knowledge than on their capacity to reflect in action, to be in control of ... learning process, to be motivated, and to perceive meaningfulness; ... it is beneficial ... when the social climate is supportive ...[11].

The intervention comprised several elements, ... the provision of individual feedback on the series of simulated cases ... and on actual prescribing, use of outreach visits, use of peer group discussions, and use of existing guidelines. ..., the sessions were especially tailored for each group[11].

Cognitive feedback is feedback on the decision process, i.e., why or how a decision is made and not on the decision itself, i.e., which decision is taken (outcome)[11].

The combination of the written simulated cases with actual prescribing allows the GPs to reflect on their decisions as well as the background for these decisions, and is in line with suggestions to make drug utilization studies closer to the reality of practice[11].

For UTI the usually high use of the non-recommended drugs was stressed and was related to the ... high use in the simulated cases and the cues that triggered these decisions... the identity of the individual doctor was disclosed at the request of the participating GPs[11].

Learning methods that have proven effective include interactive and problem-solving exercises combined with feedback on performance. Combined strategies that deal with different types of barriers seem to be more effective than single separate strategies[26].

Once the problem is acknowledged, one must learn and understand what caused the problem and how it can be solved. For this, elucidating and discussing the decision process underlying treatment decisions may be useful. To accept new information or practice recommendations the credibility of the source is of importance[15].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Problem based learning, …, places the emphasis on the learner's own initiative to discover problems and how to improve. By discussion in peer review groups the individual doctor's self-efficacy, defined as one's ability to organise and execute a course of action required to produce given results, is substantially increased[57].

Although academic knowledge is important, the fundament for professional development is reflection of one's own practice or, as Schön stated, ''reflection-in-action''. Until now, these aspects of learning have been mostly neglected, …[8].

The strengths of small CME groups are principally that learning is self-directed and based on relevant problems and ''reflection-on-action'', a pedagogic prerequisite for effective learning[8].

…, hardly any participants failed to contribute to the group discussions. … they thought that for a meaningful comparison of prescription costs such data must be correlated with morbidity and disorder distribution among patients. Every opportunity was taken to discuss various clinical aspects of patient management and pharmacotherapy[53].

…, CME should involve the learner actively and as we know from the protocols that there were hardly any participants who did not contribute to the discussions, we can say that our qualitative data support the general notion that quality circles are an appropriate CME format for practising physicians[53].

A defensive attitude of the GP, for instance, been linked to overprescribing, Quality improvement requires a reflective attitude of one's own knowledge and performance[64].

There is, however, adequate evidence that merely distributing a guideline without any additional intervention does not have an effect on prescribing behaviour[64].

Participants and facilitators saw the strength of the small groups as facilitating the learning of practical skills (e.g. through the use of role play[35].

Discussion is based on evidence-based topic notes prepared for each leader as well as individual prescribing and laboratory data related to the topic that is provided to each GP. Although the education groups cover all aspects of clinical practice… [27].

Context mechanism outcome configuration 13: 'interdependence between health insurance companies and GPs'

If physician network organisations require continuous QC activities (C), then QCs will negotiate priorities and design creative solutions (O) because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M).

The physicians in the Rhine-Main network of physicians committed themselves to participating in QCs when they joined the contract. In QCs, they discuss prescription patterns for specific clinical situations and adapt (guidelines) to local conditions [translated from German][22].

The participation of German GPs in QCs is mandatory in order to be part of government-funded disease management programmes (DMPs) or to be part of pilot projects with health insurance funds[23].

The principle of 'quality circles' is now also used for clearly defined quality promotion purposes: The Associations of Statutory Health Insurance Physicians (KVs) of Hesse, Saxony-Anhalt and Lower Saxony started off with structured QC programmes to demand rational pharmacotherapy. In the meantime, QCs have become a requirement in numerous contracts (for disease management, family doctor-centred care, etc.) [translated from German][14].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The QCPs were designed as a measure of quality assurance in pharmacotherapy and, as doctors were expected to encounter various problems in educating their patients in the use of generics, to offer them a forum for discussing these with their peers[53].

…. Specifically, we suggest that centrally organized experts make the strategic decisions about best practices based on evidence but local site staff members make tactical decisions about how best to implement the plan based on what fits local circumstances, needs, and cultures[12].

… interrelationships that exist among a particular organization's technologies, tasks, goals, stakeholder characteristics, and environment …. Participation provides one of the best methods for obtaining valuable information about .. local conditions[12]

Context mechanism outcome configuration 14: 'threat to professional autonomy'

If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and think they lack autonomy in their clinical role (M).

In general, efforts are being made to improve practice performance by developing guidelines. Guidelines are intended to help general practitioners to tailor the care of individual patients to generally accepted scientific findings. However, guidelines are not sufficiently implemented. The reason for this is probably the lack of practicability and low relevance of the guidelines for family doctors. In addition, they give general practitioners too little room for their own medical decisions [translated from German][65].

… much pressure about their prescribing budgets that they participated … as an attempt to appease their prescribing adviser. This resulted in poor attendance and a reluctance to participate …. This defeated the notion of reaching and establishing a consensus that was 'owned' by the practice as a whole[3].

…., it emerged that it could be difficult for GPs to match top-down initiatives with everyday practice. The difficulty, which is another form of pressure, was expressed well by one GP who explained in the interview[3].

The structure of each session demanded a firm commitment … to a common management strategy for …, we found that GPs were reluctant to do this. This reluctance appeared to arise from a sense of threat to their perceived need for clinical autonomy —… [3].

The concept of clinical autonomy is highly valued and it has been argued that in British general practice, prescribing is the principal battleground on which the cause of clinical autonomy is being defended[3].

An understanding of what GPs mean by clinical autonomy and how it affects their ability to reach explicit consensus on clinical management decisions is crucial if practice prescribing is to become more cost-effective. Many GPs perceive guidance on cost-effectiveness … as an intrusion on their professional independence[3].

… GPs and facilitators pointed to the difficulty of reaching consensus on a best buy, ……. Some found the term 'off-putting' because of its financial connotations. This suggests that some GPs may feel that their management decisions should be based on wider considerations than those of cost-effectiveness[3].

GPs were also unlikely to take part if they felt that the sessions would make them feel unsafe or if they felt that the sessions were yet another 'top-down' managerial intervention, where the main intention was to reduce prescribing costs[3].

The majority of respondents in both regions expected to benefit from participation in QCs, but they were unwilling to accept the risk that QI could be misused for control or cost reduction [translated from German][1].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

In the discussion with facilitators, the QC participants' claim to be able to work in a self-determined and independent manner became apparent. For this reason, the National Association of Statutory Health Insurance Physicians (KBV) and the Associations of Statutory Health Insurance Physicians (KVs) have laid down the thematic and methodological autonomy of the circles as indispensable in their guidelines for quality circle work and have committed themselves to supporting them [translated from German][4].

Physicians have raised similar concerns about threats to the autonomy of their profession ... It is within this context, a time of declining perceived autonomy for individual physicians, that we compare the participatory local and central expert approaches to QI[12].

Context mechanism outcome configuration 15: 'interdependence among group members'

If participants maintain a learning environment based on trust that promotes knowledge exchange, assisted by facilitators who use professional techniques (e.g., contentious discussion, reaching consensus, and role play), (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as similar, and so act and negotiate cooperatively to achieve a common goal (M).

… that combining information from a peer detailer with reflection on one's own need for change together with trusted colleagues would improve prescribing patterns[54].

Balancing interests and concerns is an essential aspect of GPs' work[9].

The physicians discussed their feedback data, and if it appeared that a physician clearly ordered fewer tests than his/her colleagues, he/she made plans for ordering more tests[61].

interactive group education in which national guidelines were related to the individual physician's actual test-ordering behavior and an effort to reach a group consensus on the optimal test-ordering behaviour[24].

The personal interaction and mutual influence between colleagues implicitly resulted in an individual or group contract[24].

Psychological research into group behaviour has produced an inventory of factors that influence conformity with group standards. Unanimity provides more pressure to conform, while privacy makes it easier not to[25].

In presenting the evidence we used relative and absolute effects of antibiotics by means of the numbers needed to treat and the numbers needed to treat to harm. This discussion resulted in group consensus about indication and first choice antibiotics per disease[2].

…a learner-directed agenda of topics, presentation of information by trusted peers or local experts, and opportunity for practice and feedback. If the information comes from several sources—…—the perception of need for and the durability of change are enhanced[6].

Interactive approaches, however, can be effective, particularly when they involve participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases, provide feedback on performance, and offer opportunities for practising newly learned skills[10].

It is known that small groups can encourage active participation and deep learning as well as learning of group skills and the ability to express new ideas[7].

The acquisition of new knowledge, skills, and approaches to bridge this gap follows. Often, however, access to new information alone is not sufficient. Reflection and discussion are necessary to help physicians 1) identify areas where current practice requires change and 2) develop strategies to integrate this new approach[10].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

There was widespread agreement that the principal requisites for a good facilitator were experience and competence in small-group skills. One facilitator identified another skill: 'You've got to be able to hold the tension between comforting and challenging[7]*.*

The decentralised approach at the local, internal level consists of collecting available knowledge from the everyday practice of the medical participants and formulating a workable consensus from this. The advantage of this method is that the physicians are actively involved in this process and are more motivated to implement the developed guidelines. In addition, this results in a stronger commitment and acceptance by the participants [translated from German][16]*.*

The programme for the meetings was based on principles of quality improvement, which implied that a systematic procedure was followed: themes were selected, objectives were formulated, plans for improvement were made and implemented and changes were evaluated[29]*.*

In more than 90% of the meetings, new health care aspects could be identified according to the facilitators' assessment [translated from German][14]*.*

Facilitators ensure that participants not only focused on a specific topic, but also focus on their own actions in their own practices and that they identify blind spots in their daily work. Approximately 90% of the methods used are certified as having been able to reveal previously unknown aspects of care [translated from German][14]*.*

Discussions concerning the progress made by incorporating strategies identified in the prior phases of the project were shared among the group. Based on the major findings from the profiles, members discussed additional measures that should be implemented in their practices to increase alignment with the 2002 guidelines[50]*.*

An analysis of prescription attitudes in comparison with scientific and economic data and the search for alternatives in the drug market is then run by each PPQC to build its own consensus. An annual assessment is conducted for facilitating the continuing improvement of the process[28]*.*

.. over time those GPs who, at first, were reluctant to prescribe generics changed their attitude, …. After 2 years of QCP participation ..., GPs confirmed that the prescribing of generics, where appropriate, had for them become common practice and that their efforts and the various discussions… had helped[53]*.*

The reluctance of GPs to appear in agreement with one another does not mean that discussions are pointless or ineffective. For example, as we found in an earlier study, the process of sharing different management strategies for a particular clinical problem may result in marked changes in prescribing behaviour[3]*.*

Context mechanism outcome configuration 16: 'identifying and removing barriers to change'

If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O) because participants help each other develop strategies to identify and overcome these barriers (M).

Therefore, it is recommended to address potential barriers to change when tailoring an intervention targeting change in medical performance[39]*.*

it appears to be essential that throughout the implementation personal obstacles are addressed[30]*.*

The implementation of new knowledge is facilitated by expressing and discussing how to overcome obstacles to its acceptance[25]*.*

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The barrier most often mentioned for changing the CHF treatment was related to perceived difficulties with changing treatment initiated by a specialist[2].

Cranney also identified some barriers to translating evidence into practice including: doubts about the applicability of data to particular patients, against attitudes and the absence of an educational mentor[7]. [Trustworthy data]

.. study feedback to individual doctors ... ... The recommendations needed to be reformulated to enable a quality assessment of patient treatment to be judged from prescription feedback. Such quality criteria were developed during group discussions between doctors participating in the study[57]. [Trustworthy data]

Within the group, members endeavour to identify specific barriers to these practice changes and to formulate implementation strategies to facilitate desired changes[10].

The acquisition of new knowledge, skills, and approaches to bridge this gap follows. Often, however, access to new information alone is not sufficient. Reflection and discussion are necessary to help physicians 1) identify areas where current practice requires change and 2) develop strategies to integrate this new[10].

Commonality and differences between local practices. Some participants commented that listening to ''how peers work'' was a benefit: Finding out what everybody is doing locally . . . it makes you think 'would that be better?'[5].

... an educational workshop, and facilitators led small group discussions that identify barriers to the management of osteoporosis and strategies to improve patient care, family physicians demonstrated greater odds of administering osteoporosis therapy appropriately over a two-year period[60].

Back at the practice, the difficulty is to apply the consensus reached in the group, while considering the particular situation of each patient[46].

Barriers within doctors relate to competence, motivation and attitudes, and personal characteristics such as learning style, whereas barriers within practices exist as doctors do not work entirely independently[26].

These results make clear that, although in the educational program a lot of attention was paid to overcome barriers within GPs, barriers within practice setting may not have been sufficiently addressed, preventing the correct implementation of the recommendations concerning asthma maintenance treatment in practice[15].

Once a doctor has accepted a new practice and has the intention to change, there still may be several barriers within the practice setting that prevent the actual implementation in practice. Discussing problems encountered in everyday practice may help to overcome such barriers to implementation[15].

Context mechanism outcome configuration 17: 'need for competence, autonomy and relatedness'

If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility and stewardship (O) because this fulfils their need for competence (being able to achieve specific objectives) (M), autonomy (a feeling of being in control of their own behaviour) (M), and relatedness (a sense of connection to a larger group) (M).

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The decentralised approach at a local, internal level includes participants gathering experience from daily practice and formulating a feasible consensus solution. The advantage of this method is that GPs are actively involved in this process and therefore motivated to implement the (newly) developed guidelines. In addition, participants involved will be more likely to accept (new knowledge) and feel committed to implement it [translated from German][16].

Potential advantages of the local approach: it promotes buy-in, maximizes fit to local culture and circumstances, maximizes the ability to work out the details associated with implementation, and produces a highly rewarding experience[12].

… new knowledge is … facilitated through the "… working with it, discussing it, and connecting it with what is … known…. because physicians … generate … 1 question for every 2 patients … the opportunity to explore these questions in …groups can stimulate … ideas for future change[10].

… working on projects… is … of great advantage. Everyone is involved ...has to prepare something for the next meeting. The structure of the quality cycle committed us to make all steps …. You don't cling to ideas but …come to changes. Evaluation … is … important ….[30].

A higher appreciation of the quality of the group discussion led to more effect of the intervention on the treatment of asthma exacerbations and on the duration of treatment prescribed for uncomplicated urinary tract infections[15].

The quality of the group discussion as evaluated by the participants seems to be an important predictor of successful educational group meetings[15].

When studying how physicians learn and change their medical practice, disposing, enabling, and forcing factors can be identified. These are a mix of professional factors, such as the desire for competence, social factors such as working climate, and personal factors such as curiosity[11].

International and national guidelines are more difficult to implement than local or internally developed guidelines[26].

Only in The Netherlands, national guidelines were developed by GPs and intended primarily for their use. This guideline initiative has been quite successful and highly accepted, because it is initiated and "owned" by the GPs themselves[26].

… In addition to the pragmatic benefits of the local approach, participants also mentioned one psychological advantage: intrinsic reward. …the local approach might be rewarding because it promotes team camaraderie…. "It [the local approach] is more creative and it's fun ... I enjoyed it"[12].

Not surprisingly, they personally relished the level of participation that the local approach affords. It is possible that … high level of enthusiasm permeated the entire team. In fact, every person on this team reported enjoying the opportunity to participate at a high level on this project[12].

…potential advantages of the local approach: it promotes buy-in, maximizes fit to local culture and circumstances, maximizes the ability to work out the details associated with implementation, and produces a highly rewarding experience[12].

Whereas the effectiveness of many PBLI methods is unknown, social interaction, a key element in some PBLI approaches, appears to increase physician satisfaction with learning and improve certain practice and patient outcomes[19].

Context mechanism outcome configuration 18: 'intention to change'

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

If participants publicly announce their intention to change (C), then they are more likely to implement the change (O) because they and others in the group both think it is a good idea and believe they can carry it through (M).

It is crucial to the model that practice teams formulate goals for improvement and attempt to achieve these goals in small scale[32].

The third was the development of individual and group plans for change, to stimulate GPs to really put their plans into daily practice[20].

An example of such an individual commitment was, 'I will order fewer haemoglobin tests, because I realise that this test does not give much information in patients with vague complaints'[20].

Plans at group level were also made, e.g., the plan to use the …brochure to inform patients …, or … to follow the national guideline on delaying testing in patients with vague complaints. All results show that the quality circles were an essential element in the improvement strategy[20].

The strategy gives physicians an opportunity to discuss their test-ordering performance with colleagues on the basis of actual performance data, making the participants feel more committed to the agreements[24].

Groups can be more effective in accomplishing tasks… and publicly announcing behavioural changes results in more commitment than privately announced change[25].

In most groups, there had been a discussion of the optimal treatment, as well as of barriers to change treatment in line with the recommendations of the guidelines. The idea was that by sharing experiences and learning from peers, possible solutions to perceived barriers might be offered[2].

…a structured tool for promoting reflection on the topic discussed at the group meeting and for identifying plans for practice change. The commitment to change section of the log sheet appears[10].

… participants stated that they had applied some learning to their practice. They reported a general increase in awareness of conditions and also confidence in treating them[7].

I was surprised to see how willing people were to reflect on their own behaviour and practice... and constantly make comments like: "Well, did I really do that? I surely have to pull myself together". Very strong will, apparently, to make changes[9].

The third was the development of individual and group plans for change, to stimulate GPs to really put their plans into daily practice[61].

Groups can be more effective in accomplishing tasks, and publicly announcing behavioural changes results in more commitment than private change[25].

…. draws on 'the theory of planned behaviour' and other studies that have identified the pre-requisites of successful behaviour change in general practice reviewed by Veninga et al.2000[3].

Discussions in the QCs are often lively and then lead to the determination of a consensus that everyone is committed to implementing in the best possible way [translated from French][46].

The discussions within PPQCs are often lively and end in the determination of a common consensus that everyone makes a commitment to apply to the best of his or her ability[28].

Theories of adult learning stress the importance of motivation; the doctors must see the need and be willing to change their behavior to increase their professional competence[26].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Context mechanism outcome configuration 19: 'testing new knowledge'

If participants validate and test new knowledge in a QC, moderated by a skilled facilitator in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M).

Interactive approaches, however, can be effective, particularly when they involve participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases, provide feedback on performance, and offer opportunities for practising newly learned skills[10].

Understanding application of new knowledge. The discussions helped members to consider translating evidence into practice: Sometimes you can read about things but are unable to see how to put it into practice and I feel PBSGL enables you to think how you can do that[5].

Innovative solutions to clinical problems can be shared, and nonstandard methods are highlighted in a nonthreatening way[6].

..., in some situations, evidence may not exist or local experts may disagree with the evidence. The facilitator can help by reinforcing the tenets of evidence-based medicine, by selecting methodologically sound overviews ..., and by asking the expert to address any evidence that exists for the recommendations made[6].

This means, for example, that the group is currently working on a new topic, while, analogous to steps d and e, checks are made whether changes have taken place in the doctor's actions (or in the actions of the entire practice team) with regard to the previous topic [translated from German][34].

Next, they examined empirical evidence concerning the validity of these solutions. To facilitate this process, teams had access to the large resource library that the research team had assembled[12].

Context mechanism outcome configuration 20: 'gaining confidence in an innovation'

If the group repeatedly practices implementing and adjusting to an innovation (C), then they trust their own competence and turn the innovation into a habit (O) because successful outcomes increase their confidence in their abilities (M).

A cyclic process ... is used which leads project teams through the improvement projects. This means that after having chosen a subject that requires attention, the team sets specific targets for the project, analyses the actual performance on the subject, makes and introduces plans for change, and evaluates progress[32].

One meeting may not be enough to actually change treatment, although that is the usual procedure in the peer review groups. Behavioural theories stress the importance of repetition, especially for changing routine behaviour[2].

Six months after the intervention, general practitioners again received feedback on their prescribing behaviour, based on insurance claims data comparing the period after the intervention (March to May 2001) with the same period before the intervention (March to May 2000)[2].

In general, GPs were excited to find in the second year that they had indeed changed in accordance with their plans, and they were then usually more motivated to implement further changes[61].

The intervention comprised repeated feedback on prescribing routines and an intensive programme of educational small group sessions, as described by Bahrs et al. (2001)[29].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Suitable data illustrate everyday practice. Participants formulate and discuss possibilities for improvements within the collegial framework of the quality circle and implement these in a further step in their own practice. Renewed data collection then allows them to observe effects of the implemented measures and gain confidence. The results are input for a new discussion in the quality circle [translated from German][44].

The analysis that is carried out each year secures change, as they give the pharmacist the means to maintain motivation: each doctor receives detailed feedback on their successes and the progress still to be made in relation to a control group (doctors working without particular collaboration with pharmacists) and in relation to the good results of other colleagues [translated from French][46].

The constant feedback on progress achieved and the further possible improvements are other success factors[28].

The evaluations of the GPs' prescriptions are performed every year to provide concrete feedback and a source of motivation … to change prescription attitudes[28].

Doctors who were accustomed to discussing their prescribing in peer groups changed their behavior more as a result of such (iterating) peer group meetings than doctors who are not used to this approach[26].

In contrast to our pragmatic study, the interventions in most trials consist of multiple sessions on the same topic supervised by a researcher or an expert, a situation usually very different from real life[64].

These results demonstrate the need to look at repeating/reinforcing messages at 12–24-month intervals[27].

Context mechanism outcome configuration 21: 'repetition priming and automaticity'

If participants build a steady group and practice using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because responses improve with repetition: 'practice makes perfect' (M).

This favours change: Having regular practice meetings on quality improvement with all staff [30].

Successful projects might not only positively reinforce the introduction of CQI, but could also bring about a positive attitude to the other aspects of systematic and continuous quality improvement[30].

Regular meetings with the practice team was selected as a topic for improvement by several of the practices[51].

Finally, for the same reason we were unable to assess possible learning effects, which could mean that quality activities may become less time-consuming over time, even if the approach is directed to other clinical problems[61].

This schedule was repeated a year later, using the same three clinical problems, to assess whether a GP or GP group had implemented the plans for change and to initiate further improvements. This iterative aspect was another important feature of the strategy[20].

In general, GPs were excited to find in the second year that they had indeed changed in accordance with their plans, and they were then usually more motivated to implement further changes[20].

Our strategy also seems worthwhile because small-group quality improvement meetings can help build a local practice group focusing on quality improvement[24].

However, other studies have shown that repeated interventions are needed for sustained behavioural changes[25].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

…one meeting may not be enough to actually change treatment, although that is the usual procedure in the peer review groups. Behavioural theories stress the importance of repetition, especially for changing routine behaviour[2].

The benefit from participation depended significantly on the frequency of the meetings. Real improvements to performance in daily care can only occur if there is an ongoing and regular quality circle process[31].

The benefit from participation depended significantly on the frequency of the meetings. Successful projects might not only positively reinforce the introduction of continuous QI, but could also bring about a positive attitude to the other aspects of systematic and continuous quality improvement[30].

The intervention comprised repeated feedback on prescribing routines and an intensive programme of educational small group sessions, as described by Bahrs et al. (2001)[29].

Assuming a straightforward dose–response relationship, it was expected that the groups were most effective when physicians participated in most sessions. Stronger effects were also expected, if the groups comprised of physicians who had more experience with learning in small peer groups …[38].

The quality circles (N=1,241) documented an average of 22 meetings (mean value: 21.96) (range: by definition min. 4, max. 127 meetings [translated from German][14].

The higher the attendance rate and the more experienced the GPs in a group were, the shorter the courses were prescribed for UTI after the intervention[15].

In principle, material learnt in brief training workshops decays quickly over time, whereas repetition on many occasions ensures greater retention[58].

Practitioners develop expertise when they move from their comfort zones to examine problems "at the upper limit of the complexity they can handle;" they learn, and iteratively gain mastery through cycles of reflecting on practice, obtaining feedback, and adjusting performance[19].

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1. Preconditions
a) 'Need for autonomy and obligation' If the administration at national level or at the level of health insurance companies entrusts GPs with QI and autonomy (so they can decide how to implement it) (C), then GPs might participate in QCs (O) because they feel they can take on the responsibility and make a difference (M). *So, we got more money, but it was for the government no value for money … well … extra value for the money. The only obligation was to participate in the local QC which had to gather four times a year, and you had to participate at … at least two of them every year to keep your accreditation. But you should have an obligation to improve your quality in your practice (1).*
New CMO configuration: 'Being embedded in a system of QI' If QCs are embedded in a QI system (an organisation that negotiates and signs contracts with governmental bodies or health insurance companies, trains and supervises facilitators, provides courses on QI in PHC, and easily accessed educational material, timely data on practice performance and protected time and space) (C), then participants will take on responsibility and work in a purposeful way (O) because they feel supported, empowered, and capable of meeting expectations (M). *… embedding QCs in a system … organising during working time is one ... training facilitators is another one, in a continuous way and honouring in one way or another, maybe financially, especially for the extra hours and the extra work they put into it, and ... offering GPs the possibility of easily gathering data about their own practice ... in a much shorter time, getting feedback on your practice from a national level and getting it in a systematic way ... brought into the peer review would be a good way (1).* *…so, you know the evaluation is mainly to help the person who is organising; the evaluation is really for the tutor, because they [the organisation] are structuring and organising the meetings and it is really seen as a support process … (2).* *I think our problem is at the level of the organisational context. We don't get any support, we don't have protected time, we don't get any help to ... implement new things and do quality improvement … administrative support does not exist …and we have too much to do … too many patients a day (5).*
b) 'Feeling they have a say' If an organisation, (e.g. a physician network organisation) has a decentralised *policy that* encourages use of local knowledge (C), then the QC takes on tasks (O) because members feel that they have a say in QI in their practice (M). *No additional data.*
c) 'Participants know what to expect' If the introductory workshop teaches the principles of QI in PHC and illustrates how QCs work (C), then potential members may be more willing to join QCs (O) because they know what to expect and feel that they can meet expectations (M). *so ... some of them will work well [depending on] whether there is somebody who is inspired and wants to take the lead and knows something about peer review, but most of them are just nice meetings to see colleagues and ... have somebody give a presentation or have some food and drink. So, you should really teach them first! (1).*

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…because they are paid for it and but … there has not been enough understanding in the medical corps to ... to do it and it usually comes on top of all the other ... (3).
2. Establishing the group
a) 'Sharing similar needs' If the administration at the organisational level of QCs provides support (i.e. in training facilitators, data gathering, provision of evidence-based information), protects time and space and offers CME points and small financial incentives to QC participants (C), then the latter will meet in groups to exchange ideas (O) because GPs prefer learning in QCs (M); support generates positive expectations among participants (M) and GPs believe that QC meetings with their peers will be useful (M). *And I think that ... the other thing that is important to the group is the CME / CPD points that they get and the funding from the government to attend meetings. That is all supporting the meetings as well (2).*
b) 'Need for relatedness' If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g. introduces people to each other, opens discussions, and clarifies and summarises statements (C), then group members will get to know each other and decide on rules that they are willing to follow, building a safe environment based on trust (O) because members want to be among and to interact with equals (M). *…and we do that at dinner time so we can have some food together; we work, have dinner and we can enjoy food at the same time (4).* *… but it became clear that we started to get to know each other and each other's sensibilities and to dare to tell about how we handle things and we learnt how to handle each other in a respectful way. Now we have to see how it continues (1).*
c) 'Need for autonomy and control' If the group chooses its own topics and facilitator (C), then its members will feel they own the QC (O) because their need for autonomy - a feeling of being in control of their own behaviour - is satisfied (M). *…exactly big autonomy, the groups decide, there is no pressure from the political system and there is no pressure from anybody and that is why this system is so successful – the doctors can choose (2).*
d) 'Size of the group affects communication' If group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with each other and follow all conversations (M). *For instance, if … I think …15 people is too many … I think eight is enough and … the stress increases if there are more … the smaller the group is, the better the trust and talking (4).*

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e) 'Variety of characters stimulates reflection – cognitive dissonance'

If members of the group have individual character traits and describe different professional experiences but accept each other's views (C), then they can learn from each other (O) because individual attitudes and behaviours will contrast with the knowledge of their peers and cause cognitive dissonance (a negative emotional state triggered by conflicting perceptions) that makes them reflect on their way of working (M).

…. because you can learn from [other] people with more experience, ... you have a [another] way of thinking and [another] way of talking about stuff, situations, that are different I think, so I think it is about different knowledge (4).

f) 'strong cognitive dissonance threatens self-image'

If individuals feel too strong a cognitive dissonance when integrating new knowledge (C), then they may disrupt group dynamics and halt the QC process (O) because their self-image is threatened and they fear losing their professional identity (M).

Yes, we do, yeah, we have doctors who are ... difficult in the group, yes, and they are difficult because they have very firm views and they spend very little evidence on reality. Then it is very important that you have good group leaders and leadership … It is very few … you know trying to sabotage the group … and they don't tend to change behaviour (2).

3. Learning environment

a) 'Feeling safe and not vulnerable'

If participants trust each other (C), then they can describe how they work and admit what they do not know (O), because they feel safe rather than vulnerable (M).

…she told me, you know, one of the things I learnt from you, one of the things I experienced from you is that … opening up with difficult cases and showing that you don't know everything, is showing that you are vulnerable and not knowing what do with it …you build up trust because if you dare to do this, it gives us the confidence that we also can do that … (1)

We know each other very well, so I don't think anybody gets angry about this… and nobody ... gets emotionally the wrong way… if you understand what I mean (5).

b) 'Need for competence and self-actualisation'

If the facilitator supports participants and encourages them to tell their stories and share their experiences in a safe environment, e.g. by encouraging interactive responses, through discussions and by summarising statements (C), then participants will be involved and share their positive experiences and failures (O) because they want to improve their professional competence (M), gain professional confidence (M) and fulfil their professional potential (M).

… and the fact that you can explain it to the others makes you realise that ... you have a bit anxiety about it and all the others tell you that this ok – not just because they want to comfort you … then you realise that you became nervous about something very quickly … even if you did something good after all… the group at this moment is very … a peaceful place and a good way of being with yourself and your own way of practising and it increases your self-esteem as well (4).

But sometimes it is about our problems ... our professional life … about our patient, about some case … diagnostics or prescriptions (5).

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c) 'Previous knowledge is activated'

If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by telling their own relevant stories (O) because the process activates knowledge they already possess (M).

It does satisfy us when we can discuss our own work and our own cases, and we feel closer in the group when we stimulate each other's thinking (4).

d) 'Immediate relevance for the practice'

If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O) because it relates to their everyday work and they can use it immediately (M).

... a lot of the doctors will start with a clinical case, but then come to an overview and then discussions and the next step is organising the GP surgery for that – it is quick wins (3).

e) 'Cognitive dissonance'

If participants discuss and reflect on their work processes (e.g. based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance that makes them reconsider their own way of working (M).

When for example a GP ... in a gr ... group is saying that he does a particular thing that is purely not right, not evidence-based or in fact is wrong, then the group are very good ... I think because they know each other... they do not agree with the doctor but they actually discuss it in the group and a few other doctors say what they would do which is usually different and they usually say ' you may consider this as a different way of doing it because if you do it your way, this is what I find happens...' and there is never an issue where somebody needs to feel bad, but they know that whatever they are currently doing is not what the others would (2).

f) 'Social learning'

If the facilitator uses purposeful didactic techniques (e.g., brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection on the work process (C), then the group will create a learning environment that promotes the exchange of knowledge (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

So, I think that the more experienced GPs bring in their cases into the groups and they discuss their experiences within the groups and I think this is very powerful for the group and the younger GPs bring in ... they have the latest evidence in their head and the guidelines and they bring it in .., and the mix of managing the patient with the evidence and the guidelines and the practical bit from the older GP who has the experience, I think this is really the powerful bit in the group and ... and this is where the learning really occurs (2).

Yes, ... in the beginning we thought this (sharing data) had to be in pairs or triplets because we thought that people were not willing to share, but that was quite wrong. They love to share! (3).

4. <u>Adapting, creating and testing new knowledge</u>

a) 'Positive interdependence between the administration at the national level and GPs'

If the administration at national level requires continuous QC activities (C), then QCs will negotiate

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priorities and design creative solutions (O) because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M). *It may be important for the emerging of QCs, that it becomes a mandatory thing [QI] and, after all, we have the same goals [as the health insurance companies] (4).*
b) 'Threat to professional autonomy' If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and fear they lack autonomy in their clinical role (M). *…no there are no demands, … that wouldn't help, there can be wishes, but we decide how we do it… it wouldn't work otherwise (3).*
c) 'Positive interdependence among group members' If participants maintain a learning environment based on trust that promotes the exchange of knowledge, assisted by facilitators who use professional techniques (e.g. contentious discussion, reaching consensus, and role play) (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as similar, and so act and negotiate cooperatively to achieve a common goal (M). *I think that a group … cannot just be presented with things like, 'here is the evidence, take it or leave it and goodbye' and I don't think that works. I think that people need to ... participate in the learning and they have to show what they are currently doing, whether it is the correct thing or not; it needs to be discussed and adjusted and shared within the group (2).*
d) 'Identifying and removing barriers to change' If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O), because participants help each other to develop strategies to identify and overcome these barriers (M). *And I think you have to have guidelines that are workable for doctors who are, you know, seeing 30 to 40 people every day and, if they want to implement change for the better, they have to be feasible and practical and I think the only way to do that is to consider what they are currently doing. And what the barriers are to new care (2).*
e) 'Need for competence, autonomy and relatedness' If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility and stewardship (O) because this fulfils their need for competence (being able to achieve specific objectives) (M), autonomy (a feeling of being in control of their own behaviour) (M) and relatedness (a sense of connection to a larger group) (M). *No data*
f) 'Intention to change' If participants publicly announce that they intend to change (C), then they are more likely to implement the change (O) because they and others in the group all think it is a good idea and believe they can carry it through (M).

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… and I think that is the opportunity to state it [intention to change] … not everybody participates in that … but … most people do … and they'd say look this is what I learned, this is new for me, this is what I am … going to change in my practice (2).
g) 'Testing new knowledge' If participants validate and test new knowledge in a QC, moderated by a skilled facilitator, in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M). *… and I think that the idea of a quality circle meeting trying make changes dramatically is not practical. I think doctors need to look at ideas and look at the practical parts to see what they can do and change slowly over time (2).*
5. Repeating the process
a) 'Gaining confidence in an innovation' If the group repeatedly practises implementing and adjusting to an innovation (C), then they trust their own competence and turn the innovation into a habit (O) because successful outcomes increase their confidence in their abilities (M). *… then we meet again after four months and usually the … their quality improvement project … didn't really happen or just a little bit, and we discuss the reasons for that and how we could amend that, etc. etc. (3).*
b) 'Repetition priming and automaticity' If participants build a regular group and practise using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because responses improve with repetition: 'practice makes perfect' (M). *… but the QC is really a double thing. It is about a theme but it is also about quality improvement. And the aim and goal is that they find it so rewarding that they use this this technique again and again … in their own surgeries and in their own groups (3).*

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Participants

(1) GP in a rural practice, teacher at the University of Ghent (GP from Belgium)
(2) GP in a rural practice, small group educator for 18 years (GP from Ireland)
(3) Certified facilitator in GP vocational training, active in quality improvement and patient safety (GP from Norway).
(4) GP working in an urban area, facilitating a QC, researcher (GP in training from France)
(5) GP in a rural practice, teacher for GP vocational training (GP from Croatia).

Additional interviews: consolidation of the programme theory

Preconditions

'Need for autonomy and obligation'

If the administration at the national level or at the level of health insurance companies entrusts GPs with QI and autonomy (puts them in control of how to do it) (C), then GPs may consider participating in QCs (O) because they feel they can take on the responsibility and make a difference (M).

…we had quite a lot of criticism on the whole system because we did not feel it would really enhance quality and it was just used as a way of getting more money to the doctors without guarantees that quality would be enhanced, which is when we look back 25 years later, is exactly what happened. So, we got more money but it was for the government no value for money well extra value for the money. The only obligation was to participate in the local QC which had to gather four times a year, and you had to participate at ….at least two of them every year to keep your accreditation. But you should have an obligation to improve Your quality in your practice (1).

…., the only thing that is happening is at the national level the one who is responsible for the QC has to fill in after every QC who has been there and what was the subject of the meeting … exactly there are no demands (1).

It may be important for the emerging of QCs, that it becomes a mandatory thing (4).

We have as an obligation in contracts with our insurance to have …… … peer groups…… then … I don't know how many times we should meet, actually. But we don't have or get much money out of this (5)

'Feeling of having a say'

If an organisation, (e.g., a physician network organisation) has a decentralised policy that encourages use of local knowledge (C), then the QC takes on tasks (O) because members feel that they have a say in QI in their practice (M).

No data but confirming comments.

'Participants know what to expect'

If the introductory workshop teaches the principles of QI in PHC and the workings of QCs (social persuasion) (C), this will increase the motivation of future participants to join QCs (O) because they

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learn what to expect and may feel that they are capable of meeting expectations (M).

…they (QCs) are free to choose to what group they participate without any regulation and without any support of what is happening there without any control of what is happening there so ... some of them will work well (depending) whether there is somebody who is inspired and wants to take the lead and know something about peer review but most of them are just nice meetings to see colleagues and ... have somebody have a presentation or drink something and food. So, you should really teach them first! (1).

They get the knowledge about that from … … … the tutors, when they meet at these national workshops, of which there are three, they exchange ideas on useful quality tools and ways to use these tools among the groups and among the participants (2).

…because they paid for it and but ... there has not been enough understanding in the medical corps to ... to do it and usually comes on top of all the other …. (3).

'Quality Circles should be embedded in a system'

If QCs are embedded in a QI system (an organisation that negotiates and signs contracts with governmental bodies or health insurance companies, trains and supervises facilitators, provides courses on QI in PHC, and easy to access educational material, timely data on practice performance, and protected time and space) (C), then participants will take on responsibility and work in a purposeful way (O) because they feel supported, empowered, and capable of meeting expectations (M).

But ... what did not happen is that the system of local QCs was really embedded in a movement or a way that would support people who participate that would make sure that people who took the lead really would support the facilitator the right way (1).

…by making a plan I mean having enough support on the content level which is there but also at the organisational level m... making it possible (to support facilitators) I do believe that the facilitator is very important (1)

…, the facilitator is the …at the start we …had some facilitator training a... 20 years ago, for some of the people who were interested but then that stopped because it was not financed by the government, and not supported anymore, a... and now for about 15 years there has not been a good generic facilitator training for those people who want to take on responsibility. And the ones who do that, it will be in their spare time they will not be paid for doing that e awarded in another way (1).

I can only tell that in our university in Ghent, that is one of the eight universities in Belgium, we try to learn (teach) the students during the last year, to work in peer review groups and then in the continuous education, the vocational training, they have to meet every two weeks, in groups of fifteen, so in the training, this tradition is established and there you have experienced facilitators being there to support these groups. But once they leave the training, and they start working as a GP, mmm this facilitating stops and they have to look for their own peer review groups and what is often happening, is that they cluster together, and make ….they already know each other and they build a new group with those people who started in the same region at the same time. ... and sometimes those are the most interested and the most interesting groups and they do really nice things, but of older doctors, we really don't see that …that tradition (1).

I think peer review groups could be helpful in preventing burnout and finding on a local level way of cooperating to handle this problem of too much work ... even there if it is not supported or organised in a smart way from up, I think we will miss these chances (1).

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…(embedding QCs in a system)…mmm … organising during working time is one, … training facilitators is another one, in a continuous way in and honouring in one or another way, maybe financially, especially for the extra hours and the extra work they put into it, and ... offering in the best way , offering GPs the possibility of easily gathering data of their own practice and being able to discuss that with their peers and colleagues would be the best if not, ... having in a much shorter time getting feedback on your practice from a national level and getting it in a systematic way ... brought into the peer review would be a good way (1).

It was the college that was in charge of the assessment to check the quality of the education because the Irish college of GPs has always been in control of …. of the quality and standards of education. But I think that is a good thing because I think that if your government spends money for an education system then it has to deliver what is relevant for a doctor working in primary cate at the moment. In the assessments, they try to see who is attending and how often and how big the groups should be what kind of educational material is covered and …. the three national workshops that we have and funded by the HSE executive we have the …. have to approve the programme and the teaching and how they deal with the groups (2).

The evaluation ..and usually there is a supportive evaluation so I'd have ..the year before that I had ... people that a group of doctors and you have two doctors who are familiar with this small group work and they come and visit an area and they'd sit in these groups and they talk how you can approve and it is mainly a support for the tutor I think because you have to look at what you are doing and you also get feedback from three people who are not usually attending your small group meetings. It is usually a very supportive structure and if they feel that it is something that is not appropriate or something you should change again, they actually there is an opportunity to do that as well. This is usually not seen as a negative process as far to my knowledge (2).

….. … so you know the evaluation is mainly to help the person who is organising; the evaluation is really for the tutor, because they are structuring and organising the meetings and it is really would be seen as a support process …really it… it ..unless there are big problems within that group and if there are big problems in that group you have the opportunity to discuss them with the team who is coming and actually very often you can actually clarify or solve problems that are occurring within the group. …..(interviewee moves through the room – inaudible) …and be quite supportive you know and most of us see this positive So but it is a lot of work when I had a team visiting me I had to write a report and have all the names of the GPs attending, I had to have the structure of the group clarified and show what curriculum we have covered the last number of years ... and discuss how the curriculum was selected and about the needs assessment and you also highlight how educational sessions are evaluated you do carry out evaluations on the teaching you are doing (2).

…. and now our association tried to talk with our minister of health and the director of health insurance about we want to …implement I quality indicators in our everyday work ….in our electronic medical records. so, we tried to talk about that…. but nobody really heard us. … And unfortunately, …. we have only support from the association of GPs and a little support from university, but from university every support was only words…it was not anything substantial (5).

… and then the next step will be … … talk with health insurance so they give us more money so we can buy some new equipment for our practices so we can work more quality oriented and that we can think about quality (5).

I think our problem is at the level of the organisational context. We don't get any support, we don't have protected time, we don't get any help to … implement something new and do quality improvement from the government… administrative support does not exist. ….and we have too much to do …. too many patients a day (5).

the QCs have become important at the university like the seventh and eighth year at the university ... when we do the specialisation about the GP or family medicine… but this is not very usual or common it is not nationally organised (4.)

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Establishing the group

'Sharing similar needs'

If the administration at the organisational level of QCs provides administrative support (i.e. training of facilitators, data gathering and provision of evidence-based information), protected time and space, CME points, and small financial incentives to QC participants (C), then they will meet in groups to exchange ideas (O) because QCs are the preferred learning style of GPs (M), support generates positive expectations among participants (M), and GPs think QC meetings with their peers will be useful (M).

…so obviously you get some CME credits you can use for accreditation (1)

…. some packets some information on a one topic or another in way so it can be used in QCs by the local people, often and this is working the best, is having someone who is coming with the information and carrying it into the QCs (1).

And I think that ... the other thing that is important to the group is the CME CPD points that they get and the funding from the government to attend meetings. That is all supporting the meetings as well (2).

...if you want to be recertified, every five years you have to document at least 20 hours in a QC (3).

'Need for relatedness'

If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g., introduces people to each other, opens discussions, clarifies and summarizes statements (C), then group members will get to know each other and decide on rules that they are willing to follow and so build a safe environment based on trust (O) because members want to be among and to interact with equals (M).

..this problem (no trust in the group because of competition about patient contacts) will be solved in a couple of years. When we started it was certainly that way but since about one in four is going to retire within the next five to ten years this will be solved and we get shortage of GPs and maybe that will make it easier for a peer review groups to have more trust and … and find each other to work together and to tackle new problems that may depend on shortage of GPs instead of too many (1).

…. it is the same, it is always the same 20 persons who are the member but once you will have 12 persons and the next time 6 will be the same but 6 will not have attended the last time and some come the next time again, so, the group is a fixed group, it is – of course, if you only have to participate twice a year, your group will not always be the same and it will vary a little bit, depending who is coming and who is not (1).

… but it became clear that we started to get to know each other and the sensibility of each other and to dare to tell about how we handle things and we learnt how to handle each other in a respectful way. Now we have to see how it continues (1).

I think ... the social aspect like you said you are right to discuss that because that is important. …. And I think that is an important part of the meetings (2).

And there is a rule in the group about honesty that if we discuss something that… that should stay in the group, it does not leave the group and that it stays in the group and I think that is respected because over the years there is much more honesty as the years go by (2).

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We do have a meeting now I think in September or October where the doctors get together in a meeting in the afternoon and then we have a social gathering and for each of the group meetings we have coffee or tea and something to eat before the meeting this is important I think because a lot of doctors come for their surgery and they are tired they are fed up and they can have a cup of coffee and a bit of a (inaudible because she laughs) and they are going into the small group as a better doctor. the social aspect I think is very important…and we have half an hour with coffee and sandwich and then we start the meeting (2).

We have ... we would have done these rules in the very beginning when we started the groups, now we know each other for so long that there is no need to ... I think people are very respectful for each other and not necessarily to like each other because there people in the group who do not like each other and I think a norm like that would be difficult I think the rule is to be respectful and even if you don't like the person or agree with them that you are not disrespectful (2).

we usually start with what we call the round where everybody tells what case is on their minds buggering them or causing them problems and if some of them is very important ... we save some time for the end of the group (3).

I think the group make their own rules for conduct and in my group, we revise them quite often, so if we had some incident that was not so nice, we try to find better ways of behaviour towards each other and then the facilitator has quite a lot of authority, and if the facilitator is not able to exercise that, they can get help from four or five facilitator coordinators at the medical association. then they will come and help us in the group itself (3).

There should be like in many other countries … at least the impression I get from for instance Sweden, the Netherlands, Australia, New Zealand, there is a lot of government support - but in Norway we actually do not have much at all. So, there should be much more understanding from the mostly national bureaus but also form the local authorities how important this is. There has not been enough understanding in the medical corps to ...h to do it and usually comes on top of all the other work and it is usually unpaid. So, we have to do it at night and during weekends (3).

…and we do that at dinner time so we can have some food together, we have dinner and we can enjoy food at the same time (4).

… I think if you know people a little bit you feel more comfortable … to talk with if there are too many people who you never seen before and never talked to before, then it is difficult to open up and talk about (4).

this year ... we try to have kind of rules to be more organised in the group, so I think we try to keep it working, and … I think that is the challenge, but we should think and have deeper reflection about what the real impact on our practice is (4).

'Need for autonomy and control'

If the group chooses its own topics and facilitator (C), then they will feel they own the QC (O) because this satisfies their need for autonomy, a feeling of being in control of one' s own behaviour (M).

And they discuss cases, and a topic is picked for the month and an education module occurs around a particular area the doctors bring patients they are looking after and there is a discussion about the cases and the topic area and it is facilitated either by the leader of the group or the tutor, the CME tutor in a particular area (2).

…the group decides to change the programme based on new things that are happening or changes in medicine that are happening and (inaudible) there is a general structure plan for the year but then it changes if something changes … if some group says they would like to cover this or that particular area, there are changes during the year. So, the programme adapts to the needs of the group (2).

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…exactly big autonomy, the groups decide there is no pressure from the political system and there is no pressure from anybody and that is why this system is so successful – the doctors can choose (2).

No there's is a group leader (facilitator), and they are free to elect him or her, and they have to fill in one sheet of paper, where they have to tell date and time and theme and list of attendees (3).

'Size of the group affects communication'

If group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with all of the other participants and follow their conversations (M).

…the group would be 10 to 12 people at the most and they would have a group leader or a tutor in the group that is the facilitator in the group and these groups would meet regularly every month and they would know each other because they meet eight times a year. Knowing and trusting each other is really important when doctors talk about their patients (2).

For instance, if … I think …15 people are too many …I think 8 is enough. and … the stress increases if there are more…. the smaller the group is the better the trust and talking (4)

'Variety of characters stimulates reflection – cognitive dissonance'

If members of the groups have individual character traits and describe differing professional experiences but accept each other's views (C), then they can learn from each other (O) because individual attitudes and behaviours will contrast with their peers' knowledge and cause cognitive dissonance that makes them reflect on their way of working (M).

I think it would be logical and ... more (better) with more diversity and ... with more like an enrichment (4).

…. because you can learn from (other) people with more experience, … … you have a (another) way of thinking and a (another) way of talking about stuff, situations, that are different I think, so I think it is about different knowledge (4)

'strong cognitive dissonance threatens self-image'

If individuals feel too strong a cognitive dissonance when integrating new knowledge (C), then they can disrupt group dynamics and the QC process halts (O) because this threatens their self-image and they feel at risk of losing their professional identity (M).

Yes, we do yea, we have doctors who are ... difficult in the group, yes, and they are difficult because they have very firm views and they spend very little evidence on reality. Then it is very important that you have good group leaders and leadership … It is very few … you know trying to sabotage the group…. and they don't tend to change behaviour (2).

it is more about personal reasons ……. one (participant) is really expansive and always talking about her and compares everything with herself, and she pretends to know the way …. we can't really … function and discuss as we wanted to, you know; it feels like competition … I don't know what happens … at that moment but …I don't think we have a good atmosphere then (4).

Learning environment

'Feeling safe and not vulnerable'

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If participants trust each other (C), then they can describe how they work and admit what they don't know (O), because they feel safe rather than vulnerable (M).

... if they start any discussion, that is one of the problems, most of the time they just invite some external speaker a specialist or someone with a special interest to come and present something and afterwards they will have questions to speaker and perhaps discuss a little bit in between depending on the speaker and perhaps the facilitator if he really wants to facilitate but that is most of the time what is happening (1).

... (one of the important things) ... is building the trust and building the trust…? I had a very nice compliment of one of my colleagues after wards which we have been working together ...she told me you know one of the things I learnt from you one of the things I experienced from you is that mm opening up with difficult cases and showing that you don't know everything is showing that you are vulnerable and not knowing what do with it ...you build up trust because if you dare doing this gives us the confidence that we also can do that ... (1).

...one of my experiences but that we had in the practice last month I think it was that we took up the discussion about cases with the trainee and we realised by discussing cases that ... you often find gaps in your knowledge (1).

…and if people know each other within the group they are very honest and very open and they just ….and they discuss worries and concerns and there is a lot of that if the group is functioning well and everybody is feeling comfortable and there is a good level of trust in the group and they can talk about their cases (2).

…when a doctor gets upset, that has happened over my years and usually there is a kind of…within the meeting and they upset I would usually ... deal with that situation during the meeting and if they are upset and they are quiet and then I will actually go to them after the meeting but I will never let a doctor go home with issues that somebody got upset because the last thing I think a doctor should go through in small groups is ending up feeling upset or demoralised (2).

there is surprisingly ... huge openness and some people take it up and tell 'I have made a mistake and I ... feel bad about it' (3).

…we talk about cases we have social bonding; we are a group who feels safe, it is like a safe climate, we talk about ... our difficult situations (4).

We know each other very well, so I don't think anybody gets angry for this…and nobody .... gets emotionally the wrong way… if you understand what I mean (5).

'Need for competence and self-actualisation'

If the facilitator supports participants and encourages them to tell their stories and share their experiences in a safe environment, e.g., by encouraging interactive responses, through discussions and by summarizing statements, (C) then participants will be involved and share their positive experiences and failures (O), because they want to improve their competency, a sense of self-efficacy to achieve specific objectives (M), gain professional confidence (M) and achieve professional self-actualisation (M).

…having to share feelings of sometimes being powerless in certain situations was one of the things that built up the group the group feeling and which made everybody feel relieved, maybe not relieved but feeling confident and this is going to work (1).

There is no kind of structure that is imposed on the group and that makes the group actively by into the learning process because a lot of doctors bring information into the group and they bring learning from other places into the group that they have obtained so it is a very, it is a mix of learning from various places (2).

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... and people will actually discuss for instance difficult moments in cancer treatment or cancer care, people will bring stories about patients but they will often bring problems about members in the family and the difficulties of being a GP and having to cope with this, and the major problems about being a GP, and that is very powerful stuff because that is about the personal aspect of being a doctor (2)

that is an 'after' discussion – I often call this the hidden curriculum because I think that is very important, I think that ... a lot of doctors over the years have been in distress and it is important to talk about this (2).

the truth is that if you are a doctor and if you want to do a good job then you have to make quality improvement and patient safety a part of your profession ... broader knowledge (3).

And ... I think you learn a lot of basic things you need in order to be a g good doctor for your patients, you learn respect, you learn to hold yourself back to be able to let the other people speak and the other to take ... the front floor. Social control is quite important in many ways. … and you learn that much easier in a group than on your own (3).

...someone tells which was a typical situation for one of them, for one of us – sorry… and sometimes we choose…. for example, ... we usually choose something that happened yesterday or the day before (4).

We prefer the clinical cases that we are difficult and where we have questions or bad emotions and ... ... we prefer that kind of a (difficult) decision because we ..... because first, for the person who explains the situation; and this is a good way to be or to get rid of the pain and talk about that and for the others it is always interesting because most of the time one of us had already been or experienced ... or felt that pain or talked about a situation that is similar. …it is like ahh mutual understanding and we can understand and talk about it with each other, and it is ... a good feeling if you see other people had the same and we understand each other (4).

…but it is much more it is about personal feelings and points of views in life or fear ... or non-pleasant ... feelings or something with the people we have like difficult patients and our human relations with the patients, because no we don't have someone to summarise all the facts and all the feelings and ... there is no one who takes care of that what we do in the group (4).

I think it is important for psychological point of view not the feeling to be alone sharing your thoughts and experiences with friends and colleagues …. same GPs we have the same profession. I realise we are all in the same boat….it is also very stimulating to keep learning (4).

…and the fact that you can explain it to the others makes you realise that ... you have a bit anxiety about it and all the others tell you that this ok – not just because they want to comfort you …then you realise that you became nervous about something very quick …even if you did something good after all….the group at this moment is very …….. a peaceful place and a good way of being with yourself and your own way of practising and it increases your self-esteem as well (4).

But sometimes it is about our problems ... . our professional life…about our patient about some case ……diagnostics or prescriptions (5).

'Previous knowledge is activated'

If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by telling their own relevant stories (O) because the process activates knowledge they already possess (M).

well .in different way …. it can be telling about a case even analysing a critical incident, telling about critical incidents is important to us, that can be a discussion of a guideline, a ... that can be a well something new out of the literature, ... these are the ways we want to do it (1).

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it does satisfy us when we can discuss about our own work and about our own cases, and we feel closer in the group when we stimulate each other's thinking (4)

When we talk about cases, case discussions, that is the most efficient part of the hour, because every participant wants to …… talk about and tell something about … case … about cases we experience. Sometimes, we have so different opinions and I f someone saw us from the outside, then …. they would think this is a crazy group…. but (laughs) but I think it is constructive…and we learn from each other because … then, we talk about different aspects of the case (5).

'Immediate relevance for the practice'

If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O) because it relates to their everyday work and is therefore of immediate use (M).

...a lot of the doctors will start with a clinical case, but then come to an overview and then discussions and the next step is organising the GP surgery for that -it is quick wins (3).

I think sometimes we … we have … it is more like an administrative part about the administration the administrative things about how to do the replacement of GPs, like all the papers and all the declaration stuff that is necessary for this ….it helps…. I think it is very helpful to talk about that (4).

We think about …when one participant tells a story… talks about the case and after that we talk about what we think …everyone in turn…we have only women participating in the group (laughs) …. we say what we think is correct and we talk about what each one of us would do in this situation, what we think she could do better…we look if we can find some evidence about that (medical facts) … and we can use it right after (5).

'Cognitive dissonance'

If participants discuss and reflect on their work processes (e.g., based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance that makes them reconsider their own way of working (M).

…. the government …m is now offering … the possibility but it is quite informal it is not on a massive level they offer the possibility to discuss … some indicators on polypharmacy to be discussed with a … an expert of the government and ..... then they offer the results of the QC and individual results to the people who are participating there and then they start a discussion about polypharmacy and that is existing (1).

…well if you tell a story we are doing this in this way in our practice, … another practice could tell, well in our practice we see thigs differently and we do it another way and or it could be that … we help think about the situation with a difficult patient how you … you can handle it in a different way then somebody else will tell you, well, what do you think about that maybe this could be a way or this …have you considered this with this patient and ... perhaps you could take up and discuss with the patient how he feels about that ……. it is often gives you the opportunity when you get stuck with difficult patients and mmm to get new energy and to have …mmm to listen to the way other people would handle it can help to open up and take new initiatives instead of blocking and having the feeling that you don't get any further with the patient (1).

…it is not just an easy push on one bottom but hard work … on the other hand, we have a feedback from the government ... every two to three years which offers a lot of data about your prescription and about the population you treat and which you can use but that is always old data. We will now get one in the next months to come and that will contain data from 2015 it is now 2018!!! which will be analysed then so that is quite a problem (1).

Supplemental material 10 consolidated programme theory, including illustrative quotes and complete list of supporting quotes

Yes, Yes, prescription habits so ... ... prescription habits at the moment in Ireland is ... so if you are a public GP and you have a GMS number, then you get feedback on prescribing actually only in one area at the moment and that is benzodiazepines and you get that every year on benzodiazepines but you do not get feedback on anything else (2).

When for example a GP ... in a gr ....group is saying that he does a particular thing that is purely not right not evidence based or in fact is wrong then the group are very good ...I think because they know each other... they do not agree with the doctor but they actually discuss it in the group and a few other doctors say what they would do which is usually different and they usually say ' you may consider this as a different way of doing it because if you do it your way , this is what I find happens...' and there is never an issue where somebody needs to feel bad but they know that whatever they currently are doing is not what the other would (2).

I think because when you have had doctors I the group for a long, long time and working in practice for a long time I think you have to consider what people currently are doing and what they accept as appropriate for their practices or for their work. and I think to introduce new guidelines and new evidence you have to look at what people are currently doing and to get people to accept a change and see why this change would be necessary as well and sometimes the change is not necessary for the group; if you don't know whatever they are currently doing ,and if they are not exchanging ideas within the group then ..that really...they are not learning then because ... I think my criticism of guidelines and evidence is that they are not always practical to implement (2)

We use some data extraction software from the electronic health record so that every doctor gets his own indicators ... in a report that tailors the theme (3).

We usually do it (comparing each other's data) as a plenary thing and I can always say as a facilitator what about indicator 13 and then we go around the table what figures do you have and how would you explain them and the huge differences between the results. so, there is a .... a special part of data report of the indicator we go through in each meeting and we ...when we have done that, they usually don't have use of the facilitator because the discussion is quite intense (3).

Firstly, I think they learn a lot about quality indicators and then you have to go into the matter why they differ so much. Why yours is so different from mine, and then you have to look at age spread of the population, my work, if I work a lot 'on call' for instance, which is different from sitting in the office all the time (3).

...yes, sometimes we choose difficult situations and sometimes we don't choose and we talk about the last situation we had the day before and sometimes like a simple disease that is not so difficult, so we talk about, because even if it seems to be easy we have different ways to do this and it is interesting to talk about even easy situations, because all the other do it in a different way (4).

We do have practice mirrors about hypertension, about diabetes and ... now we have some I work on some audit about prescription of warfarin, which gives a lot of interesting discussions (5).

... and I see only me ... is this ok or did do something wrong? but now we compared and compare two different practices in two different parts of Croatia and we have similar results, which surprised me (5).

We do that just like in case discussions; some of us have a little ...presentation ...we talk about guidelines or evidence-based information ....and we ahh we that .... colleagues talk about what they do in their practices and .... what she can do and why, ... giving the reasons...and after that we talk about ...every participant talks about what she does in practice and what they don't do and the reason why they don' do it (5).

'Social learning'

If the facilitator uses purposeful didactic techniques (e.g., brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection on the work process (C), then the group will create a learning environment that promotes

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knowledge exchange (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

So I think that the more experienced GPs bring in their cases into the groups and they discuss their experiences within the groups and I think this is very powerful for the group and the younger GPs bring in …they have the latest evidence in their head and the guidelines and they bring it in ..and the mix of managing the patient with the evidence and the guidelines and the practical bit from the older GP who has the experience I think this is really the powerful bit in the group and … and this is where the learning really occurs (2).

…and I (Facilitator and tutor) don't have the arrogance to believe that they leave that meeting and go and change their practice but they are certainly aware of that their practice is not what the …. the rest of the group's is (2).

…case discussions are important so cases are a huge part of the group and the other thing we would sometimes do is ... a role play we also have used video consultation playing video cases or other reals life scenarios and the other thing we should use is discussion groups. So, you know like working groups for example I have twelve people and if I have something new, I might split the group into groups of four and so people would work within these smaller groups and then they carry their points of views back to the whole group. And it is not an individual but the whole small group who feeds back, it is the group it is a safer place (2).

yes, ... in the beginning we thought this (sharing data) had to be in pairs or triplets because we thought that people were not willing to share, but that was quite wrong. they love to share (3)!

…but we like to learn and understand how the others do; so, it is a learning from each other, yes that is what it is [in French] (4).

Adapting, creating and testing new knowledge

'Interdependence between health insurance companies/physician network organisations and GPs'

If physician network organisations require continuous QC activities (C), then QCs will negotiate priorities and design creative solutions(O) because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M).

It may be important for the emerging of QCs, that it becomes a mandatory thing (QI) and after all, we have the same goals (as the health insurance companies) (4).

We have as an obligation in contracts with our insurance to have …… … peer groups…… then … I don't know how many times we should meet, actually. But we don't have or get much money out of this (5).

'Threat to professional autonomy'

If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and think they lack autonomy in their clinical role (M).

…no there are no demands, that wouldn't help, we have to do and there can be wishes how, but we decide….it wouldn't work otherwise (3).

'Interdependence among group members'

If participants maintain a trusting learning environment that promotes knowledge exchange, assisted

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by facilitators who use professional techniques (e.g., contentious discussion, reaching consensus, and role play), (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as being similar, and so act and negotiate cooperatively to achieve a common goal (M).

I think that a group …cannot just be presented with things like here is the evidence, take it or leave it and goodbye and I don't think that works, I think that people need to … participate and in the learning and they have to show what they are currently doing whether it is the correct thing or not; it needs to be discussed and adjusted and shared within the group (2).

'Identifying and removing barriers to change'

If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O), because participants help each other develop strategies to identify and overcome these barriers (M).

And I think you have to have guidelines that are workable for doctors who are you know seeing 30 to 40 people every day and if they want to implement change for the better they have to be feasible and practical and I think the only way to do that is to consider what they are currently doing. And what the barriers are to new care (2).

'Need for competence, autonomy and relatedness'

If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility and stewardship (O), because this fulfils their need for competence (being able to achieve specific objectives) (M), autonomy (a feeling of being in control of their own behaviour) (M), and relatedness (a sense of connection to a larger group) (M).

No data but confirming comments.

'Intention to change'

If participants publicly announce their intention to change (C), then they are more likely to implement the change (O) because they and others in the group both think it is a good idea and believe they can carry it through (M).

…we ask the group to give a feedback on how they feel that would change them or their practice and the routine of care for their patients. So, they usually the group …we end the meetings with a feedback a summary and a feedback and a feedback from the group what it is they feel they want to change ... and I think that is the opportunity to …. not everybody participates in that…. but ... most people do ….and they'd say look this is what I learned this is new for me this is what I am ... going to change in my practice (2).

We talk about …how we shall we implement the guidelines and shall we implement this in our everyday process, what steps we can implement and how and what we cannot implement and why not……. … how do we need support from our hospital-based colleagues…? ... in some steps of the implementation of the guidelines…. and ... sometimes we need help of our medical association because in ... some steps when we talk about guidelines, we don't have the things (equipment) in our practice (5).

'Testing new knowledge'

If participants validate and test new knowledge in a QC, moderated by a skilled facilitator, in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M).

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..time to reflect on this practice is actually something that is very important and you have to figure out where the guidelines fit in and you reflect on what you are doing and the group and the process finds out the is correct the use of the guidelines and then for you as a practitioner you can look at that and see what practical that has changed over time and I think that the idea of a quality circle meeting is trying make changes dramatically is not practical I think doctors need to look at ideas and look at the practical parts to see what they can do and change slowly over time (2).

Repeating the process

'Gaining confidence in an innovation'

If the group repeatedly practices implementing and coping with an innovation (C), then they trust their own competence and turn the innovation into a habit (O) because successful outcomes increase confidence in their abilities (M).

... then we meet again after four months and usually the ...their quality improvement project ... didn't really happen or just a little bit, and we discuss the reasons for that and how we could amend that etc. etc. (3).

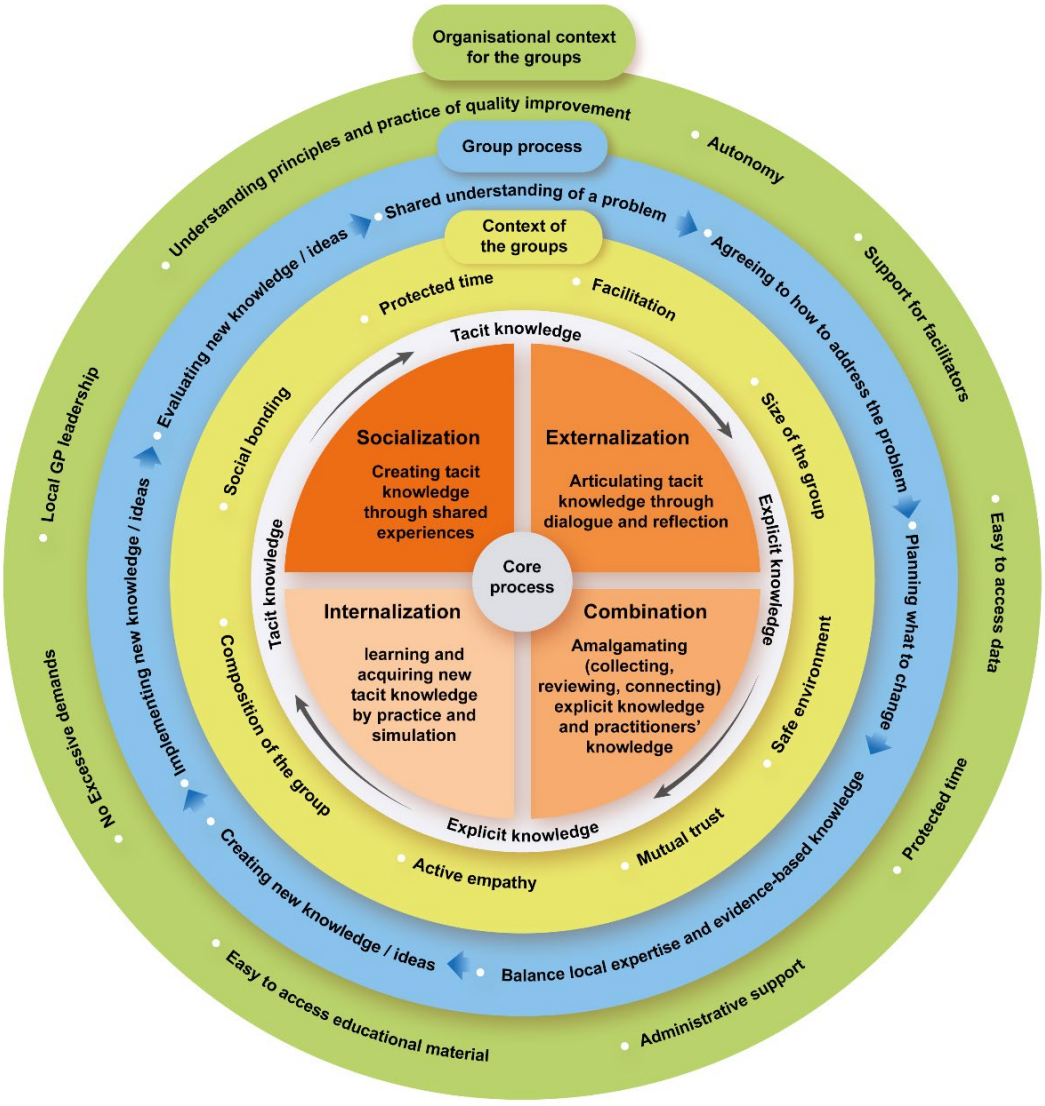
...and ... yes and then we present it and I also present it wherever we work and at the practices where we work (4).

'Repetition priming and automaticity'

If participants build a steady group and practice using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because successful responses increase with repetition: 'practice makes perfect' (M).

...but it is really a double thing. it is about a theme but it is also about quality improvement. And the aim and goal are that they find it so rewarding that they use this this technique again and again. ……in their own surgeries and in their own groups (3).

Supplemental material 11 Summary of the QC process and its implications



Legend:
The rings represent the levels of context and their associated processes. The core process is in the centre, illustrating the exchange of knowledge and the creation of innovations in QCs. The process is a spiral rather than a circle, because participants add experience and new knowledge at each turn of the cycle. The size and composition of the group, the social bonds between participants and their mutually benevolent attitude all foster mutual trust and create a safe environment in which participants can have frank discussions. Protected time and skilful facilitation lay the groundwork for a successful core process. At the next level, participants begin with a shared understanding of an issue and agree how to address it and what needs to be changed, ensuring the success of the group process. When QCs solve problems and innovate, they should balance local expertise (soft knowledge) with evidence-based information (hard knowledge); then they can generate new ideas to be tested and implemented in everyday practice. The QC process requires considerable professional and administrative support at the organisational level, so professional associations or university departments must teach QC members the principles and practices of QI and their use, and train and support facilitators. Organisations should also provide easy access to performance data and evidence-based material. Administrative organisations, whether health insurance companies or governmental organisations, should allow QCs to have professional and administrative autonomy and let them take the lead in QI, without placing excessive demands on the group or its members. The level of legislation required to entrust GPs with QI will vary depending on a country's health-care system, and could be enacted at national or local government level.

QUALITY STANDARDS FOR REALIST SYNTHESIS (for researchers and peer-reviewers)

1. The research problem

Realist synthesis is a theory-driven method that is firmly rooted in a realist philosophy of science and places particular emphasis on understanding causation and how causal mechanisms are shaped and constrained by social context. This makes it particularly suitable for reviews of certain topics and questions – for example, complex social programmes that involve human decisions and actions. A realist research question contains some or all of the elements of 'What works, how, why, for whom, to what extent and in what circumstances, in what respect and over what duration?' and applies realist logic to address the question. Above all realist research seeks to answer the 'why?' question. Realist synthesis always has explanatory ambitions. It assumes that programme effectiveness will always be partial and conditional and seeks to improve understanding of the key contributions and caveats.

Criterion	Inadequate	Adequate	Good	Excellent
The research topic is appropriate for a realist approach	The research topic is: • not appropriate for secondary research; and/or • does not require understanding of how and why outcomes are generated.	The research topic is appropriate for secondary research. It requires understanding of how and why outcomes are generated and why they vary across contexts.	Adequate plus: Framing of the research topic reflects a thorough understanding of a realist philosophy of science (generative causation in contexts; mechanisms operating at other levels of reality than the outcomes they generate).	Good plus: There is a coherent argument as to why a realist approach is more appropriate for the topic than other approaches, including other theory based approaches.
The research question is constructed in such a way as to be suitable for a realist synthesis	The research question is not structured to reflect the elements of realist explanation. For example, it: • only requires description; and/or • only requires a numerical aggregation of outcomes; and/or • only requires summary of processes; and/or • specifies methods that are inadequate to generate realist understanding (e.g. 'a thematic analysis of …')	The research question includes a focus on how and why the intervention, or programme (or similar classes of interventions or programmes - where relevant) generates its outcomes, and contains at least some of the additional elements, "for whom, in what contexts, in what respects, to what extent and over what durations".	Adequate plus: The rationale for excluding any elements of 'the realist question' from the research question is explicit. The question has a narrow enough focus to be managed within a realist review.	Good plus: The research question is a model of clarity and as simple as possible.

2. Understanding and applying the underpinning principles of realist reviews				
Realist syntheses apply realist philosophy and a realist logic of enquiry. This influences everything from the type of research question to a review's processes (e.g. the construction of a realist programme theory, search, data extraction, analysis and synthesis to recommendations). The key analytic process in realist review involves iterative testing and refinement of theoretically based explanations using empirical findings in data sources. The pertinence and effectiveness of each constituent idea is then tested using relevant evidence (qualitative, quantitative, comparative, administrative, and so on) from the primary literature on that class of programmes. In this testing, the ideas within a programme theory are re-cast and conceptualised in realist terms. Reviewers may draw on any appropriate analytic techniques to undertake this testing.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The review demonstrates understanding and application of realist philosophy and realist logic which underpins a realist analysis.	Significant misunderstandings of realist philosophy and/or logic of analysis are evident. Common examples include: • programme/intervention activities or strategies are confused with mechanisms • no attempts are made to uncover mechanisms • outcomes are assumed to be caused by the programme/intervention • relationship(s) between an outcome, its causal mechanism(s) and context(s) are not explained • some theory is provided but this is not explicitly linked to outcome(s)	Some misunderstandings of realist philosophy and/or logic of analysis exist, but the overall approach is consistent enough that a recognisably realist analysis results from the process.	The review's assumptions and analytic approach are consistent with a realist philosophy at all stages of the review. Where necessary a realist programme theory is developed and tested.	Good plus: Review methods, strategies or innovations used to address problems or difficulties within the review are consistent with a realist philosophy of science.

3. Focussing the review				
Because a realist review may generate a large number of avenues that might be explored and explained, and because resources and timescale are invariably finite, it may be necessary to 'contain' a review by progressively focusing both its breadth (how wide an area?) and depth (how much detail?). This important process needs to be considered from the start and may involve iterative rounds of discussion and negotiation with (for example) content experts, funders and/or users. It is typical and legitimate for the review's objectives, question and/or the breadth and depth of the review to evolve as the review progresses.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The review question is sufficiently and appropriately focussed.	The review question is too broad to be answerable within the time and resources allocated. There is no evidence that progressive focussing occurred as the review was undertaken.	Attempts are made by the review team to progressively focus the review topic in a way that takes account of the priorities of the review and the realities of time and resource constraints. Attempts are documented so that they can be described in publications as appropriate.	Adequate plus: The focussing process is iterative. Commissioners of the review are involved in decision-making about focussing. Decisions made about which avenues are pursued and which are left open for further inquiry are recorded and made available to users of the review.	Good plus: The review team draws on external stakeholder expertise to drive the focussing process in order to achieve maximal end-user relevance.

4. Constructing and refining a realist programme theory				
Early in the review, the main ideas that went into the making of a class of interventions (the programme theory – which may or may not be realist in nature) are elicited. This initial programme theory sets out how and why a class of intervention is thought to 'work' to generate the outcome(s) of interest. This initial programme theory then needs to be 're-cast' in realist terms (a rough outline of the contexts in which, populations for which, and main mechanisms by which, particular outcomes are expected to be achieved.) This initial tentative theory will be progressively refined over the course of the review.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
An initial realist programme theory is identified and developed.	A realist programme theory is not offered or; A program theory is offered but is not converted to a realist program theory at any stage of the review.	An initial program theory is identified and described in realist terms (that is, in terms of the relationship between contexts, mechanisms and outcomes). The refined theory is consistent with the evidence provided.	Adequate plus: An initial realist programme theory is set out at the start. The theory is refined iteratively as the review progresses.	Good plus: The relationship between the programme theory and relevant substantive theory is identified. Implications of the final theory for practice, and for refinements to substantive theory where appropriate, are described. The final realist program theory comprises multiple context-mechanism-outcome configurations (describing the ways different mechanisms fire in different contexts to generate different outcomes) and an explanation of the pattern of CMOs.

5. Developing a search strategy				
Searching in a realist review is guided by the objectives and focus of the review, and revised iteratively in the light of emerging data. Searching is directed at finding data that can be used to test theory, and may lie in a broad range of sources that may cross traditional disciplinary, programme and sector boundaries. The search phase is thus likely to involve searching for different sorts of data, or studies from different domains, with which to test different aspects of any provisional theory.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The search process is such that it would identify data to enable the review team to develop, refine and test programme theory or theories.	The search is incapable of supporting a rigorous realist review. Common errors include: • The search is driven by a methodological hierarchy of evidence (e.g. privileging RCTs) rather than the need to identify data to develop, refine or test program theory/ies • The search process is not informed by the objectives and focus of the review • The database(s) selected are narrow in the subject matter that they contain (e.g. limited to specific topics rather than extending to social science, psychology etc.) • Searching is undertaken once only at the outset of the review and there is no iterative component	Searches are driven by the objectives and focus of the review. The search strategy is piloted and refined to check that it is fit for purpose. Documents are sought from a wide range of sources which are likely to contain relevant data for theory development, refinement and testing. There is no restriction on the study or documentation type that is searched for.	Adequate plus: further searches are undertaken in light of greater understanding of the topic area. These searches are designed to find additional data that would enable further theory development, refinement or testing.	Good plus: the searching deliberately seeks out data from situations outside the program under study where it can be reasonably inferred that the same mechanisms(s) might be in operation.

6. Selection and appraisal of documents				
Realist review requires a series of judgements about the relevance and robustness of particular data for the purposes of answering specific questions within the overall review question. An appraisal of the contribution of any section of data (within a document) should be made on two criteria: • *Relevance* – whether it can contribute to theory building and/or testing; and • *Rigour* – whether the method used to generate that particular piece of data is credible and trustworthy. The selection and appraisal stage may need to run in parallel with the analysis stage.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The selection and appraisal process ensures that sources relevant to the review containing material of sufficient rigour to be included are identified. In particular, the sources identified allow the reviewers to make sense of the topic area; to develop, refine and test theories; and to support inferences about mechanisms.	The selection and appraisal process does not support a rigorous and complete realist review. For example: • Selection is overly driven by methodological hierarchies (e.g. the restriction of the sources to RCTs to the exclusion of other forms of evidence) • Sources are appraised using a technical checklist for a particular method (e.g. assessment of quality for an RCT) rather than by making a defensible judgement on the relevance and rigour of the source • Selection and appraisal processes are overly restrictive and exclude materials that may be useful for a realist analysis • Selection and appraisal processes are not sensitive enough to exclude irrelevant materials	Selection of a document for inclusion into the review is based on what it can contribute to the process of theory development, refinement and/or testing (i.e. relevance). Appraisals of rigour judge the plausibility and coherence of the method used to generate data.	Adequate plus: During the appraisal process limitations of the method used to generate data are identified and taken into consideration during analysis and synthesis.	Good plus: Selection and appraisal demonstrate sophisticated judgements of relevance and rigour within the domain.

7. Data extraction				
In a review, data extraction assists analysis and synthesis. Of particular interest to the realist reviewer are data that support the use of realist logic to answer the review's question(s) – e.g. data on context, mechanisms, and outcome configurations, demi-regularities, middle-range and/or programme theories.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The data extraction process captures the necessary data to enable a realist review.	The data extraction process does not capture the necessary data to enable a realist review. For example: • Data extraction is undertaken mechanically and with no attention to how the data informs the review • No or very limited piloting has been undertaken to test aspects of the data extraction process and improve it	Data extraction focuses on identification and elucidation of context-mechanism outcome configurations and refinement of program theory. Piloting and refinement of the data extraction process has been undertaken where appropriate. Quality control processes are in place to check that all review team members apply common processes and standards in data extraction.	Adequate plus: Data extraction processes support later processes of analysis (e.g. by organising data into sets relevant for later analysis). The data extracted is comprehensive enough to identify main CMO patterns.	Good plus: The data extraction process is continually refined as the review progresses, so as to capture relevant data as the review question is focussed and/or program theory is refined.

8. Reporting				
Realist reviews may be reported in multiple formats – lengthy reports, summary reports, articles, websites and so on. Reports should be consistent with the publication standards for realist synthesis. (See RAMESES publication standards: Realist syntheses at: http://onlinelibrary.wiley.com/doi/10.1111/jan.12095/full or http://www.biomedcentral.com/1741-7015/11/21).				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The realist synthesis is reported using the items listed in the RAMESES Reporting standard for realist syntheses.	Key items are missing. For example • No defined research question • Limited or no reporting of the review's processes (i.e. methods used) • Limited or no explanations and justifications provided for any adaptations made on the realist review process • Insufficient detail is reported to enable readers to judge the plausibility and coherence of the findings	Most items reported. In particular the following items should be reported: • Rationale for review • Objectives and focus of review • All method section items (i.e. items 5 to 11 in the RAMESES publication standards: Realist syntheses)	All items are reported clearly and in sufficient detail for an external reader to understand and to judge the methods used and the plausibility and coherence of the findings.	Good plus: The report is well written and easy to understand. Additional materials are made available for external readers to investigate aspects of the review in more detail.

For details on how these quality standards were developed, please see:
Wong G, Greenhalgh T, Westhorp G, Pawson R..Development of methodological guidance, publication standards and training materials for realist and meta-narrative reviews: the RAMESES (Realist And Meta-narrative Evidence Syntheses - Evolving Standards) project. Health Serv Deliv Res 2014;2(30)

RCTs = randomised controlled trials

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Understanding how and why Quality Circles improve standards of practice, enhance professional development and increase psychological well-being of General Practitioners - a realist synthesis

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Abstract

Objectives: To understand how and why participation in quality circles (QC) improves general practitioners' psychological wellbeing and the quality of their clinical practice. To provide evidence-informed and practical guidance to maintain quality circles at local and policy levels.

Design: A theory-driven mixed method

Setting: Primary health care

Method: We collected data in four stages to develop and refine the programme theory of QCs: 1) co-inquiry with Swiss and European expert stakeholders to develop a preliminary programme theory; 2) realist review with systematic searches in MEDLINE, Embase, PsycINFO, and CINHAL (1980-2020) to inform the preliminary programme theory; 3) programme refinement through interviews with participants, facilitators, tutors and managers of quality circles; 4) consolidation of theory through interviews with QC experts across Europe and examining existing theories.

Sources of data: The co-inquiry comprised 3 interviews and 3 focus groups with 50 European experts. From the literature search we included 108 papers to develop the literature-based programme theory. In stage 3, we used data from 40 participants gathered in 6 interviews and 2 focus groups to refine the programme theory. In stage 4, five interviewees from different health care systems consolidated our programme theory.

Result: Requirements for successful QCs are governmental trust in GPs' abilities to deliver quality improvement, training, access to educational material and performance data, protected time, and financial resources. Group dynamics strongly influence success; facilitators should ensure participants exchange knowledge and generate new concepts in a safe environment. Peer interaction promotes professional development and psychological well-being. With repetition, participants gain confidence to put their new concepts into practice.

Conclusion: With expert facilitation, clinical review and practice opportunities, QCs can improve the

quality of standard practice, enhance professional development and increase psychological well-being in the context of adequate professional and administrative support.

Strengths and limitations of this study

- This study synthesised over 100 academic papers published in English, German, French and Scandinavian languages, and data from 90 experts and participants from different European countries and health care systems.
- The resulting programme theory reflects and explains the complex process in QCs in the current context of European primary health care, and may need to be adapted in response to future changes.
- The recommendations rely on the detail and depth of the reports we identified in our literature review and on the veracity and adequacy of the information gathered in interviews.
- We were only able to test a limited set of existing theories to gain insights into how the programme theory's mechanisms work and interrelate.

Introduction

Quality circles (QCs) are made up of 6–12 primary health care professionals who regularly meet to reflect on and improve their standard practice. The terms Practice Based Small Group Work, Peer Review Group, Problem Based Small Group Learning, Practice Based Research Group, Quality Circle, Continuous Medical Education (CME) Group, and Continuous Professional Development (CPD) Group were used interchangeably and varied among countries. The labels suggest the basic, original intent of the group. We decided to use the umbrella term Quality Circle to describe all of them.[1] In the UK and Europe, QC are commonly used by general practitioners (GPs) for continuous professional development (CPD). The focus of discussion is usually a critical evaluation of an aspect of quality which participants themselves identify as important to them. GPs seek to improve the quality of their care by linking evidence to practice, learning to deal with uncertainty, discussing and reflecting on practice issues.[2] Participation in QCs can raise self-esteem, create a sense of belonging and improve psychological well-being in GPs.[1] QCs may be especially helpful in crisis situations like the current Covid-19 pandemic, where working continuously under high pressure can undermine the professionalism and mental health of GPs.[3]

QCs can improve standard practice like prescription patterns and diagnostic habits, enhance professional development and psychological well-being, but the results of randomized controlled trials are inconsistent and offer only limited behavioural explanations for these positive effects. As a complex social intervention, QCs combine didactic methods like brainstorming and reflective thinking with quality improvement (QI) techniques like audit and feedback or purposeful use of local experts. Their activities must be tailored to address local problems in primary health care (PHC) that participants want to solve.[4 5] Our understanding of QCs is incomplete, and we need to learn more about these complex social interventions and their context-dependent outcomes and effects. This study seeks to clarify the contexts in which QCs are conducted, when they change GP behaviour and improve psychological well-being and why. We intended to develop a programme theory for QCs

that explains how and why they work, with the aim of creating a common language and understanding, [6 7] to engage stakeholders in discussions about improving QC processes in a participatory way and prepare the ground for further empirical testing.[8 9] Our end goal was to develop an initial set of policy recommendations for setting up optimal QC processes and maintaining them.[10-12]

Methods

A project protocol was registered with PROSPERO (CRD42013004826) and published in 2013.[5]

We answered our research question in four stages with details to follow. In stage one, we conducted a co-inquiry with stakeholders on QCs from Switzerland and other European countries, in which we narrowed the research question and provided a preliminary programme theory. In stage two, we synthesised evidence from a literature review and built a literature-informed programme theory. In stage three, we collected evidence from interviews and focus groups with QC participants, facilitators, tutors, and managers and refined the programme theory. In stage four we consolidated the programme theory, integrating interview data with participants across Europe and examining existing theories.

We conducted this research between 2013 and 2020, when the first author (AR) was completing his DPhil (PhD) project at the University of Oxford. AR's thesis research engaged key Swiss and European expert stakeholders, including QC participants, facilitators, tutors, managers, and policy makers. The different players shared their perspectives when we developed the research questions, methods and analysis, and when we considered the implications of the results.

Pawson and Tilley's realist logic was used to analyse the collected data in order to provide an in-depth explanation of QCs that showed how mutual learning in a social context improves standard practice, enhances professional development and increases well-being. The realist approach examines causal explanations of outcomes and then expresses them in their simplest form: context

(C) 'triggers' or 'activates' a mechanism (M) that produces an outcome (O). The idea of mechanisms as being the generative power of how and why change occurs is central to realism. In the case of QCs, we looked for mechanisms at the level of human reasoning, because it is individuals who take an action or not, as a result of participating in QCs[13] . When these mechanisms are activated in their context, it can be an immediate or delayed response. The context-mechanism-outcome (CMO) configurations are 'mini' explanatory theories situated within a programme theory.[14] As we develop CMO configurations, we can more clearly see the contexts and mechanisms that produce desired outcomes. Once we identify these contexts, we can more easily select QC activities to change a given context to match our desired outcome.

Patient and public involvement

No patient involved.

Ethics Approval

The project was approved by the Central University Research Ethics Committee in Oxford (MSD-IDREC-C1-2015-002); it fulfilled the requirements of informed consent: handling of personal information and confidentiality conformed to the operational principles of the Declaration of Helsinki and adhered to the Belmont Report principles mandating respect for persons, beneficence, and justice.

Stage one: the co-inquiry

From May to December 2013, we consulted with 50 expert stakeholders, tutors, facilitators, QC participants and policy makers, from Switzerland and 23 countries within the European Society of Quality and Safety in Family Medicine (EQuiP). They shared their perspectives on our research questions and helped us construct a mental model of QCs function. For characteristics of participants, see supplemental material 1. Stakeholders provided access to detailed and local

information about QC aims, objectives and roles from professional websites, local publications and confidential training material and manuals across different European regions. We co-designed the preliminary conceptualisation of the programme theory, in short, preliminary programme theory, in discussion with the stakeholders, supported by local programme documentation and training material.

Stage two: realist review

We performed iterative searches: to become familiar with existing literature; to find possible candidate theories to be tested; to find empirical evidence to refine, refute or confirm CMOs of the emerging programme theory; and to look for further empirical evidence or theories to consolidate the programme theory.

Searching for theories

In principle, any theory that explained QCs was a candidate for our realist review, including those from psychology, social, or economic sciences. We first identified key components of QCs; these were theories that described group dynamics, the role of the facilitator and their interaction with organisations. We searched for theories about motivation, learning, behaviour change, psychological wellbeing and quality improvement in PHC. After this search we had identified 52 threads of theories across several levels. Since the theories overlapped considerably in a complex way, they did not allow empirical testing. Therefore, we deviated from the original protocol and used the preliminary programme theory (stage one) as a starting point for the emerging programme theory. However, we benefitted from these findings in stage 4.

Searching for evidence for QC outcomes

Our search strategy was informed by an earlier scoping review that reported on the intentions and benefits, historical development, and spread of QCs.[1]. In collaboration with a librarian, we refined

our search strategy, combining terminology like 'Programme', 'Quality Improvement,' and 'Group' terms with a PHC search filter.[15] We ran the search in Medline, EMBASE, PsycINFO, and CINHAL, without language restrictions (supplemental material 2) from 1974, to reflect the emergence of QCs in 1974, at McMaster, Canada, and in 1979 at the University of Nijmegen, the Netherlands. We conducted the search in October 2013 and updated it in December 2020. Some full-text papers retrieved seemed closely related so we used cluster searching, a sampling strategy, to search for and complete clusters of closely related (kinship) papers. [16] These kinship papers had common contextual features or theoretical backgrounds to the referring studies. We categorised these papers into kinship networks based on common themes, common contexts like geographical area, and common methods of organising QCs (e.g., papers that tested similar didactic methods or similar QI tools in QCs). We broadened the search by examining citations in reference lists and Web of Science and searched manually for closely related papers (kinship papers) [5 16]

Selecting articles

Criteria for inclusion were: 1) the studies focused on small group work, 2) took place in the PHC setting, and 3) had a quantitative or qualitative outcome. We managed search results in EndnoteX8. SM and JH each assessed half of the retrieved papers and AR examined them all. The authors resolved disagreements through discussion. AR updated the search and included papers published from November 2013 to December 2020. GW checked the process paper selection and interpretation of the new data.

We appraised the relevance and rigour of each paper's contribution. Data were relevant if they helped us understand a specific element or thread of theory in the emerging programme theory. Threads of theory were rigorous if they met three explanatory criteria: consilience (the theory accounts for most of the data), simplicity (the theory is straightforward, without exceptions) and analogy (the theory relates to already known principles).[14 17 18]

Analysis and synthesis of the data

We created a data extraction framework based on the preliminary programme theory and implemented it in Microsoft Excel. For each study, we extracted data on mechanisms, contexts, and outcomes (Table 1).[10] At least two authors (AR, SM, or JH) reviewed extracted data and all authors reviewed the analysis and interpretation.

Table 1 Data analysis process throughout the study

Step	Description of the analytical step
One	We collected data on the following key elements of QCs: ➢ Outcomes ➢ Participant characteristics: who was doing what and why? ➢ Activities: what was being done and why? ➢ Implementation context: where and how were QCs implemented? ➢ Patterns of outcomes over time or intermediate outcomes.
Two	Outcomes: each intermediate outcome, or final outcome received a new code.
Three	To identify the components of CMO configurations, we linked what was done in the QCs with intermediate outcomes, or final outcomes, and noted any corresponding contextual features and mechanisms that were mentioned.
Four	We sought explanations for when and why they had these outcomes (if the source mentioned context or underlying reasoning or mechanism) and then built CMO configurations.
Five	We categorised and ordered the CMO configurations to create a chain of outcomes and explained how CMO configurations related to each other.
Six	We compared and contrasted CMO patterns identified in different sources.
Seven	We consolidated the programme theory foundation of quality circles.

Initially, for each paper, we extracted components of context along with descriptions of mechanisms that led to an outcome. We summarised these configurations into descriptions of interaction between context and mechanisms that either facilitate or hinder QCs to reach their outcomes. Since papers were often closely related, we grouped them based on their kinship, which helped us look for and confirm CMO configurations between papers within the same (family) study. We iteratively

arranged and rearranged the CMO configurations, moving between the papers, their data, and families, and built patterns of outcomes (demi-regularities) to develop the programme theory (see supplemental material 3).

Stage three: refining the programme theory

AR conducted interviews and focus groups, and collected data from 40 participants to refine and test the configuration, interpretation, and underlying mechanisms of each CMO configuration and its relative position/contribution to the programme theory.[19]

We invited a broad range of participants (including QC facilitators, GPs participating in QCs, tutors and QC managers) to participate in interviews, including the expert stakeholders from stage one, so we could capture a range of professional backgrounds and roles.[20 21] We applied the concepts of data saturation and stopped collecting data when additional information added no further relevant evidence. None of the invited participants declined. Throughout the process, we reflected critically on assumptions that AR or participants might have made during the interviews or focus groups.[20]

AR conducted six 30–60-minute interviews in Swiss German between March and May 2015. After explaining the literature-based programme theory in plain words, AR offered contrasting options for participants to discuss. Then, he asked them to share their understanding of the underlying mechanisms and explain QC outcomes.

In April 2015, during an EQuiP conference, we held two focus group sessions with 33 GPs from over 19 European countries. Participants were given written descriptions of the emerging programme theory, phrased as conditional clauses that did not suggest mechanisms. During the focus group, participants were asked if and how much they agreed with the statements, and then the group discussed whether and why parts of the programme would or would not work in certain contexts. We summarise the characteristics of interview and focus group participants in supplemental material 4.

Stage four: consolidating the programme theory

Interviews with QC experts across health care systems

The literature, the interviews and focus groups contained little data about how the national contextual level or how national organisations or reimbursement of PHC affect QCs. Therefore, to consolidate the programme theory at a national and policy level, AR invited five representatives with expertise in QCs from five countries with different PHC provision systems to a one-hour online interview to discuss the ways that different professional associations, institutional settings, and other contexts affect QC outcomes.[21] Participant characteristics are summarised in supplemental material 5.

Existing theories and their relationships to CMO configurations in the programme theory

We then compared and contrasted this programme theory with formal theories to explain intermediate and final QC outcomes. Formal theories explain how mechanisms interrelate and how they may work across different disciplines. Programme theories that are based on formal, existing, theories may provide better explanations of phenomena than those that are not.[7] Our candidate formal theories came from four sources: the scoping review; [5] the realist review; theories described by interviewees; and theories identified during iterative searches when we were looking for and testing possible mechanisms. We chose theories with the highest level of explanatory coherence, based on the three criteria of consilience, simplicity, and analogy.[17 18]

Results

Stage one: the co-inquiry

This co-inquiry along with programme documentation resulted in the following preliminary programme theory: GPs want to meet with their peers, share their problems and exchange ideas. CME credits or requirements from health insurance companies seem to be additional drivers to

participate in QCs. Skilled facilitators are key to establish a safe environment where GPs share local data, and exchange experiences and knowledge. Reflection on personal experiences, successes and failures, helps in identifying learning needs. A goal-oriented facilitator helps members to choose the method they want to use to approach an issue and helps them build a learning environment where they adapt or create new knowledge which they then put into practice in a repetitive process. We described the CMO configurations we developed in this stage in supplemental material 6.

Stage two: realist review

Our search strategy returned 2,812 results (Figure 1), out of which AR, JH, and SM assessed 73 papers. An update in December 2020 yielded 35 more papers.

Figure 1. Paper flow realist review

The literature mainly covered QCs in which GPs participated. We found 24 relevant articles about German QCs, 12 about Dutch QCs, and two about Swiss QC; 10 papers were about CME groups in Canada and Scotland, 6 about a QC research project in Norway, 3 about QCs on osteoporosis in Canada, and 5 about the Drug Education Project in Sweden, Norway, the Netherlands and Slovakia; 6 papers covered QC projects in England, Austria, Belgium and France; 5 other relevant papers were from South Africa, the US (Hawaii and California), New Zealand, and Australia. We categorised these papers into groups to clarify their kinship network.

Study designs varied by research question. Our search returned 5 study protocols, 2 case series, 14 before-and-after studies, 13 controlled before-and-after studies, 9 randomised controlled trials, nine cluster randomised controlled trials, 12 surveys and 9 qualitative research papers that used data from interviews or focus groups. Few papers studied the performance of well-established QCs; data were often limited to interventions in newly formed groups. In pre-existing QCs (German, Dutch, or Norwegian trials), researchers introduced their own interventions on prescription or test-ordering patterns rather than studying interventions chosen and designed by the QC group. For full details of

study characteristics, see supplemental material 7. The resulting literature-informed programme theory gave details about necessary preconditions, group processes, learning environment, how and why participants adapt, create and test new knowledge and that repetition is necessary for sustainable changes. We present the literature-based programme theory and supporting quotations from the literature in supplemental material 8. The data we retrieved from the update search did not change our CMO configurations or programme theory.

Stage three: the refined programme theory

Data from interviews and focus group helped us refine the wording of six CMO configurations and added three new configurations that linked the chains of outcomes. Participants emphasized that the national bodies should entrust QC with QI, but national organisations or professional association should be sufficiently flexible to allow local QCs to implement their plans, giving them a feeling that they had a say and a job to do. At the level of the group, they pointed out that individual character traits and different professional experiences along with differing opinions provide a necessary tension to stimulate lively discussions as long as mutual respect exists. However, there are (a few) individuals who experience critical feedback as threat to self-image and, as a consequence, withdraw or disturb the group process. See supplemental material 9 for the resulting intermediate programme theory and supporting quotations and data from focus group sessions.

Stage four: consolidating the programme theory

Interviews with stakeholders across health care systems

In addition to supporting existing CMO configurations, these interview data suggested that QCs can only succeed if they are embedded in a wider system that helps participants to negotiate and sign contracts with governmental bodies or health insurance companies, organises training and supervises facilitators, offers courses on QI in PHC, and facilitates access to educational material and

timely data on practice performance (CMO configuration 1b 'being embedded in a QI system'). For supporting quotations during these interviews, see supplemental material 10. Figure 2 shows the final CMO configurations of the consolidated programme theory that was iteratively developed from stages one to four.

Figure 2. Consolidated programme theory on quality circles

Existing theories and their relationships to CMO configurations in the programme theory

Some theories about organisational context, groups, learning, knowledge exchange, development of innovations and their implementation were relevant. Some CMO configurations fit well with, or are directly supported by, existing theories, whilst others seem to clarify how existing theories work when they are applied to QCs. Table 2 summarises the theories and their corresponding CMO configurations.

Table 2. Existing theories and **their relationships to CMO configurations in the programme theory**

Theory	Explanation of relationships	CMO configurations in the programme theory (Figure 2)
Receptive capacity of an organisation [22-24]	Theories about the organisational setting elucidate the mechanisms by which organisations help or hinder quality circles in their work. Quality circles should be embedded in a system that provides training in QI and promotes it by providing explicit knowledge, valuing tacit knowledge, and ensuring that groups have competent facilitators. These features are part of an organisation's receptive capacity: how well it values, integrates, and uses new external knowledge.	CMO configuration 1 b-c
Self-determination theory[25]	Self-Determination Theory suggests that GPs are motivated to participate in quality circles if they feel that the quality circle will satisfy their basic needs for competence, social bonding, and autonomy.	CMO configurations 1 a, 1 c, 2 a-c, 3 b, 4 b and 4 e
Theories about groups [26-30]	Theories about groups and facilitation describe how groups form and norm their rules, a prerequisite for building an environment of trust in which participants can exchange ideas and thoughts. The knowledge and capacity of the group may be greater than the sum of the average of each individual's capacity. When participants share their knowledge and incorporate all perspectives, they can collectively solve problems more efficiently than they could alone.	CMO configurations 2 b-d, 3 a-c, 4 c and 4 g
Social learning theory [31 32]	Social learning theory frames learning as an active cognitive process of perception and thinking in a social context. Participants in quality circles learn by observing and imitating peers. They also learn from the responses they receive, or expect to receive, when they try something new or avoid unrewarding actions. Learning depends much on individual expectations and feelings of competence to carry tasks. Organisational factors that lend support to learners, e.g., by giving access to learning material, incentives or rewards, improve the process.	CMO configuration 3 f
Adult-learning theories[33]	Adult-learning theories suggest that adults are highly motivated: they learn things that are immediately useful to them, and prefer to do so in a self-directed, task-oriented, experience-based manner.	CMO configurations 1 c, 2 b and 3 b-d
Experience-based learning[34 35]	GPs prefer experiential learning, in which experience is the starting point. Reflecting on an experience enables GPs to restructure their knowledge. They turn insights gained from experience into knowledge and transfer them to other situations. They actively experiment with the new knowledge, and then report their experiences back to the group.	CMO configurations 3 b- e

Transformative learning theory [36 37]	Transformative learning begins with cognitive dissonance, a negative emotional state triggered by conflicting perceptions. Generally, people want to reduce discordant feelings. In the safe environment of a quality circle, cognitive dissonance prompts GPs to reflect on and accept new arguments or revise their old ones to resolve their internal conflict.	CMO configurations 3 e and 4 g
Social interdependence theory [38 39]	Social interdependence theory explains why groups may work together towards a common goal. When quality circle participants realise that they will only achieve their own goals if their peers achieve theirs, this creates a positive interdependence, which encourages participants to reassure and support each other in pursuit of those goals. Positive interdependence improves psychological well-being and raises self-esteem through cooperation and mutual appreciation.	CMO configurations 4 a and 4 c
Knowledge-creation theory [40-42]	Knowledge-creation theories describe the process by which implicit knowledge becomes explicit when participants relate and combine their experiences with other explicit knowledge like evidence-based information, generating new concepts that participants integrate into their everyday clinical practice.	CMO configurations 1 b, 3 c, 4 c, e, g
Theory of planned behaviour[43 44]	The theory of planned behaviour describes how intentions can change behaviour: if the new behaviour makes sense, others approve and it feels easy enough to change.	CMO configuration 4 f
Automaticity [45]	There are theories that support the argument that quality circles are much more successful when they repeatedly implement new knowledge, giving participants the opportunity to build confidence in innovation and their quality circle skills.	CMO configurations 5 a-b

Discussion

The consolidated programme theory

The most important contextual requirements for successful QCs are governmental trust in the ability of GPs to deliver QI and appropriate professional and administrative support for QC work. Professional support includes training in QI techniques, easy access to teaching materials, and trustworthy personalised performance data. Administrative support includes providing protected time, an appropriate venue, and financial resources for meetings. If QC groups are to be successful, participants must feel that they have a say in their CPD and QI work, but the additional workload from participating in QCs must be manageable.

Several factors in QCs influence practitioner performance. QC members and their group dynamics are at the core of the process. Facilitators help participants build social bonds and mutual trust so that the QC becomes a safe environment that fosters open discussions and where participants link insights to everyday practice, manage uncertainty, and develop their professional role. Members reflect on personal experiences, add information from relevant sources, including evidence-based information and personal performance data, and then develop new ideas and concepts to improve their practice. With skilful facilitation, participants work towards a common goal and test their new ideas in the group, knowing that success depends on the individual member contributions. The QC process raises self-esteem and fosters psychological well-being. QI is cyclical, so putting innovations into practice is a continuous and repetitive process that increases participants' confidence in their innovation and QI skills with each repetition.

How the programme theory contributes to our understanding of QCs and relates to existing QC literature

Our understanding that QCs should be embedded in a system of QI that values, integrates, and uses new external knowledge aligns with the existing literature.[23 46] Health systems should provide training in QI tools and give access to trustworthy data (explicit knowledge) that help participants identify their own learning needs (CMO configuration 1 b-c and 3 e in Figure 2). [22 47-50]

Our research confirmed that well-functioning groups are essential to the QC process. The group's capacity for problem-solving surpasses the ability of the individual when members share and pool their experiences and views [29 48]. Supportive facilitation in a non-threatening environment of mutual trust eases learning in the group and opens possibilities for sharing, creating and integrating new knowledge.[23 48 51-53] Trust implies that participants operate on the basis of equality and mutual respect, according to the principle of benevolence, when they take risks and participate actively in the group (CMO configurations 1 c, 2 b 3 a-c, 4 c and 4 g in Figure 2).[26 54]

Literature and interview data provided us with mechanisms that had not been reported in current QC literature. Cognitive dissonance, like conflicting attitudes, beliefs or behaviours that create unease, is a mechanism that compels GPs to reflect on, accept, and adopt new reasoning to resolve inner conflict. This is the starting point of transformative learning.[36].According to our interview data, GPs can risk doing this in a QC group where they feel safe and confident, a process described in educational literature (CMO configurations 3 e and 4 g in Figure 2).[55-59]

Our data show that reflecting on an experience enables GPs to restructure their knowledge for transfer to other situations. When they share knowledge and experience, they can validate their clinical reasoning and thus integrate tacit and explicit knowledge and develop professional values like integrity and empathy; this process is recognised in the literature on psychology of learning as

important to professional development.[60 61] Explicit knowledge can be easily expressed through language or in writing because it is factual, e.g., evidence-based information, or a measurement of practice performance; whereas implicit or tacit knowledge is embodied in the knowledge or skills that a GP accumulates through experience but may find difficult to communicate.[62] GPs need tangible experiences and opportunities for repeated attempts to absorb new knowledge (CMO configurations 3 b-e, 4 g, and 5 a in Figure 2).[37]

According to our data, the mechanism of positive interdependence explained how and why collective or social learning can flourish and create a sense of ownership in QCs. When QC participants realise that they will only achieve their own goals if their peers achieve theirs, they are encouraged to reassure and support each other. Peers create new ideas and the cooperation and mutual appreciation that results improves their psychological well-being, increases their self-esteem, and may reduce their risk of burnout (CMO configurations 4 a and 4 c, e in Figure 2).[1 39 63-65]

Participants relate and combine their experiences with other explicit knowledge and generate new concepts or improve quality of care — a process described in business literature as knowledge creation.[40-42 60 66-68] A key function of QCs is to merge familiar knowledge, local context, and personal experience with evidence-based knowledge and extend this from the micro view of single-patient care to a wider view of the whole system (CMO configurations 3 c, 4 e, 4 g and 5 g in Figure 2).

Participants may change their behaviour if it makes sense to do so, if others approve, and if change is not too demanding.[69] But to embed these behaviour changes in everyday practice, the QC processes must be repeated until they become habitual , especially during the phase when GPs are implementing new knowledge,[70 71] (CMO configurations 4 f, 5 a and 5 b in Figure 2).

Implications for policy and practice

Based on our findings, we summarised the recommendations for organising and performing QCs to increase the likelihood that GPs successfully improve the quality of their work (Figure 3). Each

recommendation is based on one or more CMO configurations. These recommendations should be considered as a form of decision support that QCs can draw on to determine if action is needed in their specific circumstances.

Figure 3. Recommendations and principles for organising successful quality circles

The QC process and its implications are summarised as an infographic in supplemental material 11.

Limitations

Our study has some limitations The resulting theory relies on the detail and depth of the reports we identified in our literature review and on the veracity and adequacy of the information stakeholders revealed during 2015-2020 in Europe. CMO configurations reflect and explain the complex process in QCs in the current context of European primary health care, and may need to be adapted in response to future changes.

Quality appraisal of relevance and rigour of data that contributed to the emerging programme theory may depend on research team judgements. Another team might have taken differing decisions.

We could not include all theories found during iterative searches but had to make choices of the ones that fitted best. Finally, we could not relate all aspects of the theories in Table 2 to the CMO configurations to explain how the programme theory's mechanisms interrelate.

Future research

Future researchers can build on this programme theory to design, implement and evaluate new QC interventions. We encourage researchers to test our programme theory to confirm, refute or refine it for specific settings and/or professional groups.

Conclusion

Our consolidated programme theory explains how participation in QCs can improve standard practice, enhance professional development and increase psychological well-being. Group dynamics are at the core of the process. Facilitators help participants exchange knowledge in a safe

environment where they generate new concepts to improve their practice. With repetition, QC participants gain confidence in their QI skills and put their innovations into practice. The most important contextual requirements for successful QCs are 1) governmental trust in GPs' abilities to deliver QI and appropriate support like professional facilitation, 2) training in QI techniques, 3) access to educational material and personal performance data; 4) granting protected time, appropriate venues, and financial resources for QC group members.

Author Contributions

AR performed the research as part of formal postgraduate studies (DPhil Programme in Evidence-Based Health Care, University of Oxford, Oxford, UK). SM and JH supervised the development of the research and actively participated in the review process (eligibility, selection, data extraction followed by discussions). GW, as AR's main supervisor, provided important input regarding the methodology and supervised the whole research process. All authors critically reviewed the text, assisted with editing read and approved the final manuscript. GW, SM and JH contributed independently to this project from their academic and methodological experience.

Competing interest

The authors report no conflicts of interest. AR works as a general practitioner at Medbase Health Care Centres, a network providing primary health care services in Switzerland. As a member of the committee for quality improvement in the Swiss Society of General Internal Medicine, he supervises and trains quality circle facilitators.

GW is Deputy Chair of the United Kingdom's National Institute of Health Research Health Technology Assessment Prioritisation Committee: Integrated Community Health and Social Care Panel (A) and a member of Methods Group (A).

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Data sharing statement

All data relevant to the synthesis are included in the article or uploaded as supplementary information.

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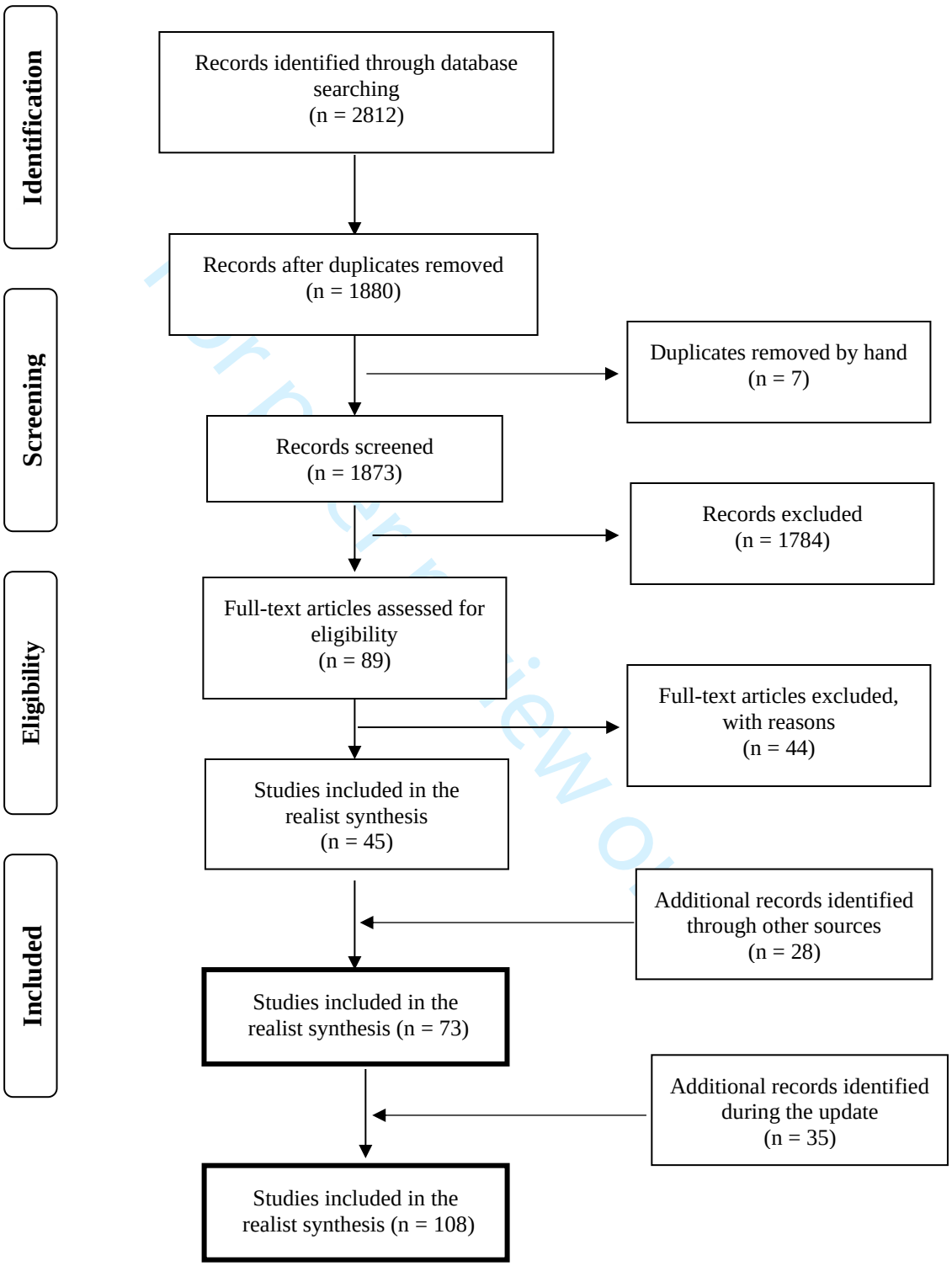

Identification
Screening
Eligibility
Included
Records identified through database searching (n = 2812)
Records after duplicates removed (n = 1880)
Duplicates removed by hand (n = 7)
Records screened (n = 1873)
Records excluded (n = 1784)
Full-text articles assessed for eligibility (n = 89)
Full-text articles excluded, with reasons (n = 44)
Studies included in the realist synthesis (n = 45)
Additional records identified through other sources (n = 28)
Studies included in the realist synthesis (n = 73)
Additional records identified during the update (n = 35)
Studies included in the realist synthesis (n = 108)

1 Preconditions

(a) 'Need for autonomy and obligation'
If the administration at national level, or at the level of health insurance companies, entrusts GPs with QI and autonomy (so they can decide how to implement it) (C), then GPs might participate in QCs (O) because they feel they can take on the responsibility and make a difference (M).

(b) 'Being embedded in a QI system'
If QCs are embedded in a QI system (an organisation that negotiates and signs contracts with governmental bodies or health insurance companies, trains and supervises facilitators, provides courses on QI in PHC and easy access to educational material, timely data on practice performance, and protects participants' time and space) (C), then participants will take on responsibility and work purposefully (O) because they feel supported, empowered, and able to meet expectations (M).

(c) 'Feeling they have a say'
If an organisation (e.g., a physician network organisation) has a decentralised policy that encourages use of local knowledge (C), then the QC takes on tasks (O) because members feel that they have a say in QI in their practice (M).

(d) 'Participants know what to expect'
If the introductory workshop teaches the principles of QI in PHC and illustrates how QCs work (C), then potential members may be more willing to join QCs (O) because they know what to expect and feel that they can meet expectations (M).

2 Establishing the group

(a) 'Sharing similar needs'
If the administration at the organisational level of QCs provides support for training facilitators, data gathering, provision of evidence-based information, and the administration protects participants' time and space and offers CME points and small financial incentives to them (C), then participants will meet in groups to exchange ideas (O) because GPs prefer learning in QCs (M). Support generates positive expectations among participants (M) and GPs believe that QC meetings with their peers will be useful (M).

(b) 'Need for relatedness'
If a regular group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g., introduces people to each other, opens discussions and clarifies and summarises statements (C), then group members will get to know each other and decide on rules that they are willing to follow, building a safe environment based on trust (O) because members want to be among and to interact with equals (M).

(c) 'Need for autonomy and control'
If the group chooses its own topics and facilitator (C), then its members will feel they own the QC (O) because their need for autonomy - a feeling of being in control of their own behaviour - is satisfied (M).

(d) 'Size of the group affects communication'
If the group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with each other and follow all conversations (M).

(e) 'Variety of characters stimulates reflection – cognitive dissonance'
If members of the group have individual character traits and describe different professional experiences but accept each other's views (C), then they can learn from each other (O) because individual attitudes and behaviours will contrast with the knowledge of their peers and cause cognitive dissonance (a negative emotional state triggered by conflicting perceptions) that makes them reflect on their way of working (M).

(f) 'strong cognitive dissonance threatens self-image'
If the cognitive dissonance individuals feel when they integrate new knowledge is too strong (C), then they may disrupt group dynamics and halt the QC process (O) because it poses a threat to their self-image and they fear losing their professional identity (M).

3 Learning environment

(a) 'Feeling safe and not vulnerable'
If participants trust each other (C), then they can describe how they work and admit what they do not know (O), because they feel safe rather than vulnerable (M).

(b) 'Need for competence and self-actualisation'
If the facilitator supports participants and encourages them to share their stories and experiences in a safe environment (e.g., by encouraging interactive responses) through discussions and by summarising statements,
(C) then participants will become involved and share their positive experiences and failures (O) because they want to improve their professional competence (M), gain professional confidence (M), and fulfil their professional potential (M).

(c) 'Previous knowledge is activated'
If participants exchange case stories and experiences whilst actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by relating their own relevant stories (O) because the process activates knowledge they already possess (M).

(d) 'Immediate relevance for the practice'
If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O) because they can connect it to their everyday work and put it to immediate use (M).

(e) 'Cognitive dissonance'
If participants discuss and reflect on their work processes (e.g., based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance that makes them reconsider their own way of working (M).

(f) 'Social learning'
If the facilitator uses purposeful didactic techniques (e.g., brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection on the work process (C), then the group will create a learning environment that promotes knowledge exchange (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

4 Adapting, creating, and testing new knowledge

(a) 'Positive interdependence between the administration at national level and GPs'
If the administration at the national level requires continuous QC activities (C), then QCs will negotiate priorities and design creative solutions (O) because the tension between autonomy and obligation spurs the group to act and negotiate to reach a common goal M)..

(b) 'Threat to professional autonomy'
If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and fear they lack autonomy in their clinical role (M).

(c) 'Positive interdependence among group members'
If participants maintain a learning environment based on trust that promotes the exchange of knowledge, assisted by facilitators who use professional techniques (e.g., contentious discussion, reaching consensus and role play) (C), then participants will adapt and generate new knowledge for local use (O) because they have a sense of collective responsibility (M).

(d) 'Identifying and removing barriers to change'
If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O) because participants help each other develop strategies to identify and overcome these barriers (M).

(e) 'Need for competence, autonomy and relatedness'
If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility, and stewardship (O) because their need for competence (being able to achieve specific objectives) is fulfilled (M), autonomy (a feeling of being in control of their own behaviour) (M), and relatedness (a sense of connection to a larger group) (M).

(f) 'Peer pressure'
If participants announce their intention to change (C), then they are more likely to implement the change (O) because they have openly committed to each other to make changes (M).

(g) 'Testing new knowledge'
If participants validate and test new knowledge in a QC, moderated by a skilled facilitator in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M).

5 Repeating the process

(a) 'Gaining confidence in an innovation'
If the group repeatedly practises implementing and adjusting to an innovation (C), then its members trust their own competence and turn the innovation into a habit (O) because successful outcomes increase their confidence in their abilities (M).

(b) 'Repetition priming and automaticity' - 'practice makes perfect'
If participants build a regular group and practise using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because responses improve with repetition (M).

	Recommendation	CMO configurations in the programme theory
For the administration at a national level	Invite participants to take responsibility for their QI but let them decide what they do and how they perform QI.	CMO configuration 1 a-c, 4 b
For professional organisations or university departments	Provide information about the basic principles of QI, like the Plan-Do-Study-Act cycle (PDSA) and explain how to implement those principles in QC practice.	CMO configuration 1 b and 1 d
	Give rewards (such as CME credits) to acknowledge that QI work is further education.	CMO configuration 1 b and 2 a
	Provide facilitator training and additional coaching or supervision.	CMO configuration 1 b
	Provide access to knowledge resources like evidence-based information, clinical practice guidelines, and help with gathering practice performance data including their interpretation. Actively involve health-care professionals in collecting the local data needed to address their local priorities; this will increase their motivation and trust in the findings.	CMO configurations 1 b and 2 a
For administrative organisations	Give access to appropriate venues and help them organise meeting times.	CMO configurations 2 b and 2 a
	Integrate and use the new knowledge developed by QCs, so that GPs can see that their efforts have changed practice. Administrations must also accept local adjustments to national solutions or guidance, because QI is a local process and QCs will adapt or devise new interventions and ways of working.	CMO configuration 1 c and 4 a
	Provide protected time, so groups can work during regular working hours or at mutually agreed times. The process should not be disturbed by phone calls or urgent patient problems since these disrupt discussions.	CMO configuration 2 a, 4 a
	Accept that QCs work at different speeds, because excessive demands for rapid results often undermine QI efforts.	CMO configuration 1 c, d, 4 b
	Group size affects the level of cooperation between members. Between six and twelve members is the optimal size for communication.	CMO configuration 2 d
For facilitators	The social aspect of the group lays the ground for frank discussions. For example, eating together before starting work eases social interaction, making participants feel more comfortable. A friendly, relaxed, and non-hierarchical atmosphere encourages participants to share sensitive information and motivates their continued attendance. Agreement on group norms and removing barriers like computer screens, or arranging tables and chairs in a circle facilitates social interaction.	CMO configurations 1 c, 2 b-c and 3 a
	Create an atmosphere of openness based on trust, so that participants can interact authentically. Facilitators should open discussions, summarise, clarify statements, and raise questions.	CMO configuration 2 b
	Encourage participants to talk about their own clinical cases, because these are the basis of a learning community where participants can reflect on their current practice and compare it with educational or evidence-based material.	CMO configurations 3 a-c
	Aim at a balance between comfort and challenge that allows an appropriate degree of conflict within the group to stimulate learning.	CMO configuration 3 f
	Close meetings on time and plan future meetings by summarising progress and highlighting the goals that have been achieved.	CMO configurations 2 b, 4 c-d
	Support participants in expressing themselves since it can be hard to make implicit knowledge explicit. Participants require 'active empathy' when they struggle to express their thoughts. Active empathy is the ability of QC members to actively listen to and care for each other, even when they question each other's statements.	CMO configuration 3 b
	Promptly identify and resolve conflicts because breaking established habits may feel high-risk and even threaten selfimage. Individuals who feel this way may choose to withdraw or, worse, disrupt the group process.	CMO configuration 2 f
For participants in the group	Gaining agreement on the topic to be discussed is central in QC work. The group must have a shared understanding of the problem when it embarks on the QI process and the topic must be relevant to everyday practice and manageable. The group should agree on the need for change, or at least agree that a problem exists.	CMO configurations 2 c and 3 d
	Come to an agreement on how to address the topic and balance local expertise with wider knowledge. Once a topic is chosen, members should start with personal experiences. Discussing personal cases increases a sense of ownership and helps connect new knowledge to everyday practice.	CMO configurations 3 b d
	Develop new concepts and ideas by reflecting on members' experiences, discuss individual cases, add information from guideline and educational evidence-based material, prescription data, or invite input from a respected local opinion leader. Members should be ready to adjust their ideas about how to change and improve care, or work differently, to fit local circumstances	CMO configurations 3 ef, 4 a and 4 c
	Implementing innovation is a continuous, repetitive process. Discuss the advantages and disadvantages of new ideas or changes to practice and address barriers to change.	CMO configuration 4 d
	Debate proposals for change and agree on action plans. After testing and trying out these plans, the group may then choose to move forward with one or more of them, depending upon how sure it is that the plans will be successful.	CMO configuration 4 f
	Each time the group tests the innovation, the goal should be improving it. Members should devise plans to implement the next version based on their own practice until they feel satisfied.	CMO configurations 4 g and 5 a
	Be patient. QC groups have a learning curve and the group grows more skilled and improves performance after each QI cycle.	CMO configuration 5 b

Supplemental material 1

Experts and stakeholders participating in interviews and focus groups

Experts / groups	Type of qualitative data	Date and location	Length of time
CEO of a network of primary health care centres owned by a health insurance company	Interview	01/05/2013 Zürich	1½ h
Tutor in a doctor-owned network of primary health care centres	Interview	02/05/2013 Bern	1½ h
Two social scientists, representatives of the professional body, Swiss Medical Association	Interview	02/05/2013 Bern	1½ h
8 Participants, GPs, and a QC facilitator a doctor-owned network of primary health care centres	Focus group	14/05/2013 Zürich	1¼ h
Member of the management board of a network of primary health care centres owned by health insurance companies	Interview	15/05/2013 Bern	1¼ h
12 Representatives of the quality committee of the Swiss Society of General Internal Medicine, GPs	Focus group	13/06/2013 Bern	1h
24 delegates of the European Society of Quality and Safety in Family Medicine, all GPs	Focus group	16/11/2013 Bologna	1h

Supplemental material 2
Purposive search strategy in OVID Medline / EMBASE / PsycInfo

PRIMARY HEALTH CARE TERMS

1. general practice/ or family practice/
2. Primary Health Care/
3. general practitioners/ or physicians, family/ or physicians, primary care/
4. community health services/ or community health nursing/ or community mental health services/
5. (family adj3 (practice or practitioner* or physician*)).ti,ab.
6. (general adj3 (practice or practitioner* or physician*)).ti,ab.
7. (primary adj3 (care or healthcare)).ti,ab.
8. practice nurs*.ti,ab.
9. (community adj2 nurs*).ti,ab.
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
11. Management Quality Circles/
12. quality circle*.ti,ab.
13. (group* adj3 (learning or work* or teaching or education*)).ti,ab.
14. (group* adj2 (intervention* or strateg* or program* or review*)).ti,ab.
15. (quality improvement* adj3 (intervention* or strateg* or program* or initiative* or tool*)).ti,ab.
16. (audit adj3 feedback).ti,ab.
17. peer review*.ti,ab.
18. reflective practice.ti,ab.
19. (learning adj3 (intervention* or strateg* or program* or initiative*)).ti,ab.
20. (education* adj3 (intervention* or strateg* or program* or initiative*)).ti,ab.
21. (continuing adj2 (education or development)).ti,ab.
22. Peer Review, Health Care/
23. medical audit/ or nursing audit/
24. exp Education, Continuing/
25. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24

TERMS for QUALITY IMPROVEMENT

26. Quality Assurance, Health Care/
27. Total Quality Management/
28. Quality Improvement/
29. "Quality of Health Care"/
30. evidence-based practice/ or evidence-based medicine/ or evidence-based nursing/
31. Physician's Practice Patterns/
32. exp Professional Competence/
33. Guideline Adherence/

34. (quality adj3 (improv* or assurance or change)).ti,ab.

35. (practice adj3 (improv* or change)).ti,ab.

36. ((care or healthcare) adj3 (improv* or change)).ti,ab.

37. ((professional or physician* or medical or clinical or nurs*) adj competenc*).ti,ab.

38. ((guideline* or guidance or standard* or protocol*) adj2 (adhere* or complian* or concord* or implement*)).ti,ab.

39. (evidence based adj2 (practice or prescrib*)).ti,ab.

40. 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39

41. Peer Groups/

42. Group Process/

43. Group Practice/

44. practice based.ti,ab.

45. 41 or 42 or 43 or 44

ADDITIONAL GROUP TERM

46. facilitator.ti,ab.

GROUP TERMS IN PRIMARY CARE

47. 10 and 46

PRIMARY CARE **AND** PROGRAM TERMS **AND** QUALITY IMPROVEMENT TERMS **AND** GROUP TERMS

48. 10 and 25 and 40 and 45

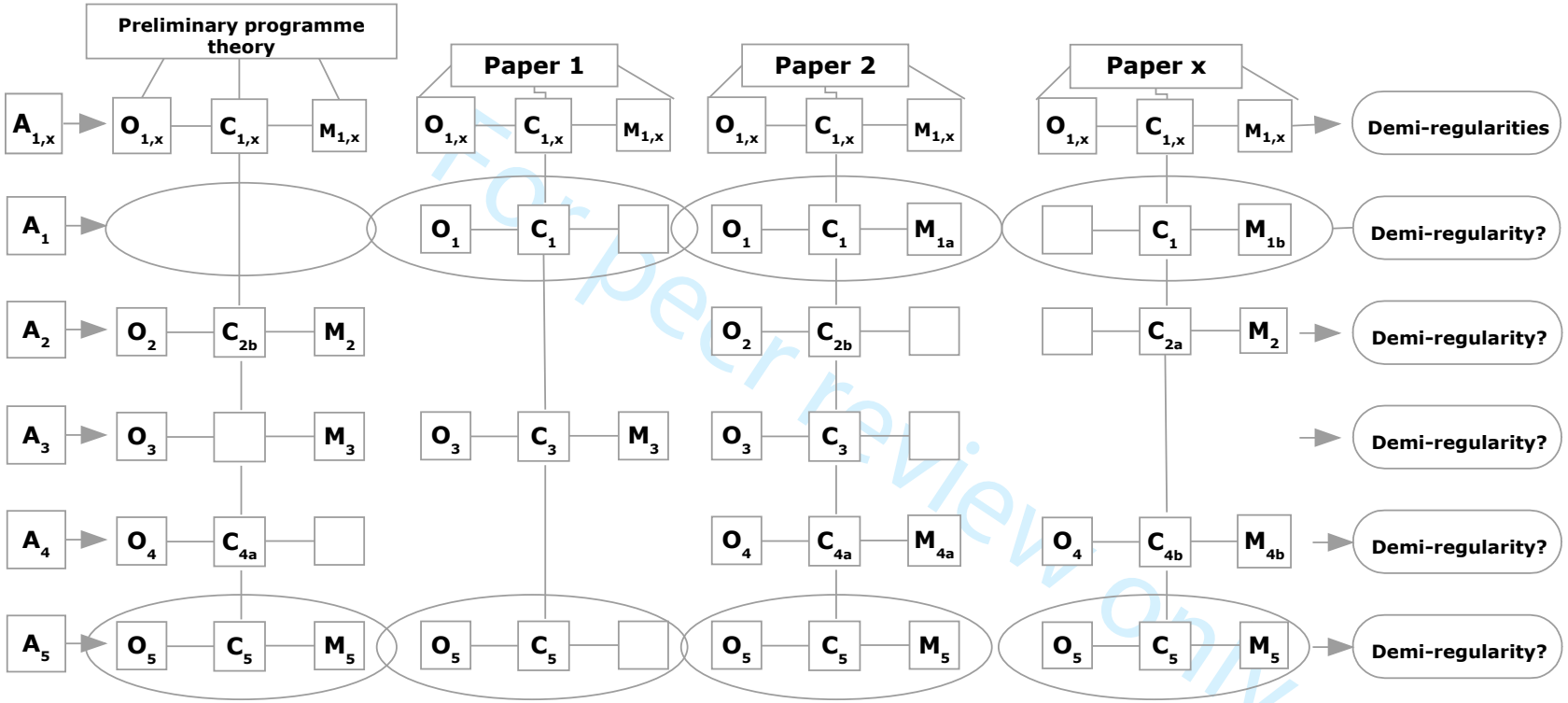
ADDING THE "QUALITY CIRCLES" **AND** "GROUP FACILITATION" IN TITEL **AND** ABSTRACT

49. 12 or 47 or 48

50. limit 49 to yr="1974 -Current"

Supplemental material 3

CMO configurations across studies and demi-regularities



Legend

A: Activity. Activities 1 to 5.

O: Outcome. Outcomes 1 to 5.

C: Context. Contexts 1 to 5, although some may be missing.

M: Mechanism. Mechanisms at different levels of activity; the same outcome may have several mechanisms; if no mechanism was mentioned, the square is blank.

Comparing groups of CMOs across studies may create a demi-regularity.

The marked demi-regularities are examples of how I built CMO configurations across the papers.

Supplementary material 4 Participants in interviews and focus groups, refining the literature-based programme theory

Participants: number of people	Type of qualitative data	Date and location	Length of time
CEO of a network of primary health care centres owned by a health insurance company	Interview	18/03/2015 Wil	23’26’’
Tutor in a doctor-owned network of primary health care centres	Interview	19/03/2015 Bern	64’21’’
Member of the management board of a network of primary health care centres owned by health insurance companies	Interview	25/03/2015 Bern	42’40’’
Two social scientists, representatives of the professional body Swiss Association of Medicine	Interview	02/04/2015 Bern	72’47’’
Researcher in a doctor-owned network of primary health care centres	Interview	02/04/2015 Zurich	61’26’’
Group of 21 GPs at the open meeting in Fischingen on QCs organized by EQuiP	Focus group	24/04/2015 Fischingen	90’
Group of 12 GPs at the open meeting in Fischingen on QCs organized by EQuiP	Focus group	25/04/2015 Fischingen	90’
Executive for General Practice at a central hospital	Interview	08/05/2015 Aarau	37’17’’

Supplemental material 5 Participants in interviews designed to consolidate the programme theory

Participant's characteristics	Country	Date of interview	Length of interview	Characteristics of the health care system
GP in a rural practice, teacher at the University of Ghent	Belgium	07/02/2018	49'	Belgium's health-care system is funded principally through social insurance contributions on a fee-for-service basis, and these fees support doctors. The mandatory insurance can be replaced by a voluntary health insurance. Self-employed doctors provide the majority of outpatient services. GPs in Belgium are paid a small capitation fee but are not gatekeepers who refer patients to specialists.
GP in a rural practice, small group educator for 18 years	Ireland	09/02/2018	64'	The Health Service Executive (HSE) funds the CME small-group network but the Irish College of General Practice (ICGP) has a governance role. The ICGP receives funds from the HSE to cover the majority of costs for tutors and group leaders, and some of the funds for group leaders come directly from the ICGP. At present, most of the funding is from the HSE. Ireland has a centrally organised PHC system which has a public and a private branch. GPs in Ireland are gatekeepers, with exceptions similar to France.
Certified facilitator in GP vocational training, active in quality improvement and patient safety	Norway	08/02/2018	71'	Norway's health-care system is mainly public; insurance is covered by a percentage of income and tax subsidies. Almost everyone is registered with a primary care physician. The GP is the first point of contact for the patients and is a gatekeeper. Only 10% of GPs are directly employed by municipalities; 90% are self-employed and are licensed by their municipality, which guarantees them a basic salary. In addition, there are capitation fees for each GP.
GP working in an urban area, facilitating a QC, researcher	France	16/02/2018	79'	Health insurance is compulsory in France. Depending on the occupational sector, workers pay a small proportion of their salary for their health insurance, with the employer paying the remainder of the cost; the amount depends on the worker's income. Immigrants and the unemployed have separate health insurance. As in Belgium, GPs in France are principally remunerated by a fee-for-service system. GPs are gatekeepers, except to paediatricians, gynaecologists and ophthalmologists.

Supplemental material 5 Participants in interviews designed to consolidate the programme theory

GP in a rural practice, teacher for GP vocational training	Croatia	07/12/2018	53’	All Croatian citizens are covered by the state health insurance fund. The health-care system is public and paid for by social security contributions. Despite financial constraints, the health-care system has expanded and covers the whole country, providing primary health care and specialised hospital-based care. GPs act as gatekeepers with certain exceptions, as in France. They are remunerated through a combination of salary, capitation fees and fee-for-service systems.

Supplemental material 6
Preliminary programme theory based on the scoping search und consultations with stakeholders

CMO configuration I: **'sharing similar needs'** If health insurance companies require QI, and physician network organisations provide protected time and space, CME points and small financial incentives for participants (C), then GPs meet in groups to exchange ideas (O), because the organisational support generates positive expectations among participants and they believe these meetings with their peers will be useful (M).
CMO configuration II: **'size of the group affects communication'** If group size exceeds 15 (C), then communication becomes difficult (O), because participants cannot keep track of so many people (M).
CMO configuration III: **'need for relatedness'** If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who e.g. introduces people to each other, opens discussions and clarifies and summarises statements (C), then group members will get to know each other and decide on rules that they are willing to follow, building a safe environment based on trust (O) because members want to be among and to interact with equals (M).
CMO configuration IV: **'need for autonomy'** If the group chooses its own topics and facilitator (C), then it has a sense of ownership (O), because this satisfies the need for autonomy and control (M).
CMO configuration V: '**need for competence and self-actualisation'** If participants can tell their stories and experiences with the facilitator's support (e.g. encouragement of interactive responses and discussions, and summary of statements) in a safe environment (C), then they are involved in exchanging experiences and failures (O), because they want to be competent, gain professional confidence and fulfil their professional potential (M).
CMO configuration VI: **'previous knowledge is activated'** If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator (C), then they will be motivated to share their knowledge through telling such relevant stories (O), because the process activates the knowledge they already possess (M).
CMO configuration VII: **'cognitive dissonance'** If participants discuss and reflect on their work processes during a professionally facilitated exchange of positive experiences or failures (C), then they become aware of knowledge gaps and identify learning needs and relevant topics (O), because conflicting attitudes and behaviours, together with differences between their own and other participants' knowledge, cause a cognitive dissonance (a negative emotional state triggered by conflicting perceptions) (M).
CMO configuration VIII: **'social learning'** If the participants know what they need to learn or know what topic they want to discuss, and if they reflect on their own and other participants' trustworthy data (their own cases, diagnostic habits or prescription patterns, or evidence-based material such as guidelines) and if the facilitator uses purposeful didactic techniques (such as brain-storming, discussions and role play) to keep the group active and to reward exploratory behaviour (C), then the group will create a learning environment that promotes knowledge exchange (O), because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).
CMO configuration IX: **'interdependence between health insurance companies and physician network organisations/QCs; tension between autonomy and obligation'**

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Preliminary programme theory based on the scoping search und consultations with stakeholders

If physician network organisations require continuous QC activities (C), then QCs will negotiate priorities and design creative solutions (O), because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M).
CMO configuration X: **'interdependence among group members'** If participants maintain a learning environment based on trust that promotes knowledge exchange, assisted by facilitators who use professional techniques (e.g. contentious discussion, reaching consensus and role play) (C), then participants will adapt and generate new knowledge for local use (O), because they see themselves as similar, and thus act and negotiate cooperatively to achieve a common goal (M).
CMO configuration XI: **'gaining confidence in QC techniques'** If the group repeatedly practises implementing and adjusting to an innovation (C), then they trust their own competence and turn the innovation into a habit (O), because successful outcomes increase their confidence in their abilities (M).
CMO configuration XII: **'repetition priming and automaticity'** If participants establish a regular group and practise using QI tools (C), then they will successfully implement new knowledge in everyday practice (O), because responses improve with repetition: 'practice makes perfect' (M).

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Norwegian papers on peer groups										
Gjelstad 2006[1]	Norway	Study protocol	PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	Reduce prescription of antibiotics for upper respiratory tract infections and prescription of inappropriate drugs for elderly. Pre-existing CME groups.	Trained tutor serving 3 CME groups, reflection on own prescription strategies, disclosure of areas for individual improvement.	Discussions, reflective thinking on individual prescription data, one-day introductory workshop, audit and feedback, group educational outreach visits, academic detailing.	After one year, improvement of prescription patterns was expected.	Norwegian QC studies on improving drug prescriptions, accompanied by a qualitative study. Brekke provided the baseline study for the trial.
Gjelstad 2013[2]	Norway	Cluster randomised controlled trial	PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	As in Gjelstad 2006 Each group acted as blind control for the other groups (Rognstad 2013).	As in Gjelstad 2006	Authors consider the key element in the study to be 'what happens to a general practitioner's prescribing behaviour when they reflect on their prescriptions'.	After one year, reduction of prescription rate of antibiotics and increase of prescription rate of penicillin compared to control groups.	
Straand 2006[3]	Norway	Study protocol	Norwe gian PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	Reduce prescription of inappropriate drugs for elderly people and prescription of antibiotics in upper respiratory tract infections. Pre-existing CME groups.	Trained tutor serving 3 CME groups, reflection on own prescription strategies, disclosure of areas for individual improvements.	As in Gjelstad 2006	After one year: reduction of inappropriate prescription patterns to elderly out-patients ≥ 70 years.	

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Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Brekke 2008[4]	Norway	Cross-sectional study	PHC	454 GPs in 80 CME groups, 85,836 patients	6 months	Baseline data of ongoing CME groups for one year	Ongoing CME groups without intervention	Ongoing CME groups	After 1 year:18.4% of the patients received at least one inappropriate prescription.	Norwegian QC studies on improving drug prescriptions, accompanied by a qualitative study. Brekke provided the baseline study for the trial.
Rogn-stad 2013[5]	Norway	Cluster randomised controlled trial	PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	As in Straand 2006 Each group acted as blind control for the other groups (Gjelstad 2013).	Training in drug treatment of elderly people, the rationale for the 13 listed inappropriate drugs, how to facilitate learning within a group setting.	Audit and feedback, tailored feedback, tailored academic detailing, discussions of own prescribing pattern.	After one year, reduction of inappropriate prescriptions for elderly people. Potentially more harmful combinations were more likely to be reduced.	
Frich 2010[6]	Norway	Qualitative study to explore experiences with academic detailing	PHC	39 GPs and 20 tutors who were also GPs, 9 focus groups	6 months: meetings once a month; the study covered 3 meetings.	Qualitative analysis of the RCTs, focusing on three meetings with the CME groups.	Groups have their own cultures; tutors perceived themselves as members of the group.	Consensus discussions, audit and feedback, academic detailing, discussions of their own cases.	Reflective thinking increased; inappropriate results upset some GPs.	
Dutch papers on peer groups										
Geboers 1999[7]	The Nether-lands	Case series	PHC	All staff of 20 general practices (each working as a group) tested the model over a period of 18 months.	18 months. Monthly quality meetings.	Evaluate the feasibility of a model for continuous quality improvement (CQI) in small practices.	Trained facilitators: practice assistants with managerial experience. Involving all staff at regular meetings.	Course on CQI: choose topic, observe practice, compare performance with targets, implement change, plan care and repeat cycle.	After 18 months, this model seemed feasible to the authors.	Dutch QC studies of a continuous quality improvement model.

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Geboers 2001[8]	The Nether-lands	Mixed methods: before-and-after study and qualitative inquiry	PHC	20 practices (each working as a group): 53 physicians and 57 medical practice assistants	18 months. Monthly quality meetings.	Measure the attitude towards CQI model in small practices before and after study.	As in Geboer, 1999	Feedback on practice assessment, introductory meeting, support for adoption of the model.	After 18 months, participants experienced perceived success and were willing to continue.	Dutch QC studies of a continuous quality improvement model.
Engels 2003[9]	The Nether-lands	Controlled before-and-after study	Mid-wives, mainly PHC	255 midwives in 28 groups	Study period 1998 to 2000	Measure CQI effect on clinical practice of midwives in PHC in a before-and-after study.	Three-day training of facilitators. Peer groups of midwives in the same geographical area. Regular group meetings.	Allocated topics with no choice, using the CQI model.	Positive effect on change of clinical practice was noted. Technical skills could not be improved.	
Engels 2006[10]	The Nether-lands	Ran-domised controlled trial	PHC	26 sites in the intervention and 23 sites as controls. Size and composition of groups unknown.	December 2001 - February 2004; inclusion October 2001 - April 2003	Examine the effects of a team-based model for CQI on primary-care practice management in small-scale practices.	Medical practice assistants as facilitators after 3 days' training.	Visitation Instrument for Practice (VIP) provided topics, CQI model with detailed oral and written feedback, monthly team meetings.	Evaluation after one year showed an increased number of CQI projects compared to control group, but the study was statistically underpowered.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Verstap-pen 2003[11]	The Nether-lands	Multicentre, randomised controlled trial	PHC	26 QCs consisting of 174 GPs.	6 months baseline followed by 6 months' interventio n.	Determine the effects of a multifaceted strategy aimed at improving test ordering patterns in existing QCs.	Discussion and comparison of feedback reports among colleagues, communication course.	3 consecutive, personal-feedback reports, comparison of results with guidelines, plans for change, discussion of Bayesian rules.	Modest improvement in test ordering when comparing the two intervention groups	Dutch QCs on improving test ordering
Verstap-pen 2004[12]	The Nether-lands	Cluster randomised controlled trial	PHC	27 QCs consisting of 194 GPs.	6 months of baseline followed by 6 months' inter-vention.	A multifaceted strategy aimed at improving test-ordering patterns in pre-existing QCs; 13 QCs followed a new strategy while 14 only received feedback.	Discussion and comparison of feedback reports among colleagues, communication training. 3 meetings.	As in Verstappen 2003	Compared to feedback, the tailored intervention decreased test ordering significantly.	
Verstap-pen 2004[13]	The Nether-lands	Cluster randomised trial	PHC	27 QCs consisting of 194 GPs. 13 QCs used a new strategy while 14 only received feedback	6 months of baseline followed by 6 months' inter-vention.	Determine the effects of a multifaceted strategy in pre-existing QCs aimed at improving test ordering patterns. 3 meetings took place.	Discussion and comparison of feedback reports among colleagues, communication course.	As in Verstappen 2003	Mean costs were reduced by cutting unnecessary tests.	Dutch QCs on improving test ordering
Verstap-pen 2004[14]	The Nether-lands	Cluster randomised trial; surveys	PHC	27 QCs consisting of 194 GPs. Mean group size was 7.4	6 months of baseline followed by 6 months'	A process evaluation of a multifaceted strategy in pre-existing QCs aimed at	Discussion and comparison of feedback reports among colleagues using feedback in pairs,	As in Verstappen 2003	Individual plans for change and group plan changes were made with a high level of	

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					inter-vention.	improving test ordering patterns.	communication course.		satisfaction.	
Smeele 1999[15]	The Nether-lands	Ran-domised controlled trial	PHC	2 QCs, 17 GPs in each group	Pre-measure-ment and post-measure-ment after one year.	Evaluate the effects of a QC programme on guideline adherence. 4 sessions for GPs and 1 session for medical practice assistants.	The group education was conducted in two small groups with 9 and 8 GPs respectively. Facilitator was a GP. Not all GPs participated in all sessions.	Lectures, role-play, skills training, peer review of performance, group consensus discussions and problem-solving of hypothetical situations involving patients.	No significant changes were found for care provided and patient outcomes compared with the control group.	Dutch QC studies on guideline adherence.
Kasje 2006[16]	The Nether-lands	Cluster randomised trial using a balanced incomplete block design.	PHC	10 peer review groups (97 GPs): chronic heart failure. 6 peer review groups (46 GPs): hypertension and diabetes mellitus type 2.	One educa-tional meeting followed by data collection after 6 months	Evaluate the effects of a QC programme on guideline adherence in pre-existing groups. One group received a programme on chronic heart failure, the other on diabetes mellitus type 2.	Facilitators adhered to a specific process.	One meeting: consensus about guideline statements, evaluation of current management of five of their own patients, listing barriers and possible solutions, formulation of personal intentions	No effect was shown. High dropout rate especially in the group dealing with diabetic patients. The programme was not implemented as intended.	

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Van Eijk 2001[17]	The Nether-lands	Ran-domised controlled trial with three parts: individual visits, group visits, and a control group.	GPs and phar-ma-cists in PHC	Individual approach: 70 GPs and 14 pharmacists; Group approach: 52 GPs and 9 pharmacists in five QCs; Control: 68 GPs and their pharmacists.	12 months	Comparison of individual educational visits versus group visits to improve inappropriate prescriptions for elderly people. Pre-existing groups of GPs. 3 visits at 4-month intervals.	There was no description about the process that took place in the groups or at the individual level.	First visit: guidelines about appropriate prescription of drugs for elderly. Second visit: personal prescription habits were highlighted. Third visit: short follow up	The individual and the group approach led to a reduction in the rate of starting inappropriate drugs and to an increase of prescription of appropriate drugs.	Dutch QC studies on improving drug prescriptions involving pharmacists.
Wel-schen 2004[18]	The Nether-lands	Ran-domised controlled trial.	GPs and phar-ma-cists in Dutch PHC	12 peer review groups including 100 GPs with their collaborating pharmacists.	Approx. 6 months. Evalu-ation after 9 months.	Reduce prescription of antibiotics to patients with upper respiratory tract infections in pre-existing groups.	Group education with consensus procedure. One meeting followed by individual feedback after 2 weeks and 6 months.	Group education meeting about guidelines, communication skills training, patient leaflets. After 2 weeks and 6 months, individualised feedback.	Prescription rate for antibiotics was reduced after 9 months. After 15 months, the effect was lasting. Satisfaction among patients remained high.	Dutch QC studies on improving drug prescriptions involving pharmacists.
Problem Based Small Group Learning (PBSGL) in Canada, Scotland and England										
Davis 1999[19]	Canada	Case series	PHC	54 GPs in 4 newly formed groups.	A 2.5-hour workshop	Develop and evaluate a CME programme on osteoporosis for PHC. 54 family physicians participated in 1 of 4 pilot PBSG learning sessions.	GP trained as a facilitator. The facilitator elicited interactive responses using specific predetermined prompting questions.	Practice-based case scenarios to increase awareness of risk factors for osteoporosis.	Participants' satisfaction was high. Participants increased their knowledge scores (not significant because of size of the study).	Papers about Practice Based Small Group Learning in Canada, Scotland and England

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Mc Sherry 2000[20]	Canada	Before-and-after study	PHC	544 GPs in 75 workshops with a mean of 7 GPs in each newly formed group.	A 2-hour workshop with question-naires before and after.	Pilot study to introduce PBSGL groups in PHC. Topic: a patient-centred approach to managing benign prostate problems and evaluate 'intent to change'.	Initial needs assessment, problem-based educational materials, opportunities for participants to develop implementation strategies through discussion with peers.	Educational video case studies illustrating various presentations of prostatism, a handbook with detailed information on the case studies. A toll-free telephone line was provided for scientific and technical support.	Practice behaviours were improved, especially those linked to a patient-centred approach not commonly practised before the workshops.	Papers about Practice Based Small Group Learning in Canada, Scotland and England
Peloso 2000[21]	Canada	Qualitative inquiry over three years	PHC	12–15 GPs, a facilitator and sometimes an expert.	3 years	Discuss a 3-year experience with the small-group format, comprising more than 25 sessions as either learners or facilitators. Facilitators have 20 hours of training. Monthly meetings, each session takes 1.5 to 2 hours.	Sessions took place in the evenings with a meal in a relaxed atmosphere. The group chose their topics. Presentation of own clinical cases. Experts did not lecture but answered questions.	Learner-directed agenda of topics, information from trusted peers, opportunity for feedback. Information from several sources – printed materials, peer discussion, patient questions – the perception of need for change is enhanced.	GPs can discuss topics relevant to day-to-day practice and obtain access to local experts. They compare their practice with that of others. The group and the inter-active format are fun. Experts are comfortable with the format.	

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Herbert 2004[22]	Canada	Ran-domised controlled trial	PHC	200 GPs in 28 pre-existing groups.	6 months, com-parison of data 6 months before and after the inter-vention.	Assess the impacts of individualised prescribing feedback. 4 groups: control, prescribing portrait only, educational module only, both portrait and educational module.	3 representative patient cases were discussed, evidence-based information to guide management. Facilitation 'as usual' in the CME group.	Histograms comparing an individual's prescribing rates with those of the group and of all GPs in the study. A succinct evidence-based message to guide future prescribing.	The group that received both the module and the portrait had the greatest increase in preferred prescriptions.	Papers about Practice Based Small Group Learning in Canada, Scotland and England
Mc Vicar 2006[23]	Scotland	Before-and-after study (pilot)	PHC	5 small groups, 7–9 GPs in each group	12 months	Assess effectiveness of the PBSG approach in developing participants' knowledge, skills and attitudes in interpreting, discussing and applying current medical evidence.	Facilitators establish and maintain a learning environment. They create a culture of openness, honesty and willingness to acknowledge unawareness as a precursor to learning.	Educational material, a tool that triggers reflection, discussion of personal experiences and acknowledge-ment of gaps between current and best practice.	The study was statistically underpowered. Participants highlighted general enjoyment, professional reassurance and personal learning.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Armson 2007[24]	Canada	Description of the programme	PHC	4–10 GPs	Meeting of around 90 minutes once or twice a month	Identify gaps between current practice and best available evidence, to encourage reflection on individual practice, and promote changes in patient care, using an educational approach.	The facilitator's tasks are to focus discussion, to encourage the group to identify barriers to the implementation of new know-ledge and to establish a safe, supportive environment for learning.	Facilitation of discussions based on educational material and a tool (log sheet) that triggers reflection. The group starts with personal experiences and reflects on and acknowledges gaps between current practice and best practice.	Groups of various compositions function effectively in this particular small group environ-ment. If the facilitator lost the group's interest, disintegration of the group was likely.	Papers about Practice Based Small Group Learning in Canada, Scotland and England
Kelly 2007[25]	Scotland	Qualitative study: semi-structured interviews	PHC	One-to-one interview to evaluate the process in 5 small pre-existing groups.	Interviews among partici-pants of the Mc Vicar 2006 study	Explore the perceptions and experiences of PBSG participants to gain an understanding of how PBSGL works.	Facilitator opens discussions, clarifies statements, summarises what was said and questions issues, creating a learning environment.	Case discussions make evidence-based material relevant to participants and stimulate reflection. Mutual learning is important. Discussing data with others stimulates reflection.	Participants joined PBSGL groups because of the need to update medical knowledge, to compare personal practice with peer practice.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Overton 2009[26]	Scotland	Qualitative approach: theory-driven framework developed by Chen and Rossi	PHC	19 GPs and practice nurses	Interviews among partici-pants of PBSGL groups	Study the experiences of GPs and practice nurses in PBSGL. Data sources: logbooks, e-mail, telephone conversations and one-to-one interviews.	Qualitative study of the process in PBSGL groups: Group cohesion grew and mutual emotional support increased. With increasing trust, open discussions were possible.	Qualitative study of the process in PBSGL groups: case discussions kept people going and different perspectives could be considered. Self-esteem increased, as did mutual respect.	Motivation for joining the groups: preferred learning style, keeping up to date, learning in multi-professional groups, group atmosphere. and increased self-esteem.	Papers about Practice Based Small Group Learning in Canada, Scotland and England
Cunning ham 2011[27]	Scotland	Qualitative study: focus group	PHC	Two focus groups of PBSGL facilitators.	Focus groups	Learn about motivators to become a facilitator in PBSGL groups.	Qualitative study of the process in PBSGL groups	Qualitative study of the process in PBSGL groups	Motivators to become a facilitator were positive past experience of group learning, the chance of career advancement. Support for facilitators after initial training.t.	

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Rial 2013[28]	England	Before-and-after study	Trai-nee GPs in PHC	2 newly-founded groups of seven future GPs.	After 8 months, 4 meetings	Identify whether they were supported in making the transition from trainee to independent practitioner through attending PBSGL groups.	One group member was trained as a facilitator.	Canadian PBSGL approach was used	Improved ability to identify and use evidence in practice, shifting the focus from postgraduate exams towards 'real world' practice. The PBSGL groups still meet.	
QCs in Canada										
Ioan-nidis 2007[29]	Canada	Before-and-after study (pilot)	PHC	5 QCs, 52 physicians, GPs and some osteoporosis specialists	12 months	Assess whether use of QCs could improve family physicians' adherence to osteoporosis guidelines. 3 training meetings for the facilitators, 3 meetings for participants.	QC facilitators were local family physicians recruited and trained specifically to lead study meetings.	Educational material, interactive group meetings, use of local opinion leaders, audit and feedback, reminders, multi-professional collaboration, financial incentives and information distributed to patients.	The intervention seemed to be feasible and was well received among GPs. 84% agreed that the feedback helped them understand their current practice patterns and decide on areas that needed improvement.	Papers on guideline adherence using continuous quality improvement cycles in Canada.

Supplemental material 7 Study characteristics

Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Ioan-nidis 2008[30]	Canada	Before-and-after study	PHC	340 participants (GPs) in 34 QCs and local opinion leaders	1 year	Increase guideline adherence concerning osteoporosis. 5 meetings (60–90 minutes) for two years.	5 educational meetings	As in Ioannidis 2007	Physicians' awareness of osteoporosis risk factors and appropriate bone mineral density testing increased.	Papers on guideline adherence using continuous quality improvement cycles in Canada
Ioan-nidis 2009[31]	Canada	Before-and-after study	PHC	As in Ioannidis 2008	2 years	As in Ioannidis 2008	As in Ioannidis 2008	As in Ioannidis 2008	Guideline adherence increased	
German QCs										
Szecse-nyi 1994[32]	Germany	Before-and-after study	PHC	10 GPs	2 years	Observation of the initialisation and establishment of a QC. Monthly meetings.	Presentation round, discussion of possible topics, choice of a topic impacting all participants; a GP facilitates the process.	Setting priorities, analysing the situation, developing criteria for improving quality, analysis of present practice, general priorities for necessary changes, comparison with evidence-based literature, change of practice.	GPs are interested in everyday practice-related topics. The gap between existing knowledge and clinical practice is acknowledged.	Papers about establishing QCs in Germany: pilot stage.

Supplemental material 7 Study characteristics

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Gerlach 1995[33]	Germany	Survey among 138 QC participants	PHC	138 GPs taking part in QCs, 8–12 GPs in each one.	Not applicable	Evaluation of case-based QC process focussing on a topic.	GPs use their own medical records, patient data or video recordings as a basis for problem-based learning. Facilitation by a GP.	Case-based discussions may indicate a need to change everyday practice. Evidence-based material and/or local opinion leaders may contribute to the discussion and consensus finding.	79% of the GPs thought that cases from daily practice should be the starting point of QCs. The process led to locally adapted guidelines.	Papers about establishing QCs in Germany: pilot stage.
Hart-mann 1995[34]	Germany	Controlled before-and-after study	PHC	2 QCs, 10 GPs in each group compared to control group	4 months. Evalua-tion after 5 meetings	Increase guideline adherence in diabetic care. Test training modules for facilitators (GPs).	2 GPs in each group received training in facilitating small groups.	Didactic techniques as in Gerlach 1995, role play to practise patient–doctor communication.	Guideline adherence improved compared to control group.	
Murad 1998[35]	Germany	Before-and-after study	PHC	1 QC including 10 GPs	12 months	Improve guideline adherence for patients with diabetes mellitus type 2. 23 existing QCs meeting once a month.	GPs use their own medical records, patient data or video recordings as a basis for problem-based learning. Facilitation by a GP.	Use of practice data, medical records and case discussions involving a local opinion leader.	According to QC documents, improved guideline adherence.	
Tausch 1995[36]	Germany	Before-and-after study (protocol)	PHC	23 QCs, 10 GPs in each group	Evalua-tion over 18 months	Evaluate facilitators' manuals on different common diseases. 23 existing QCs met	The facilitators prompted and encouraged participants to identify common problems in their	The manual may provide a starting point for developing consensus guidelines.	Evaluation on three levels: reasons for participation in QCs, usability of the manual,	Papers about establishing QCs in Germany using manuals.

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Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
						once a month.	practice.		assessing behaviour change.	
Tausch 1996[37]	Germany	Survey	PHC	25 QCs, 246 GPs	Evalua-tion after 12 months and 10 meetings	Capture the objectives of the participants. 25 pre-existing QCs met once a month.	As above	Case vignettes, discussion of adequate diagnostic and therapeutic procedures in relation to evidence-based material.	Reasons for participating in QCs: exchange among colleagues, improved self-confidence.	Papers about establishing QCs in Germany using manuals.
Tausch 2001[38]	Germany	Before-and-after study	PHC	23 QCs, 243 GPs	Evalua-tion after 18 months	Evaluate reasons for participation, usability of manuals and assessment of behaviour change (self-reported improvement). To expand QCs within short time.	Voluntary participation in monthly meetings, 6–12 GPs in each group, trained facilitator.	Moderator-manuals that allow self-evaluation provide information about appropriate diagnostic and therapeutic recommendations for common diseases.	Reasons for participating: exchange of experiences among colleagues, increased competence and high level of satisfaction.	
Andres 1997[39]	Germany/ Hessen	Controlled before-and-after study	PHC	32 GPs were grouped into 3 QCs promoted by the association of statutory health insurance	12 months	Evaluate the process in the groups after 10 meetings. Participating GPs exceeded average prescription costs.	Participants felt forced to join QCs to change their behaviour. They had to overcome the feeling of being controlled.	Case discussions, audit charts to analyse prescription habits, interactive learning, reflective thinking and consensus finding as to rational prescription practice.	66% reported change in behaviour. 22 of 27 wanted to continue with QCs.	Papers about establishing QCs in Germany using data on everyday practice to improve prescription patterns.

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Andres 2004[40]	Germany/ Lower Saxony	Survey among 797 QC participants	PHC	648 out of 797 participants answered the survey	Evalua-tion after 1 year	Evaluate QC participants' experiences in QCs intended to improve prescription patterns.	7–10 GPs, monthly meetings, facilitator guiding through the process, support by academic staff members if necessary.	Case discussions, peer-led academic detailing allowing comparison with colleagues, reflective thinking, consensus discussions, evidence-based material, patient information.	Main problems were initial prescribing in hospitals and communication with patients when changing drugs.	Papers about establishing QCs in Germany using data on everyday practice to improve prescription patterns.
Wen-sing 2004[41]	Germany / Saxony-Anhalt	Controlled before-and-after study	PHC	87 GPs in 10 groups of 7–12; control group: 90 GPs not participating in the intervention.	Evalua-tion after 2 years	Determine the impact of a large-scale programme of QCs on quality and costs of prescribing, 11 meetings of 2 hours, existing QCs promoted by the association of statutory health insurance.	A trained facilitator (GP) supported the group.	Structured feedback report, patient video, evidence-based material, interactive learning and reflective thinking about willingness to change.	High satisfaction with QCs. Prescriptions decreased in the intervention group while increasing in the control group. Aspects of quality of prescriptions improved.	
Andres 2004[42]	Germany /Hessen	Survey	PHC	483 out of 612 GPs (57 QCs) answered.	Evalua-tion after 2 years	Evaluate participants' experiences of existing QCs taking part in a large project.	7–10 GPs in each QC, facilitator guiding through the process, support by academic staff members.	Personal prescription data with the opportunity to compare with colleagues.	Positive effects on medical practice and increase in knowledge.	

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Fessler 2006[43]	Germany (Rhine Main)	Controlled before-and-after study	PHC	90 GPs participating in QCs were compared to non-participants in another area	Evalua-tion after 2 or 3 years	Improve prescription patterns concerning statins, antidiabetics, other drugs for cardiovascular diseases. Intervention in existing QCs.	Facilitated group work every 4–6 weeks.	QC process according to German standards; discussion of any results not in line with guidelines.	Guideline adherence increased.	Papers about establishing QCs in Germany using data on everyday practice to improve prescription patterns.
Papen-dick 2006[44]	Germany (Rhine Main)	Controlled before-and-after study	PHC	59 GPs participating in QCs compared to 52 non-participants	Evalua-tion after 12 months	Examine the development of drug costs among GPs participating in existing QCs.	Facilitated group work every 4–6 weeks.	QC process according to German standards; discussion of any results not in line with guidelines.	The cost of medical drugs and the increase in expenditure were lower compared to the control group.	
Wen-sing 2009[45]	Hesse, Lower Saxony, Saxony-Anhalt	3 controlled before-and-after studies with baseline in 2001 and follow-up in 2003	PHC	1090 GPs in the inter-vention group and 2090 in the control group.	Baseline data 3 months; evaluation using another 3 months' data after 24 months.	Determine the effectiveness of the QC process on prescribing patterns in existing and new QC groups. Data were gathered on different groups of drugs. One QC meeting a month.	8–14 physicians in a group, trained facilitator (GP)	Repeated feedback on prescribing patterns, evidence-based information, reasons for variations were discussed, case-based discussions, objectives for improvement were formulated and specific plans made.	Attendance rate 71–79%, high satisfaction >80%. Reduction of mean prescription costs per patient, increased prescription of recommended drugs compared to the control group.	

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Andres 2010[46]	Hesse, Saxony-Anhalt, Westfalen-Lippe, Schleswig-Holstein	Interrupted time series 1995–2007	PHC	1242 QCs documented 27,255 meetings. Evaluation of QCs only if they meet at regular intervals and have done so for at least one year.	12 years	Assess the quality of the structure, processes and results of existing QCs promoted by the association of statutory health insurance.	Facilitators questioned the groups and tried to detail an agreement on best practice.	A group of GPs met at regular intervals to consider their standard practice. Their work was based on personal experience, own data and was target-oriented to promote quality in their own practice.	8 and 12 meetings per year, group atmosphere was generally very good; the proposed method was actually used in the groups; consensus was often achieved.	
Beyer 1999[47]	Saxony-Anhalt, Bremen	Cross-sectional survey	PHC	2412 out of 4270 answered	Not applicable	Analysis of demands and expectations on supporting institutions	Not applicable	Not applicable	GPs reported good emotional support from colleagues, improved professional self-confidence, but also fear of control and excessive demands.	Paper about evaluation of reasons for and against participation in QCs.
Aubke 2003[48]	West-phalia-Lippe	Cross-sectional survey 1995–2001	PHC	520 QCs with 7350 participants: 3260 meetings were evaluated	5 years	Assessment of QI cycle in existing QCs using a checklist. 15 GPs in each group, meeting time 120 minutes on average	Not applicable	QCs work both continuous and topic-centred, based on documentation from own practice with the aim of promoting their quality of care.	29.6% of all QCs had implemented the PDCA cycle, 54.9% had partially implemented the characteristics.	Paper on QCs about evaluation of adherence to the PDCA cycle.

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Beyer 2003[49]	Germany and European countries	Cross-sectional survey among EQuiP delegates	Euro-pean PHC	Reports of EQuiP delegates from 26 countries	Cross-sectional	Provide an overview of QC activities across Europe.	Facilitator is usually a GP.	A consistent group of 8 to 15 health-care professionals meet at regular intervals to consider and reflect on their standard practice.	High activity of QCs (i.e. > 10% of all GPs are involved) in 9 European countries.	Paper about the spread of QCs across Europe (Update Rohrbasser 2019).
Mols 2005[50]	Germany (Black Forest region)	Controlled before-and-after study	PHC	36 GPs in QCs treated 75 patients, 25 GPs in the control group treated 51 patients	Baseline after 6 months, evaluation after 18 months.	Study the effect of existing QCs on secondary prevention of stroke.	Facilitated group work every 6 to 8 weeks.	QC process according to German standards.	QCs did not have an additional effect on secondary prevention after stroke compared to the control group.	Paper on QCs about testing guideline adherence.
Schnei-der 2007[51]	Germany	Ran-domised controlled trial	PHC	12 QCs involving 96 GPs; out of 256 partici-pants, 185 responded to the follow-up.	Evalua-tion after 1 year	Evaluate the efficacy of QCs for asthma care working with individual feedback with and without benchmarking.	Trained facilitators supported the groups in the process.	Collective discussion of evidence-based pharmacotherapy and management of patients on the basis of prescribing data.	Both groups improved their guideline adherence.	Testing the question whether benchmarking in QCs improves guideline adherence - or not.
Vollmar 2007[52]	Germany (North-Rhine West-phalia)	Protocol of a randomised controlled trial	PHC	174 GPs in approx. 20 QCs	Evalua-tion after 3 meetings (6 months)	Improve GPs knowledge and skills about people with dementia.	QCs are facilitated by a trainer rather than by a facilitator.	Study concept A: e-learning followed by case discussions in QCs. Study concept B: oral presentation of evidence-based information followed by a discussion led by a presenter.	Possible change of behaviour, use and acceptance of new learning tools.	Papers about evaluation of e-learning methods in QCs.

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Vollmar 2009[53]	Germany (North-Rhine West-phalia)	Cross-sectional survey	PHC	264 out of 449 GPs answered the questionnaire	Cross-sectional	Gain understanding of German GPs' preferences for different forms of educational methods, such as e-learning.	Not applicable	Not applicable	Approx. 70% wanted to discuss everyday practice with colleagues. Meeting experts and e-learning were not favoured.	.
Vollmar 2010[54]	Germany (North-Rhine West-phalia)	Ran-domised controlled trial	Ger-man PHC	166 GPs in 26 QCs	1 year after study start	Compare knowledge acquisition about dementia management between blended learning and QC methods alone.	QCs are facilitated by a trainer rather than by a facilitator	Study concept A: e-learning followed by case discussions in QCs. Study concept B: oral presentation of evidence-based information and its discussions in a QC.	Groups A and B improved their knowledge. A blended learning approach was not superior to the QC approach.	
Siebolds 2012[55]	Germany	Survey	PHC	83 facilitators received survey	Cross-sectional	Evaluation of training and support for facilitators by tutors.	To support facilitators, the KBV (National Association of Statutory Health Insurance) developed structured didactic handouts for the QC work.	Guidelines of the National Association of Statutory Health Insurance for Quality Assurance Procedures.	High level of satisfaction with didactic handouts (manuals) and training opportunities.	Paper about the quality of training and support for facilitators.

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Swiss QCs										
Bugnon 2004[56]	Switzer-land	Controlled before-and-after study	PHC	6–10 GPs in 1 QC.	Develop-ment over 3 years	Improve prescription patterns and reduce costs for drug prescriptions.	A pharmacist facilitated the group through the process of academic detailing. The group engaged in local networking. Group cohesion increased with time.	Evidence-based information, feedback on prescriptions including information about possible substitutions. Consensus discussions and agreement on best choices.	Improvement of prescription patterns (antibiotics, antidiabetic and antihypertensive drugs, NSAIDs); reduction of costs compared to control groups.	Papers about pharmacist-led QCs in Switzerland.
Niquille 2010[57]	Switzer-land	Controlled before-and-after study	PHC	24 GPs in 6 QCs	Develop-ment over 9 years	Improve prescription patterns and to reduce costs for drug prescriptions.	A pharmacist facilitated groups of 3–6 GPs through the process of academic detailing. Group cohesion increased with time.	As in Bugnon 2004	42% decrease in drug costs, improved adherence to prescription guidelines compared to control group.	

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Drug Education Project										
Lund-borg 1999[58]	Sweden	Ran-domised controlled trial	PHC	18 groups (104 GPs) compared with 18 groups (100 GPs), 3–10 GPs in each group	6 months	Improve the treatment of asthma and urinary tract infections. The two study groups served as controls for each other.	Pharmacists facilitated the GP groups, two meetings, each meeting 1.5 hours.	Information on their judgements of written simulated cases. Discussion of actual decisions taken on the simulated cases. Discussion of personal experience of difficult clinical cases and underlying reasons for prescriptions.	Guideline adherence increased for patients with urinary tract infections and patients with asthma.	QC study on improving drug prescriptions in Sweden, Norway, The Netherlands and Slovakia: Drug Education Project.
Lund-borg 1999[59]	Sweden	GPs' evaluation of the trial: survey	Swe-dish PHC	82 out of 104 GPs and 83 out 100 GPs responded.	6 months	Capture GPs' experiences of the trial through a questionnaire.	As above in Lundborg 1999	As above in Lundborg 1999	87% of participating GPs wanted to take part in similar CME activities for other conditions.	
Lager-lov 2000[60]	Norway	Ran-domised controlled trial	Norwe gian PHC	32 groups (199 GPs), 4–8 GPs in each group	6 months	As above in Lundborg 1999	As above in Lundborg 1999	As above in Lundborg 1999.	Guideline adherence increased.	

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Veninga 1999[61]	Sweden, Slovakia, The Nether-lands	Evaluation of a randomised controlled trial	Swe-dish, Norwe gian, Dutch and Slova-kian PHC	The Netherlands: 24 groups, 181 GPs; Sweden: 36 groups, 204 GPs; Norway: 32 groups, 199 GPs; Slovakia: 20 groups, 81 GPs.	6 months	Explore whether a specific educational approach for implementation of guidelines has a similar effect when used in different health care settings.	As above in Lundborg 1999 (Slovakia only one meeting).	As above in Lundborg 1999	Attitudes changed and prescription patterns improved.	QC study on improving drug prescriptions in Sweden, Norway, The Netherlands and Slovakia: Drug Education Project (DEP).
Veninga 2000[62]	The Nether-lands	Ran-domised controlled trial	PHC	24 groups (181 GPs)	6 months	As above in Lundborg 1999	As above in Lundborg 1999	As above in Lundborg 1999	Guideline adherence increased.	
European single studies										
Eliasson 1999[63]	Sweden	Literature review, survey and authors' reflections	PHC	5–10 GPs in each of approx. 230 groups	Meeting once to twice a month	Give an overview of CME group work in Sweden and describe its strengths and weaknesses.	Facilitated group discussions. Reflection on emotional responses was part of the group process.	Prearranged modules with short introductions and facts on a topic. Discussions based on experiences.	80% of the group members assessed the pedagogical value of the group sessions as more valuable than direct instruction.	Paper on Swedish QCs

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Watkins 2004[64]	England	Qualitative study: focus group	PHC	6 different facilitators with different backgrounds. A total of 19 GPs in four practices and one practice manager took part. 11 GPs were interviewed.	7 monthly sessions taking place at midday	Reflect on inappropriate and costly prescribing. Investigate feasibility of educational sessions for GPs: acceptability among GPs and possible barriers.	'Reflective practice' as a potential solution to high-cost prescribing. GPs felt that participation was to appease their prescribing adviser. No or little sense of ownership. Information overload was a problem.	Video-tape of a scenario, followed by brainstorming, and personal responses in the group. 'Best buy' response was selected. Identification of barriers to implementation and discussion of means to overcome barriers.	Low response for participation (4 out of 61 practices). There was friction between clinical autonomy and the experience of a top-down intervention.	Paper on English QCs (reflective groups)
Tonies 2006[65]	Austria	Survey	PHC	In 2001, 29 GPs out of 169 (17%) responded; in 2002, 46 out of 272 (27%) responded.	Evalua-tion after 4 years of offering QCs	Improve care of patients with drug replacement therapy using synthetic opioids in PHC.	A GP facilitated the group and had the support of an experienced local opinion leader.	Local opinion leaders introduced topics. Stimulation of discussions to increase self-awareness and frustration tolerance.	High level of satisfaction with the teaching. Communication skills improved. Topic-specific knowledge increased.	Topic-specific QC activities in Austria.
Riou 2007[66]	France	Controlled before-and-after study	PHC	Number of groups is not mentioned, 7–11 GPs per group, 24 participating GPs, 3–6 local pharmacists in each area.	12 months (Dec 2001 to Dec 2002)	Improve prescription patterns in three semi-rural areas of Brittany, France. Financial incentive.	4 plenary meetings with consultants lecturing on pre-specified topics. QCs every 6th week using personalised feedback.	Expert input during plenary sessions, voluntary feedback, peer review and specific recommendations for changes during QCs.	Increase in generic prescription rates and decreased prescription of drugs with no evidence-based efficacy.	French QC study on improving drug prescription patterns.

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van Driel 2007[67]	Belgium	Cluster randomised controlled trial	PHC	9 QCs (122 GPs) in the intervention and 9 QCs (134 GPs) in the control group	November 2004 to March 2005	Improve antibiotic prescribing in patients with rhinosinusitis. Existing QCs.	The group meetings were scheduled as regular QC sessions without the presence of an external expert.	Dissemination of the guidelines by e-mail; facilitators received educational material concerning antibiotics.	A single intervention in QCs did not have a significant effect on prescription patterns.	Belgian QC study on improving drug prescription.
Spiegel 2012[68]	Austria	Qualitative evaluation	PHC	445 out of 821 GPs took part in the groups, 8–10 participants in each group	2 years: 2004 and 2005	Explore GPs' perception of QCs concerning prescribing habits. Qualitative analysis was used to evaluate QC protocols.	Facilitators' duties were to schedule dates for QCs, give introductory talks on intended topics and facilitate the group process.	Use of educational material on various issues of pharmacotherapy; costs were addressed; provision of personal feedback on prescription habits.	Prescription of generic drugs increased.	Austrian QC study on improving drug prescription.
OTHER AREAS										
de Villiers 2003[69]	South Africa	Qualitative evaluation using Nominal Group Technique followed by survey	PHC	64 GPs answered (response rate 38%), 51 out of 101 responding GPs had participated in QC, 8 out of 12 facilitators responded	Evalua-tion of 9 months CME/ CPD activity	A nominal group technique was used to compose two questionnaires (for participants and facilitators)	Facilitated small-group activities	Activities built on previous experience, involved the learners, focussed on relevant problems; solutions were applicable in practice; the process followed a cycle of action-reflection and GPs acquired technical skills.	91% of the respondents indicated improved knowledge, 73% indicated improvements in their patient care and 61% improved clinical skills	South African QCs

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Rich-ards 2003[70]	New Zealand	Pilot study: retro-spective, controlled before-and-after study	PHC	52 GPs in small education groups: approx. 10 GPs in each group	After 1 and 2 years	Determine whether a QC-programme designed to promote rational GP prescribing succeeds in changing practice when added to audit and feed-back, academic detailing.	Meetings were monthly and group composition remained the same over time.	Control group: audit and feedback on prescription habits, academic detailing and educational bulletins. Intervention group: peer-led groups, monthly meetings.	Positive effect of the education strategy in groups compared to the combination of audit and feedback and academic detailing.	QCs on improving drug prescriptions in New Zealand.
Parker 2007[71]	USA (Hawaii)	Ran-domised controlled trial	PHC	4 health-care facilities of similar size participated and were randomly assigned the local or the central QI approach	Duration about 2.5 years	Compare the participatory local approach with the central expert approach to QI in depression care.	Researchers allowed teams to design their own programmes. Local QI groups had a facilitator.	The QI teams followed guidance regarding team composition and process. The central expert approach used centrally organised teams of experts.	A hybrid model (central expertise and local participation) may be the most effective approach to maintain a high level of motivation.	QCs on Hawaii compared to centrally steered options.
Som-mers 2007[72]	USA (Califor-nia)	Survey and attendance rate	PHC	Researchers invited 30 sites, 11 (103 GPs) out of 14 sites who started continued with their meetings	5 years	Introduce small-group meetings as means of managing clinical uncertainty.	A group member or an invited, external member facilitated discussions, searched for and appraised evidence and coordinated meeting logistics.	Reflection on and appraisal of one's own delivery of clinical care. Case-based discussion and reflection.	Most common themes: being with colleagues, the role of time in GP practice. Other common themes: acknowledging uncertainty, receiving validation.	Practice-Based Learning and Improvement in in California.

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Murrihy 2009[73]	Australia	Before-and-after study	PHC	6 groups of GPs (32 GPs)	6 months	Improve GPs' skills and actual use of cognitive behaviour therapy. 8 two-hour sessions.	Expert-led small-group interactive learning, and ongoing discussion of patients.	Development of mentor-type relationships, the use of interactive learning and skills-based training, discussion of ongoing patients.	GPs' knowledge, skills in and actual use of cognitive behaviour therapy increased.	QCs in Australia.
UPDATE December 2020										
Fisher 2013[74]	North East Ohio, USA	Before-and-after study and survey (qualitative data)	PHC	78 participants in 20 practices/ groups; some groups were inter-professional	1 year	The American Board of Medical Specialties' Performance and Practice initiated the project to support GPs in working in groups to improve practice.	A coach facilitated the process, led discussions, helped the team to recognise their skills, to identify the next steps and to address problems arising.	Physicians discussed their priorities for improvement, narrowed the topic, reflected on results of patient surveys and shared their view of 'best practice' using personal examples.	Introduction of QI tools into groups succeeded. Participants felt that the group activity encouraged collaboration with colleagues.	Practice-Based Learning and Improvement in the USA.
Francois 2013[75]	Isère, France	Survey	PHC	16 groups, 132 GPs	Not applicable	Review the implementation of QCs by mapping the groups, describe the perspective of participants and study how these groups work.	Facilitators helped the groups to share experiences and to discuss difficult cases and medical errors.	Case discussions, audit charts to analyse prescription habits, interactive learning, reflective thinking and consensus-finding, local opinion leaders.	6–10 GPs in each group, meetings lasted between 1 and 2.5 hrs, 6–10 meetings per year, participants had a high level of satisfaction.	Description of QC development in Isère, France.
Wilcock 2013[76]	England	Cluster randomised controlled trial	PHC	11 practices using workshops, 12 practices usual care	12 months	Test of a tailored educational intervention on the clinical management of	Facilitated small-group workshops with practice teams.	Adult learning approach to solving real-world problems, tailoring the learning need, using	The intervention did not alter the clinical management of patients with	QC-like intervention in England testing guideline adherence.

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				(NICE guidelines)		people with dementia.		workshops at the work place.	dementia.	
Andres 2015[77]	Germany	Focus group	PHC	12 health-care professionals	Not applicable	Evaluation of 20 years' QC work	Maintaining autonomy, self-determination of topics and the process in QCs ensure the practical rele-vance of topics and emotional engagement of participants.	Case-based learning among peers in a facilitated group process is key in the QC process.	Measures to support QC-work: evidence-based information and trustworthy prescription patterns.	20 years' experience of QCs in Germany
Dowling 2015[78]	Ireland	Survey	PHC	96% of GPs participating in CME groups responded (1366), 146 groups	Not applicable	Investigate whether taking part in CME groups improves GPs' clinical knowledge.	A local, small-group setting provides live peer-group interaction, peer support and reflection on practice.	Face-to-face activities, multiple exposure, the use of multi-media and multiple education techniques.	97% stated that they want to improve their clinical practice, 86.3% agreed that taking part in CME groups is key for this.	QCs in Ireland
Ver-bakel 2015[79]	The Nether-lands	A three-group cluster randomised controlled trial	PHC	10 groups in each intervention group	4 months	Assess the effect of two interventions on patient safety culture: a survey compared to adding a QC-like intervention compared to usual care.	Team-based reflection on personal practice data and team-based development of action plan.	Didactics were added to the experiential learning principles of Kolb, for example, concrete experience, reflection, conceptualisation, and experimentation.	Increased reporting of critical incidents	Dutch QC study on improving patient safety culture.

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Mahl-knecht 2016[80]	Austria (Salzburg) and Italy (Tirol)	Before-and after-study	PHC	20 GPs in regional QC groups (number of groups not mentioned)	3 years	Assess whether quality can be improved by self-auditing, benchmarking and QCs.	Facilitated, regular group meetings	Critical self-reflection, audits and feedback, benchmarking.	The mean quality score increased significantly.	Austrian–Italian study using benchmarking in QCs.
Vervloet 2016[81]	The Nether-lands	Controlled before-and-after study	PHC	4 groups (39 GPs) in the intervention and 4 groups (38 GPs) in the control group	1 year	Evaluate the effect of a multifaceted, peer-group-based intervention aiming to reduce respiratory tract related antibiotic prescriptions.	A series of regular meetings between GPs and pharmacists in the same catchment area.	Communication skills training, including communication about delayed prescribing, quarterly feedback figures for GPs.	Guideline adherence increased.	Dutch QC study on improving drug prescription involving pharmacists.
Jäger 2013[82]	Germany	Protocol of a cluster randomised controlled trial	PHC	10 QCs (40 GPs)	6 months	To implement structured medication counselling, use of medication lists and medication reviews to avoid potentially inappropriate medication.	QC meetings every three months.	Development of individual concepts of change and their presentation at QC meetings. Posters and flyers for patients. Written feedback on individual practice patterns.	The degree of implementation of the three recommendations measured at patient level.	German QC study on improving drug prescription.
Jäger 2015[83]	Germany	Description of intervention	PHC	12 GPs and 8 medical practice assistants from 8 practices participated in the workshop.	6 months	Describe the content and delivery of the tailored intervention.	No further mention of QCs in the paper.	Workshops about structured medication counselling, use of medication lists and medication reviews to avoid potentially inappropriate medication.	The workshop seemed to improve participants' knowledge of medication management.	German QC study on improving drug prescription.

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Jäger 2017[84]	Germany	A cluster randomised controlled trial	PHC	Intervention group: 10 GPs in 5 different QCs; control group: 11 GPs in 6 different QCs,	6 months	As above in Jaeger 2013	Not mentioned	Training for GPs and medical practice assistants, educational material for patients, individually developed action plans, written feedback on prescription patterns.	Little or no effect of the tailored programme on the combined primary outcome could be substantiated. Lack of statistical power to detect any effect.	
Jäger 2017[85]	Germany	Interviews	PHC	Analysis of 12 interviews, 21 question-naires, 120 documenta-tion forms.	Evalua-tion of 6 months' study	To evaluate the study Jaeger 2017 using various data sources.	Facilitation or group dynamics were not described as QCs were not used as planned.	Workshop-like atmosphere of one meeting.	Patients were not able to use the tablets provided. Participants suggested integrating the training into QCs.	
Ter Brugge 2017[86]	The Nether-lands	Mixed-methods design: question-naire about types of group meetings followed by interviews	PHC	78 out of 128 GP supervisors filled out the questionnaire; 18 GP supervisors were interviewed	Not applicable	Examine different types of group meeting and explore the use of clinical research evidence.	Little discussion on clinical applicability of evidence.	Guidelines, local opinion leaders who lecture, consensus discussion.	QCs are the type of group meeting that occur most often in PHC. They seem to be more goal-oriented than learning-oriented. The agenda was heavily influenced by health insurance companies.	Dutch QC study on improving drug prescription involving pharmacists.

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Author year	Country	Study design	Set-ting	Participants, professional background	Study duration	Objective and intervention setting	Facilitation and group dynamics	Didactic and QI technique	Outcome oriented data	Common characteristics of the cluster (kinship)
Trietsch 2017[87]	The Nether-lands	A cluster randomised controlled trial	PHC	21 QCs (197 GPs)	3 years	Test the effect of audit and feedback with peer review on GP' prescribing and test-ordering performance.	Facilitation by local opinion leaders (laboratory specialist or local pharmacist) who were trained in a three-hour meeting. The groups met twice for each topic.	Facilitators had written and digital evidence-based materials, individual feedback reports	The increase in total tests ordered was 3% in the intervention and 15% in the control group. The increase in prescriptions was 20% in the intervention and 66% in the control group.	Dutch QC study on improving test ordering and drug prescription.
Andres 2018[88]	Germany	Controlled before and after study	PHC	48 GPs	12 months	Test the effect of audit and feedback with peer review on quality indicators for coronary heart disease (CHD)	Classic German QC without further description	Individually presented 11 quality indicators for patients with CHD; feedback reports for each doctor's practice at two QC meetings	For three of these indicators the increase rates were higher than those in the Bavarian control group	German study of use of quality indicators in QCs
Binienda 2018[89]	USA (Ohio)	Survey	PHC	126 GPs	Not applicable	To explore the research efforts of Practice Based Research Networks (PBRN)	Not applicable	Not applicable	PBRNs currently thrive on conducting research predominantly in quality improvement and practice transformation	QI in US

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Kral 2018[90]	Czech Republic	Case study	PHC	GPs, not stated how many	6 months	Use of quality circles as a support tool in the taking over of practices by young general practitioners.	1st meeting, identification of problems; 2nd meeting, discussion of specific issues of starting to practice; 3rd meeting, analysis of the suggested measures and implementation; 4th meeting, evaluation.	Facilitated discussions	QC work offers a good platform for young GPs in starting their own practice.	QC pilot in the Czech Republic
Park 2018[91]	Scotland	Focus groups	PHC	GPs/Practice Nurses/Pharmacists	Not applicable	To determine how groups recruit new members and discern what are the important attributes of the new members.	Not applicable	Not applicable	4 themes: group formation and purpose; group culture; experience of group members; professional socialisation.	Recruitment to PBSG in Scotland
Pedersen 2018[92]	Norway	Case series	PHC	53 health care professionals PHC	12 months	to investigate what is discussed when QCs work to complete an action form as part of an audit and feedback cycle.	Insight into their own and their colleagues' practices.	Discussion of results of the audit; identification of gaps between recommendations and local practice; choice of areas for improvement; addressing local barriers and enablers; evaluation.	Acting on audit and feedback provided an opportunity to discuss practice.	QC I Norway

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Rogn-stad 2018[93]	Norway	Cluster-randomised controlled study	PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	To undertake a multifaceted, educational intervention to improve GPs' prescribing practice for patients aged ⩾ 70.	See Rognstad 2013	See Rognstad 2013	Reduction of Potentially inappropriate prescriptions.	Norwegian QC studies on improving drug prescriptions
Rogn-stad 2018[94]	Norway	Cluster-randomised controlled study	PHC	80 CME groups; 7–8 GPs in each group located in the southern part of Norway	6 months: meetings once a month; the study covered 3 meetings.	To explore the characteristics of the GPs responding to QC intervention.	See Rognstad 2013	See Rognstad 2013	GPs with the lowest adherence to recommended practice at baseline improved their practice most.	Norwegian QC studies on improving drug prescriptions
Will-man 2018[95]	Scotland	Survey	PHC	Not known	Not applicable	To assess the educational impact of PBSGL.	Not applicable	Not applicable	PBSGL is an essential pillar for supporting all doctors in Defence Primary Healthcare.	Scottish PBSGL

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Cunningham 2019[96]	Scotland	Evaluation	PHC	Not applicable	Overview of 17 years	To increase clinical knowledge and to implement it.	Facilitated discussion case presentations; study of current evidence base; proposal of changes to practice.	Members are encouraged to make a commitment to change, to log these changes in a shared document, and to review changes with their colleagues.	3,400 members drawn from GPs, GP nurses, pharmacists and other professions.	Scottish PBSGL overview
Dowling 2019[97]	Ireland	Survey	PHC	1686 GPs answering the questionnaire	Not applicable	To examine whether local, accessible ongoing CME-SGL for rural GPs meets their educational needs.	Not applicable	Not applicable	87% reported that their educational needs were fully or mostly met.	Irish CME groups
Martin 2019[98]	Switzer-land	Before and after study	PHC	9 GPs	2 years	Assess status of colorectal carcinoma screening and use of shared decision when choosing screening method.	Facilitated small group work according to Swiss standards.	data-driven Plan-Do-Study-Act cycles to implement changes in practice.	Through data-driven PDSA cycles and organisational changes, GPs implemented SDM tools in their daily routine.	Swiss QC on screening of colorectal carcinoma

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Sieben-hofer 2019[99]	Germany	Cluster randomised controlled study	PHC	52 general practices	24 months	To examine whether case management reduces thromboembolic events and major bleeding events.	Training for healthcare assistants; information and quality circles for GPs; 24 months of case management.	Quality circles to discuss practical problems; case discussions.	The intervention appears to have positively influenced several process parameters under 'real-world conditions'.	German QCs on antithrombotic treatment
Armson 2020[100]	Canada	Mixed methods	PHC	139 GPs	Not apppli-cable	To assessed feasibility and effectiveness of practice-based small-group learning in academic half days; question-naire and interviews.	Participants were divided into groups of 14-16 members to discuss 12 different module topics.	Presentation of clinical cases presented in educational modules and reflection on own clinical experiences; trained peer facilitator.	Feasible approach for half day learning sessions.	Canadian PBSGL
Dowling 2020 [101]	Ireland	Before and after study using mixed methods	PHC	4 CME groups including 43 GPs	6 months	To identify whether CME-small group learning increases knowledge and changes behaviour; questionnaires, prescribing audits and qualitative focus groups.	A two-hour teaching module on deprescribing in older patients was devised and implemented.	Needs assessment; four case studies and own examples; facilitated discussion.	Learning outcomes seemed achieved; 79.9% of cases were de-prescribed; sharing experiences helped them change practice	Irish CME groups

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Mahl-knecht 2020[102]	Austria and Italy	Before and after study	PHC	56 GPs	2 years	To assess the changes in quality of life (QoL) and patient satisfaction of chronically ill patients in Tyrol and South Tyrol.	Not described	Intervention consisted of self-audit, benchmarking and QCs	The impact of the intervention was not significant within the intermediate time periods analysed in the study.	QCs in Tyrol (Austria and Italy)
Mercer 2020[103]	Scotland	Survey	PHC	4371 GPs	Not applicable	To determine GPs' views on QCs.	QC participants were asked to what extent QCs were: 1) well organised; 2) friendly; 3) well facilitated; and 4) productive	Not applicable	2456 responses were received from 4371 GPs (56.4%). QCs are in need of more support to improve quality of care	Scottish PBSGL
Plüss-Suard 2020[104]	Switzer-land	Before and after study	PHC	GPs, nurses and pharmacists	6 Years	To describe antibacterial use in long-term care facilities and to investigate the determinants of use.	Improving the enforcement of clinical guidelines within long term care facilities prescribing practices.	Benchmarking, analysis of attitudes towards guidelines, building consensus and evaluation of results.	Antibacterial use decreased from 45.6 to 35.5 DDD per 1000 beds per day.	Swiss QC on drug prescription

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Kamradt 2018[105]	Germany	Study protocol: three-armed cluster randomised trial compared to standard care	PHC	193 practices	3 years	To examine the change of the antibiotic prescription rate within three intervention arms and the comparison between the three intervention arms	Various social mechanisms influence the spread of new attitudes and behaviours	A: e-learning, QCs, data feedback B: A plus in addition, feedback tailored for practice staff C: A plus computerized support and multiprofessional QC.	Established indicators of the European Surveillance of Antimicrobial Consumption Network. Process evaluation: interviews.	German QC for rational antibiotic prescribing patterns. Effectiveness study is still pending.
Poss-Doering 2020[106]	Germany	Evaluation: interviews and surveys	PHC	76 GPs and 80 medical assistants	Not applicable	To describe the individual and organizational factors affecting the uptake of this multi-faceted program using surveys and interviews	Not applicable	Not applicable	Highest uptake gave feedback reports, background information, e-learning modules and disease-specific QCs.	
Poss-Doering 2020[107]	Germany	Evaluation: interviews	PHC	GPs, medical assistants and stakeholder representa-tives	Not applicable	To explore factors and processes attributed to the network's contribution to improving antibiotic prescribing.	Not applicable	Not applicable	Professional peer exchange, social support and reassurance contributed to behaviour change.	

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Stewart 2020[108]	Scotland	Evaluation: interviews	PHC	GPs, secondary care doctors	Not applicable	To identify the perceptions and experiences of participants in mixed groups of general practitioners and secondary care doctors	Not applicable	Not applicable	There was desire to improve working relationships; logistics of arranging further meetings seemed challenging.	Scottish PBSGL in mixed groups (GPs and secondary care doctors)

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Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

CMO configuration 1: **'participants know what to expect'**

If the introductory workshop conveys the principles of QI in PHC and the workings of QCs (social persuasion) (C), this will increase future participants' motivation to join QCs (O) because they learn what to expect and may feel that they are capable of meeting expectations (increase of self-efficacy) (M).

Surveys have revealed wide-reaching gaps in information, some of which are the cause of misunderstandings and misjudgements. In particular, the working methods and objectives of medical quality circles are apparently insufficiently known. Better general information on this subject, which contracted doctors, in particular, expect from their KV [health insurance company], is therefore urgently needed. As examples from the Netherlands and Great Britain show, active information from the target group is a basic prerequisite for quality-enhancing measures in practice [translated from German][1].

Introduction of the model … is important for understanding and helps participants during the start of the process. It was also vital to have a common and shared understanding of the problem among participants. It is worthwhile taking the time for an agreement on shared guidelines …[2].

To deal with these issues [information overload], an initial, introductory session of 'Reflective Practice' needs to be included, where GPs' experience of previous prescribing management interventions can be aired, where safe 'rules of engagement' can be agreed, and the purpose of the 'reflective practice' intervention made explicit[3].

CMO configuration 2: **'need for autonomy and obligation'**

If the administration at the national level or at the level of health insurance companies entrusts GPs with QI and autonomy (puts them in control of how do it) (C), then GPs may consider participating in QCs (O) because they feel they can take on the responsibility and make a difference (M).

In the discussion with facilitators, the QC participants expressed their desire to be self-determined and work independently. For this reason, the Federal Association of Statutory Health Insurance Physicians (KBV) and the Associations of Statutory Health Insurance Physicians (KVen) have laid down the thematic and methodological autonomy of QCs as a prerequisite in their guidelines for quality-circle work and have committed themselves to supporting them [translated from German [4].

CMO configuration 3: **'sharing similar needs'**

If the administration at the organisational level of QCs provides support (i.e. in training facilitators, data gathering, provision of evidence-based information), and the administration protects time and space and offers CME points and small financial incentives to QC participants (C), then the latter will meet in groups to exchange ideas (O) because GPs prefer learning in QCs (M); support generates positive expectations among participants (M) and GPs believe that QC meetings with their peers will be useful (M).

External staff should organise QCs as facilitators have too little time to do this [translated from German][1].

The most-cited reason for joining Problem Based Small Group Learning (PBSGL) ……. their preferred learning style. 'I find my preferred method of learning to be in small groups and case-study discussion, so this programme seems ideal for my learning needs[5].

To ensure attendance in the future, the educational sessions need to be protected by the use of a paid locum, in the same way as other practice development work is now being supported[3].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

CMO configuration 4: **'need for relatedness'**

If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g., introduces people to each other, opens discussions, clarifies and summarizes statements (C), then group members will get to know each other and norm rules that they are willing to follow and build safe environment based on trust (O), because members want to be among and to interact with equals (M).

We estimate it took three to four sessions for the group to be comfortable with this process. Open discussions and debates then came more freely, and the group continued to gel[6].

Interestingly, the stage of storming, which is characterized by interpersonal hostility and conflict, was not evident in either group[5].

The role of the facilitator has been recognised. They need to be competent at many tasks including opening the discussion, clarifying, summarising, questioning and devising strategies to improve group function[7].

GPs regard the group as a place for social support, … growth in the professional role … for protection against burnout. Although … main purpose of small-group work is exchange … of knowledge, social aspects should not be neglected because they will increase the motivation to continue with meetings …. [8].

The success of group learning between GPs within a practice depends to a large extent on the quality of relationships within the group. Where individuals feel that their management decisions are under threat from colleagues with whose judgements they are not comfortable, discussion may be abruptly curtailed [3].

CMO configuration 5: **'need for autonomy and control'**

If the group members choose their own topics and facilitator (C), then they will feel they own the QC (O) because their need for autonomy - a feeling of being in control of their own behaviour - is satisfied (M).

Tutors did not consider themselves as 'experts' but as 'one of them'. Being open about their background as GPs was an agreed-upon strategy, and tutors deliberately tried to avoid being perceived as experts. The tutors experienced that their own background was important for GPs' trust and acceptance[9].

The facilitator is selected by the group[10].

It is important for a learner to be in control of his or her learning process, to be motivated and to perceive meaningfulness[11].

… the rise of evidence-based medical guidelines probably decreases individual providers' autonomy. Physicians have raised similar concerns about threats to the autonomy of their profession …. … It is within this context, … declining perceived autonomy for … physicians, that we compare the participatory local and central expert approaches to QI[12].

CMO configuration 6: **'size of the group affects communication'**

If group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with all participants and follow their conversations (M).

All GPs participating in such peer groups, on average consisting of six to eight peers, located in southern Norway[13].

How can QCs be supported? (Table 2) Group sizes > 15 or < 5 - are problematic and participants need support [translated from German][14].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The effect of the educational asthma programme was partly modified by the group size; prescribing behaviour for [asthma] exacerbations improved more in smaller groups. The group size varied from 4 to 13…. This result is … an optimal group size of 5 to 6 group members[15].
CMO configuration 7**: 'feeling safe and not vulnerable'** If participants trust each other (C), then they can disclose how they work and also the holes in their knowledge (O), because they feel safe rather than vulnerable (M). *In time, group members develop confidence and security in the group, rendering the disclosure of ignorance and 'blind spots of knowledge' easier. Group members could either use the whole group or parts of it to assess their own learning needs*[8].
CMO configuration 8: **'need for competence and self-actualisation'** If the facilitator supports the participants and encourages them to tell their stories and share their experiences in a safe environment, e.g. by encouraging interactive responses, through discussions and by summarising statements (C), then participants will become involved and share their positive experiences and failures (O) because they want to improve their professional competence (M), gain professional confidence (M) and fulfil their professional potentials (M). *Subjects, topics and cases discussed in groups come from daily work and are highly relevant to practice. The small group will meet the demands of developing generalist knowledge as well as the expert role in general practice*[8]. *Small groups will have opportunities to discuss the 'art of medicine', founded upon context, anecdote, patient stories of illness and personal experiences. Accepting emotional responses being mirrored by other group members corresponds in some respects to the process in Balint groups*[8]. *Comparison with one's peers was important, as was the support, confidence and reassurance that some gained from being part of the group*[7]. *Exchanging experiences in QCs, GPs can work out and clarify the characteristics of general practice, which improves knowledge transfer [translated from German]*[16]. *'It [the role as a facilitator] gives you licence to play devil's advocate as well and challenge people a bit more whereas, if you were always doing that as just a group member, people might think you were just doing it to annoy them*[17].
CMO configuration 9: **'previous knowledge is activated'** If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by telling their own relevant stories (O) because the process activates knowledge they already possess (M). *The use of a case-based format encourages activation of previous knowledge, allowing better retrieval of knowledge in the clinical setting…, particularly when it involves participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases and provide feedback on performance*[10]. *During discussions at the level of relationships [case discussion], the exchange is more intense than in the exchange of pure facts; one's own behaviour is better analysed and suggestions arose for training in one's own practice [translated from German]*[18].

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Virtually everyone participates in presenting a case, asking for advice or clarification, or describing their practice patterns[6].
CMO configuration 10: **'immediate relevance for the practice'** If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O), because it relates to their everyday work and is therefore of immediate use (M). *To better support PCPs (GPs) in managing uncertainty, more meeting time should be spent on the deliberate practice of blending evidence with experience (e.g. per-case, focused analysis of guidelines/relevance) and using case follow-up insights to 'reconstruct practice' for the individual patient while appreciating implications for the clinic/office[19].* *There also must be some motivation for learning and change: this can be ensured if the issues discussed are derived from the learner's own clinical practice[6].* *The decision to focus on clinical problems instead of tests was a good choice, since it allowed the feedback and group work to be linked to national evidence-based guidelines. GPs appreciated this approach, because it was also closely related to their everyday work routine[20].* *By discussing specific cases, real problems in participants' everyday practice become the topic of discussion in QCs instead of designed problems. In systematic reconstructions [of patient situations], the experiences are made conscious, so that intuitively applied – implicit – mental guidelines can be made explicit [translated from German][21].*
CMO configuration 11: **'cognitive dissonance'** If participants discuss and reflect on their work processes (e.g. based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance (a negative emotional state triggered by conflicting perceptions) that makes them reconsider their own way of working (M). *During the meetings, the treatment of these specific patient records was discussed, especially differences between what was prescribed according to the records and what was actually dispensed[11].* *One of the key features of QCs is that working methods map the quality of care in one's own practice. First of all, this distinguishes QC work from further training in the classical style and second, it enables participants to identify real quality problems in their own practice [translated from German][14].* *The combination of the written simulated cases with actual prescribing allows the GPs to reflect on their decisions as well as the background for these decisions, and is in line with suggestions to make drug utilization studies closer to the reality of practice[11].* *Through reflection, a gap between current practice and best practice is recognized. Distinguishing this gap presents an opportunity to identify learning objectives specific to the family practice setting[10].* *Our results are in concordance with research that suggests that GPs may feel disappointment if their prescribing practice conflicts with their ideals[9].*
CMO configuration 12: **'social learning'** If the facilitator uses purposeful didactic techniques (e.g. brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection on the work

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process (C), then the group will create a learning environment that promotes knowledge exchange (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

The participating GPs experienced the CME group meetings as an important arena for learning. They reported picking up good advice from others and learning practical alternatives …. GPs said their prescription data would not mirror all learning effects: 'The whole point is to reflect more …' [9].

Once the problem is acknowledged, one must learn and understand what caused the problem and how it can be solved. For this, elucidating and discussing the decision process underlying treatment decisions may be useful. To accept new information or practice recommendations, the credibility of the source is of importance[15].

Cooperative learning can increase flexibility and joy in medical action (everyone learns from everyone) [translated from German][16].

Learning from and with colleagues is an important source of both new information and strategies for applying that information to practice[10].

Cognitive feedback is feedback on the decision process, i.e. why or how a decision is made and not on the decision itself, i.e. which decision is taken[11].

CMO configuration 13: **'positive interdependence between health insurance companies and GPs'**

If physician network organisations require continuous QC activities (C), then QCs will negotiate priorities and design creative solutions (O) because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M).

The physicians in the Rhine-Main network of physicians committed themselves to participating in QCs when they joined the contract. In QCs, they discuss prescription patterns for specific clinical situations and adapt guidelines to local conditions [translated from German][22].

The participation of German GPs in QCs is mandatory in order to be part of government-funded disease management programmes (DMPs) or to be part of pilot projects with health insurance funds[23].

CMO configuration 14: **'threat to professional autonomy'**

If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and fear they lack autonomy in their clinical role (M).

GPs and facilitators pointed to the difficulty of reaching consensus on a best buy…. Some found the term 'off-putting' because of its financial connotations. This suggests that some GPs may feel that their management decisions should be based on wider considerations than those of cost-effectiveness[3].

GPs were also unlikely to take part if they felt that the sessions would make them feel unsafe or if they felt that the sessions were yet another 'top-down' managerial intervention, where the main intention was to reduce prescribing costs[3].

The majority of respondents in both regions expected to benefit from participation in QCs but were unwilling to accept the risk that QI could be misused for control or cost reduction [translated from German][1].

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CMO configuration 15: **'positive interdependence among group members'**

If participants maintain an atmosphere of trust in a learning environment that promotes the exchange of knowledge, assisted by facilitators who use professional techniques (e.g. contentious discussion, reaching consensus and role play) (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as similar, and so act and negotiate cooperatively to reach a common goal (M).

The acquisition of new knowledge, skills, and approaches to bridge this gap follows. Often, however, access to new information alone is not sufficient. Reflection and discussion are necessary to help physicians 1) identify areas where current practice requires change and 2) develop strategies to integrate this new approach[10].

There was widespread agreement that the principal requisites for a good facilitator were experience and competence in small-group skills. One facilitator identified another skill: 'You've got to be able to hold the tension between comforting and challenging'[7].

The personal interaction and mutual influence between colleagues implicitly resulted in an individual or group contract[24].

Psychological research into group behaviour has produced an inventory of factors that influence conformity with group standards. Unanimity provides more pressure to conform, while privacy makes it easier not to[25].

CMO configuration 16: **'identifying and removing barriers to change'**

If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O) because participants help each other to develop strategies to identify and overcome these barriers (M).

Barriers within doctors relate to competence, motivation and attitudes, and personal characteristics such as learning style, whereas barriers within practices exist as doctors do not work entirely independently[26].

Within the group, members endeavour to identify specific barriers to these practice changes and to formulate implementation strategies to facilitate desired changes[10].

The implementation of new knowledge is facilitated by expressing and discussing how to overcome obstacles to its acceptance[25].

CMO configuration 17: **'need for competence, autonomy and relatedness'**

If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility and stewardship (O) because this fulfils their need for competence (being able to achieve specific objectives) (M), autonomy (a feeling of being in control of their own behaviour) (M), and relatedness (a sense of connection to a larger group) (M).

The decentralised approach at a local, internal level includes participants gathering experience from daily practice and formulating a feasible consensus solution. The advantage of this method is that GPs are actively involved in this process and therefore motivated to implement the (newly) developed guidelines. In addition, the participants involved will be more likely to accept (new knowledge) and feel committed to implement it [translated from German][16].

Potential advantages of the local approach: it promotes buy-in, maximizes fit to local culture and circumstances, maximizes the ability to work out the details associated with implementation, and produces a highly rewarding experience[12].

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CMO configuration 18: **'intention to change'** If participants publicly announce their intention to change (C), then they are more likely to implement the change (O) because they and others in the group all think it is a good idea and believe they can carry it through (M). *I was surprised to see how willing people were to reflect on their own behaviour and practice e... and constantly make comments like: 'Well, did I really do that? I surely have to pull myself together'. Very strong will, apparently, to make changes*[9]. *The third was the development of individual and group plans for change, to stimulate GPs to really put their plans into daily practice*[20]. *Groups can be more effective in accomplishing tasks, and publicly announcing behavioural changes results in more commitment than private change*[25]. *… draws on 'the theory of planned behaviour' and other studies that have identified the pre-requisites of successful behaviour change in general practice reviewed by Veninga et al. 2000*[3].
CMO configuration 19: **'testing new knowledge'** If participants validate and test new knowledge in a QC, moderated by a skilled facilitator in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M). *Interactive approaches, however, can be effective, particularly when they involve participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases, provide feedback on performance, and offer opportunities for practising newly learned skills*[10]. *Understanding application of new knowledge. The discussions helped members to consider translating evidence into practice: 'Sometimes you can read about things but are unable to see how to put it into practice and I feel PBSGL enables you to think how you can do that'*[5]. *Next, they examined empirical evidence concerning the validity of these solutions. To facilitate this process, teams had access to the large resource library that the research team had assembled*[12].
CMO configuration 20: **'gaining confidence in an innovation'** If the group repeatedly practises implementing and adjusting to an innovation (C), then its members trust their own competence and turn the innovation into a habit (O) because successful outcomes increase their confidence in their abilities (M). *One meeting may not be enough to actually change treatment, although that is the usual procedure in the peer review groups. Behavioural theories stress the importance of repetition, especially for changing routine behaviour*[2]. *In general, GPs were excited to find in the second year that they had indeed changed in accordance with their plans, and they were then usually more motivated to implement further changes*[20]. *These results demonstrate the need to look at repeating/reinforcing messages at 12–24-month intervals*[27]. *The constant feedback on progress achieved and the further possible improvements are other success factors*[28].

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The intervention comprised repeated feedback on prescribing routines and an intensive programme of educational small group sessions, as described by Bahrs et al. (2001)[29].
CMO configuration 21: **'repetition priming and automaticity'** If participants build a regular group and practise using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because responses improve with repetition: 'practice makes perfect' (M). *Practitioners develop expertise when they move from their comfort zones to examine problems 'at the upper limit of the complexity they can handle'; they learn, and iteratively gain mastery through cycles of reflecting on practice, obtaining feedback, and adjusting performance[19].* *The benefit from participation depended significantly on the frequency of the meetings. Successful projects might not only positively reinforce the introduction of continuous QI, but could also bring about a positive attitude to the other aspects of systematic and continuous quality improvement[30].* *Real improvements to performance in daily care can only occur if there is an ongoing and regular quality circle process [translated from German][31].*

In blue: changed wording

CMO configurations across papers

Context mechanism outcome configuration 1: 'participants know what to expect'

Improved wording: If the introductory workshop conveys the principles of QI in PHC and the workings of QCs (social persuasion) (C), this will increase future participants' motivation to join QCs (O) because they learn what to expect and may feel that they are capable of meeting expectations (increase of self-efficacy) (M).

The introduction strategy included a meeting with all staff in which the model was explained, a manual on theoretical and practical backgrounds of the model; support in the use of the model and the start of a first improvement project; a one-day course on quality management ….[32].

This (small projects) seems to be in accordance with previous findings where improvement of the internal structure is often seen as the first step towards the full adoption of continuous quality improvement. It is sensible therefore to advise practices to start with this kind of improvement project[32].

Our findings stress the importance of starting CQI with small, easy-to-handle projects[30].

For CQI to be introduced successfully, a positive attitude toward CQI is required from all who will be working with it[30].

(They) learned how to organise the meetings, how to guide the members of a peer group through the steps of the quality circle, and how to deal with group processes[33].

Introduction of the model … is important for understanding and helps participants during the start of the process. It was also vital to have a common and shared understanding of the problem among participants[2].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

In September 1992, 200 general practitioners and internists of a defined postal code area were contacted by the Kassel district office of the Kassenärztliche Vereinigung Hessen and invited to an information event [translated from German][34].

It might be better to provide targeted information in advance of the project at an information event. This would make it easier for potential participants to decide for or against participating in the project, since questions as well as fears and reservations can be clarified immediately [translated from German][31].

Surveys have revealed far-reaching gaps in information, some of which are the cause of misunderstandings and misjudgements. In particular, the working methods and objectives of medical quality circles are apparently insufficiently known. Better general information on this subject, which contracted doctors in particular, expect from their KV (health insurance company), is therefore urgently needed. As examples from the Netherlands and Great Britain show, active information from the target group is a basic prerequisite for quality-enhancing measures in practice [translated from German][1].

Introduction of the model … is important for understanding and helps participants during the start of the process. It was also vital to have a common and shared understanding of the problem among participants. It is worthwhile taking the time for an agreement on shared guidelines …….[2].

To deal with these issues (information overload), an initial, introductory session of 'Reflective Practice' needs to be included, where GPs' experience of previous prescribing management interventions can be aired, where safe 'rules of engagement' can be agreed, and the purpose of the 'reflective practice' intervention made explicit[3].

A more structured introductory meeting that would assess participants' learning needs, negotiate the future content of the small group meetings, seek agreement on learning agenda, dates, times and venues, establishing communication channels and explicitly discussing the educational rationale[35].

Context mechanism outcome configuration 2: 'need for autonomy and obligation''

Improved wording: If the administration at the national level or at the level of health insurance companies entrusts GPs with QI and autonomy (puts them in control of how do it) (C), then GPs may consider participating in QCs (O) because they feel they can take on the responsibility and make a difference (M).

Social Law Code has given new impetus to the obligation of the associations of statutory health insurance physicians to implement quality assurance measures. As early as 1991, the board of the Kassenärztliche Vereinigung decided to introduce nationwide quality circles as an instrument of quality assurance in outpatient care [translated from German][34].

In January 1993, the Association of Statutory Health Insurance Physicians in Southern Baden constituted an interdisciplinary working group with the aim of developing the organisational and conceptual framework for the establishment of quality circles in the Southern Baden region [translated from German][36].

The participants expressed their fears that participation in the quality circle could lead to possible regulation by KV or health insurance companies [translated from German][37].

The respondents are suspicious of an obligation for all physicians to participate in quality assurance measures. In Saxony-Anhalt in particular - as shown by the clear statements made by those surveyed - this scepticism is linked to the consideration that a commitment to quality assurance measures would be more acceptable if it also affected those colleagues who refrain from continuous medical education training [translated from German][1].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

In 1993, the health structure law ('Gesundheitsstrukturgesetz') added more specific recommendations to the existing body of rules about quality assurance with the explicit aim to stimulate quality assurance programs (quality circles) in primary and hospital care[31].

The participation of German GPs in QCs is mandatory in order to be part of government-funded disease management programs (DMPs) or to be part of pilot projects with health insurance funds[23].

Furthermore, some differences between the regions could be observed. In region 1 the impact seemed highest, which may be explained by the activities of the Association of Statutory Health Insurance ('Kassenarztliche Vereinigung') in that region regarding continuing professional education[38].

Research evidence showed that budget constraints could reduce prescribing volume and costs (14 Sturm H 2007)[38].

In the discussion with facilitators, the QC participants expressed their desire to be self-determined and work independently. For this reason, the Federal Association of Statutory Health Insurance Physicians (KBV) and the Associations of Statutory Health Insurance Physicians (KVen) have laid down the thematic and methodological autonomy of QCs as a prerequisite in their guidelines for quality circle work and have committed themselves to supporting them [translated from German][4].

Context mechanism outcome configuration 3: 'sharing similar needs'

If the administration at the organisational level of QCs provides administrative support (i.e. for training facilitators, data gathering, provision of evidence-based information), and the administration protects time and space, and offers CME points, and small financial incentives to QC participants (C), then they will meet in groups to exchange ideas (O) because GPs prefer learning in QCs (M); support generates positive expectations among participants (M) and GPs think QC meetings with their peers will be useful (M).

contextual features at the organisational level:

With a restricted although realistic budget, facilitation should be set up as efficiently and effectively as possible[32].

We have a very busy schedule most of the time, leaving little or no time for extra work[30].

It was mainly a logistics problem. We have little room in practice[30].

We already had so many meetings and we have so many tasks to fulfil. I work in a health care centre[30].

I have often postponed things knowingly. Sometimes the bucket just overflowed[30].

Staying close to the needs and expectations of the practices could be a way to introduce continuous quality improvement more effectively[32].

We also found that the available time and possibilities to plan activities well were felt to be the most important barriers to using the CQI model[30].

When there are great obstacles to change (e.g. limited time, the need to acquire a new skill), the group might decide to set aside time to specifically address strategies for overcoming these barriers[10].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

As a discussion platform, we developed special facilitator manuals according to a uniform didactic concept. It includes relevant clinical portraits (sleep disorders, back pain, upper abdominal pain, heart failure, etc.) in general practice. These materials provide the facilitators with guidance and make it possible to stimulate and supplement the problem-oriented discussion of the diagnostic and therapeutic procedure at critical points. ...In our opinion, the advantage of this approach is that it makes it easier to get started with concrete quality circle work and that quality circles can be implemented on a broad basis [translated from German][36].

External support should help with the administrative organisation of QCs, as this exceeds the time capacity of the facilitators [translated from German][1].

The majority of respondents (85%) [HB: 87.1%] want or even urgently demand support for quality circle work from their Association of Statutory Health Insurance. In Saxony-Anhalt, the vast majority of respondents want both organisational support (e.g. by making rooms available, making contacts and making those contacts available - "start-up on site" - and granting reimbursement of expenses) and content-related support (e.g. by providing materials, topic recommendations, arranging speakers). In Bremen, primarily organisational support is expected [translated from German][1].

The fact that all groups are led by recognised (i.e. trained) facilitators speaks for the existing structural quality. The high level of continuity and frequency of participation also suggests that structural conditions such as accessibility, suitable conference room and location, clear scheduling, etc. are in place [translated from German][14].

In some cases, the KVs took different approaches, for example by organising external facilitator training courses, developing special structure of QC meeting or supervision of facilitators [translated from German][4].

In addition, long-term maintenance of small groups implies a national support for CME in general practice with enough personnel and economic resources to assist all those GPs who have key roles in providing CME at the local level[8].

Participation, ..., does not come without costs. ..., it is time consuming, ... For clinicians, who often see patients continuously throughout the day, it can be especially difficult to find time to participate in QI efforts[12].

... substantial organizational resources ...., including tools that the QI teams could use to develop their programs and the costs of the local approach facilitator. ... HealthOrg covered some but not all of the time that participants spent outside of formal meetings, ...[12].

Staying close to the needs and expectations of the practices could be a way to introduce continuous quality improvement more effectively[32].

The peer groups met on a regular basis according to their needs[33].

...as a so called "clinical theme-course", which will give the participants important CME credits[13].

In Norway, specialists in general practice must renew their clinical specialty every five years. In this renewal process, participation in a number of peer CME group meetings are compulsory, in order to stimulate a continuously medical education and reflection[39].

CME group members earned CME points to renew their speciality[9].

General practitioners (GPs) favour learning environments such as reading journals, discussion with colleagues, and participation in quality circles[9].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

GP specialists have to renew their specialty every 5 years. Recertification demands participation in a number of peer CME group meetings. Typically, a peer CME group comprises seven or eight GPs who set up their own educational programme for monthly evening meetings[40].

The strategy also fts in well with the work setting of many GPs in European and non-European countries, which are often characterised by small practices, relatively isolated settings and a desire for more contacts with peers[20].

The innovative, multifaceted strategy for improving test ordering behaviour was favourably evaluated by a large GP population. All local GP groups expressed a desire for continuation of the meetings after the experiment[20].

GPs appreciate the combination of individual feedback, discussions about guidelines and small group quality improvement meetings driven by peer influence[20].

Success rates of specific strategies seem to be strongly influenced by the extent to which they fit in with the local and organizational context and the physicians' day-today work routines[24].

The first success was the easy recruitment, with practice groups eager to participate in the trial[24].

…these groups of professionals practising in the same region meet regularly to discuss treatment, pharmacotherapy, and patient management[25].

We have also arranged for CME credits, needed to fulfil the educational requirements of ongoing licensure[6].

General practitioners can discuss topics relevant to day-to-day practice. They get access to a local expert … l. Since topics come out of their own and their peers' practices, and are discussed by the expert, it is more likely that perceived and unperceived needs will be addressed[6].

…that a small group format might be more attractive than other forms of CME, since this has been our experience[6].

This learning format may meet a need for practices that have protected learning time to enable them to use multi-professional group learning to its full advantage[41].

PBSGL enabled participants to compare their practice with that of their peers, and this was mentioned frequently as a very positive motivator in joining and continuing in the groups[7].

…with surprisingly few opportunities to gauge themselves and their practice against their peers, and they have been found to value this opportunity highly[7].

The most-cited reason for joining PBSGL … as the PBSGL format matched their preferred learning style. …. Keeping up-to-date in clinical practice was the second-most mentioned reason[5].

The most significant outcome did not come from the evaluative data collected during the research; rather that both groups are continuing to meet more than six months after the pilot finished[42].

PBSG enabled participants to compare their practice with that of their peers, and this was mentioned frequently as a very positive motivator in joining and continuing in the groups. This corroborates previous work which found this to be an enhancer for translating research into practice[7].

The reasons for participation varied and ranged from overcoming the lone fighter situation in the practice, defining the image of the family doctor, possibilities and limits, to searching for practical solutions to everyday treatment problems [translated from German][34].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The most frequently mentioned motives for participating in quality circles were practical help and exchange of experience (57 and 58 mentions) [translated from German][21].

The vast majority of participants cite the collegial exchange of experience as the greatest motivating factor for working in a quality circle. The primary goal is to improve the collegial relationships. At the same time, the desire for more consensus in medical action and the improvement of skills in diagnostics and therapy is mentioned as a very important objective [translated from German][16].

The main motives for participating in quality circles were the expectation of practical help for one's own practice, inter-collegial exchange of experience, improvement of patient care and opportunities for self-reflection on one's own work as well as personal support. Competing time commitments and above all the fear of external controls were mentioned as obstacles to participation in quality circles [translated from German][1].

Quality assurance in outpatient care was considered necessary - even more so in Saxony-Anhalt than in Bremen [translated from German][1].

External staff should organise QCs as facilitators have too little time to do this [translated from German][1].

The summary makes it clear that the question of participation in a quality circle is primarily based on specific medical needs. Many physicians wish to receive practical assistance in their daily practice and wish to overcome the structurally dependent professional and emotional isolation through intercollegial exchange. The most important goal is therefore personal support [translated from German][1].

Overall, more than 86% of the participants were (very) satisfied with the work in the quality circle. In contrast, only 2.8% were dissatisfied and 0.4% very dissatisfied [translated from German][43].

For almost all participants (97.1 percent), the desire to analyse their own prescribing behaviour and to optimise it with the help of the prescription data evaluation of colleagues was at the top of the list. The exchange of experience with colleagues and the expansion and refreshing of knowledge regarding pharmacotherapy were also considered important [translated from German][44].

Data from older surveys showed that family physicians indicated colleagues most often as information sources, followed by journals and books…. The most important requirements for media in medical education as perceived by the participants were its relevancy for daily practice and dependability[23].

… we … predict that German general practitioners … favour the "classical" learning environments such as: journals, colleagues, and quality circles. journals and books. … exchange ideas and discuss actual trends with colleagues collegial and interactive rather than to meet experts …[23].

The second key area of expectation was with the promotion of collegial exchange: more than conventional further-training events, quality circles assumed that a special form of group work by doctors would be a way of overcoming isolation in the private practice [translated from German][1].

To ensure attendance in the future, the educational sessions need to be protected by the use of a paid locum, in the same way as other practice development work is now being supported[3].

The workshop was based on a provincial learning needs assessment and data from focus groups of family physicians from each of the provinces to ensure the curriculum material would meet the needs of physicians across Canada[45].

One of the strengths of the programme is its adaptation to the needs of GPs and pharmacists [translated from French][46].

GPs' participation in PPQC meetings is accredited by the association for their continuing education[28].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

when asked, GPs also express a need for drug information/education that is academic and not promotional[47].

The participants were not offered any extra incentives, except for the education itself[47].

Doctors learn best when they recognise the need for learning and when learning is self-directed[8].

Many studies have shown that small group sessions are one of the most popular and stimulating CME activities practised by doctors[8].

The idea of problem-based and self-directed learning from everyday practice, closely linked to quality improvement, seemed to appeal to many Swedish GPs and the CME programme was successively accepted by the majority of them[8].

A meeting attendance fee was paid to the GPs, €70/hour for a plenary meeting (with the consultants), €45/hour for a quality circle meeting[48].

The brief qualitative responses indicated that participants chose to join the small groups mainly because …there is a better rapport between the individuals and one gains more than just attending a lecture[35].

The importance of a needs-identification process and the involvement of the programme user group in this process have been identified as crucial factors in the success of any effective learning programme[27].

Beginning in 2005, attendees received category-I CME credit[19].

Context mechanism outcome configuration 4: 'need for relatedness'

Improved wording: If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g., introduces people to each other, opens discussions, clarifies and summarizes statements (C), then group members will get to know each other and norm rules that they are willing to follow and build safe environment based on trust (O), because members want to be among and to interact with equals (M).

The groups were different ... we thought that a group is a group and all we have to do is to run the scheme ...and then I experienced that groups have their own cultures. These groups have existed for a while, which we probably have to consider …[9].

Tutors did not consider themselves as "experts" but as "one of them"., Being open about their background as GPs was an agreed upon strategy, and tutors deliberately tried to avoid being perceived as experts: The tutors experienced that their own background was important for GPs' trust and acceptance[9].

Both tutors and GPs emphasised that a "good atmosphere" in the group, and "a sense of security" among group members was essential for an open and constructive discussion[9].

Membership in the peer review group has been stable over time because it is unusual for general practitioners (and their patients) to switch between groups[2].

CME has focused on disseminating information, but it has become increasingly clear that acquisition of knowledge is less important in changing physicians' behaviour than the social context of learning. Habit and custom, the beliefs of peers, and social norms are the major determinants[49].

Sessions are generally held in the evenings with a meal[6].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

We estimate it took three to four sessions for the group to be comfortable with this process. Open discussions and debates then came more freely, and the group continued to gel[6].

The need to maintain the appearance of competence may be more compelling than the need to learn. Several strategies …. First, we tried to create as relaxed an atmosphere as possible. We arranged tables in a circle, removed all barriers …, and held the sessions with a meal[6].

The group and the interactive format are fun[6].

Initially, problems with group functioning were anticipated, but they are … uncommon. Groups of various compositions function effectively in this particular small group environment. … heterogeneous groups might provide broader practice experiences and greater variety in potential solutions to practice problems…[10].

Participants liked the inclusive nature of the small groups and appreciated the egalitarian quality of the interaction within them[7]*. [No hierarchy]*

It didn't matter where we came from; Skye, Wick or Brora. It soon became clear that we were all in the same learning position. And those in Inverness and Aberdeen didn't have all the answers[7].

When the expert comes in, learning stops. … The use of invited experts (invariably hospital-based consultants using a traditional didactic approach to learning) was seen as an anathema to adult learning and the small-group ethos[7].

Members of both groups described the meetings as relaxed, friendly and informal. The facilitators played a crucial role in creating the atmosphere: …, it would seem that the group members also contributed to the positive climate[5].

Reasonably quickly I relaxed. Everybody was keen to make it a success. The group opened up and there was a sense of calm. The positive atmosphere enabled members to be open about knowledge gaps and to ask questions[5].

The two groups appear to be at different stages of development. Group 1 seems to have developed a strong sense of cohesion quite quickly compared to Group 2[5].

Interestingly, the stage of storming, which is characterized by interpersonal hostility and conflict, was not evident in either group[5].

Norming reflects the development of group cohesion, openness and emotional support. The positive social dimension enabled the group to perform – that is, to focus on the task at hand, with resulting effectiveness[5].

To encourage GPs' engagement, all sessions took place over lunchtime, and a sandwich lunch was provided. GPs gained PGEA accreditation for their participation[3].

…, two practices have instituted a regular morning coffee break, which was described in positive terms as a discussion: "The indigestion .. has come up, and we have a coffee break and quite often discuss clinical things and some comments have come out about that"[3].

The success of group learning between GPs within a practice depends to a large extent on the quality of relationships within the group. Where individuals feel that their management decisions are under threat from colleagues with whose judgements, they are not comfortable, discussion may be abruptly curtailed[3].

Most participants stressed the benefits of the intervention for facilitating discussion, which was implicit in the design of the educational intervention. This seemed to counteract the convention of autonomous working practices by GPs, which can lead to professional isolation, even in partnerships[3].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

(GPs) in non-academic settings have few safe and reliable forums where they can reflect and learn from the clinical dilemmas inherent in their work[19].

"Being with colleagues" ... yield four subthemes: (1) gaining renewal through reflection, (2) obtaining others' perspectives, (3) developing collegial trust, and (4) learning specific information/skills .... Over half of the respondents commented on time issues related to participation; a third saw time constraints as deterring attendance[19].

They will facilitate the discussion ..., based on the individual feedback reports, enabling participants to compare own prescription patterns ..... This will probably trigger discussion ..., aimed at critical reflection towards own prescription strategies for elderly patients and facilitating disclosure of areas where individual improvements may be desirable[39]. [Facilitation]

Facilitators .... trained .... over approximately 20 training hours. Facilitators provided ... opportunity for all participants to ask questions .... We ... encouraged participants to discuss their ...practice patterns. The facilitator ...redirected conversations that moved off topic, calmed the skeptics, and encouraged quieter participants to share their personal experiences[6]. [Facilitation]

In the mature group, the facilitator's major role is to introduce the expert to the group and the process, and to provide some closure at the end of the meeting[6].

... tasks of the facilitator are to focus discussion ... to encourage the group to identify factors that ... hinder implementation of new knowledge ... . To successfully fulfil this role, facilitators ...establish a safe, supportive environment ... identify practice gaps and encourage the discussion of sensitive ... issues[10]. [Facilitation]

The role of the facilitator has been recognised. He/she needs to be competent at many tasks including opening the discussion, clarifying, summarising, questioning, and devising strategies to improve group function[7]. [Facilitation]

There was widespread agreement that the principal requisites for a good facilitator were experience and competence in small-group skills. One facilitator identified another skill: 'You've got to be able to hold the tension between comforting and challenging[7]. [Facilitation]

The facilitators were also skilled in encouraging participation[5]. [Facilitation]

'I think you need a facilitator certainly need it for the donkey work of the, arranging the meeting and making sure everybody has the module[17]. [Facilitation]

'It gives you licence to play devil's advocate as well and challenge people a bit more whereas if you were always doing that as just a group member, people might think you were just doing it to annoy them[17]. [Facilitation]

Participants considered that one-to-one mentorship with an experienced or established PBSGL facilitator would be very beneficial. This was also suggested as a method to encourage members of existing groups to train as facilitators[17]. [Facilitation]

Any anxieties that potential facilitators may feel, mainly the concern that a new group will be hard to form, or will be dysfunctional, – need to be discussed with potential facilitators before and during the initial training. Facilitators of such groups will need the most support ...[17]. [Facilitation]

In countries using PBSGL, national networks provide training for facilitators and supporting material for the groups[10]. [Facilitation].

The facilitator is selected by the group[10]. [Facilitation]

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The reasons for participation varied and ranged from overcoming the lone fighter situation in the practice, defining the image of the family doctor, possibilities and limits, to searching for practical solutions to everyday treatment problems [translated from German][34]. [Facilitation]

Our group prepared the facilitators for their task in two one-day training sessions. They had to conduct a model quality circle and critically discuss their role based on a pre-developed manual. In the second training course, we taught them important basic knowledge of group dynamics and basic didactic skills for their role as a facilitator [translated from German][36]. [Facilitation]

The vast majority of participants cite the collegial exchange of experience as the greatest motivating factor for working in a quality circle. The primary goal is to improve the collegial relationships. At the same time, the desire for more consensus in medical action and the improvement of skills in diagnostics and therapy is mentioned as a very important objective [translated from German][16].

The summary makes it clear that the question of participation in a quality circle is primarily based on specific medical needs. Many physicians wish to receive practical assistance in their daily practice and wish to overcome the structurally dependent professional and emotional isolation through intercollegial exchange. The most important goal is therefore personal support [translated from German][1].

1-2 doctors from each group took on the task of the facilitation. AQUA employees trained and supported them during the course of the project. They also prepared facilitation materials and provided organisational support [translated from German][43]. [Facilitation]

The groups were moderated by a primary care physician, who had had a 2-day training on moderation of quality circles and who received supervision in about two sessions per year. One session per 1 or 2 months was planned[38]. [Facilitation]

For this purpose (tutor system to support the moderators) 50 experienced facilitators were trained as quality circle tutors, who have been responsible for the training and further training of facilitators since 2001. In 2002 the KV Westfalen-Lippe followed this concept and trained 30 tutors. The encouraging experiences from both projects led to the KBV introducing the concept at a federal level in 2003. Since then it has trained 116 tutors [translated from German][4]. [Facilitation]

In order to support the facilitators in the design of circle meetings, the KBV has developed structured didactic handouts for circle work, so-called quality circle manuals.... The materials are to be understood as recommendations.... [translated from German][4]. [Facilitation]

The (facilitator) training usually lasts two days, i.e. between eight and 16 hours, usually twelve hours. ... In all twelve KVs, the trainers use the Quality Circle Handbook and their manuals. Further training for facilitators usually takes place in one day and lasts between three and ten hours [translated from German][4]. [Facilitation]

The CQC facilitators were local family physicians recruited and trained specifically to lead study meetings. They were chosen by the CQC steering committee for their skills in facilitating small-group activities, their known interest in chronic disease management, and their involvement in continuing professional development[45]. [Facilitation]

Before the meetings, train-the-trainer workshops were conducted to assist facilitators in their role as group leaders[45]. [Facilitation]

Facilitators were local family physicians recruited to lead and initiate discussion at study meetings and were chosen because of their skills in small group facilitation and involvement in continuing professional development and were selected by the study's steering committee[50]. [Facilitation]

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

... facilitation skills and aptitude were ... important … …. As one of the GPs commented …: "I think the person's much more important than their background." A facilitators' ability to manage a group successfully was central. ... a good facilitator should "... whipping us into line"[3]. [Facilitation]

The ability of the facilitator to manage group discussions, … to create an atmosphere that was non-threatening and supportive. … willing to challenge the group when members colluded with one another to evade potentially contentious issues[3]. [Facilitation]

The respect of the group for the facilitator was crucial to the success of the intervention. Facilitators needed to be grounded in a sound knowledge of prescribed medicines, but also needed to have group facilitation skills[3]. [Facilitation]

Context mechanism outcome configuration 5: 'need for autonomy and control'

If the group chooses its own topics and facilitator (C), then they will feel they own the QC (O) because their need for autonomy is satisfied (a feeling of being in control of their own behaviour) (M).

Tutors did not consider themselves as "experts" but as "one of them". Being open about their background as GPs was an agreed-upon strategy, and tutors deliberately tried to avoid being perceived as experts. The tutors experienced that their own background was important for GPs' trust and acceptance[9].

The extra benefits gained by using GPs instead of non-physicians as (facilitators) have also been reported in a Dutch study[40].

A final limitation, caused by the study design is the fact that the peer groups did not have the opportunity to choose their own topics, …. After reading and discussing the content of the workbooks the peer-review groups defined self-selected change objectives[33].

A bottom-up approach to CQI stands central, along with an active role for the practice team and the application of a clearly structured, stepwise problem-solving method to develop and implement the improvement plans[51].

it is crucial to the model that practice teams formulate goals for improvement and attempt to achieve these goals in small scale[32].

Reasons that were reported most often included "the subject chosen was felt to be a problem or a bottleneck in practice management", "the practice wanted to implement the national guidelines (on that specific topic)", and "the outcomes of the audit report"[32].

As practices were free to select their own topics for improvement and set their own objectives, the fact that the intervention group met a significantly greater number of self-defined improvement objectives than the control group is an important finding[51].

it consists of involving all staff, holding regular meetings on quality, designating a quality coordinator, and writing annual plans and reports on quality improvement[32].

…. were willing to continue using the model, but were less positive about the quality cycle and preparing an annual report[30].

(many physicians) …. felt that activities not directly related to practice work[30].

The groups themselves generate topics for modules, with the subsequent module being authored by a GP[10].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Each group decided the frequency, timing and location of the meetings at the first introductory meeting. Each group also decided their preferred method for module selection[41].

The facilitator is selected by the group[10].

The same publication points out that GPs – due to the lack of therapeutic consequences – do not seriously wish to diagnose the illness[52].

The group established common criteria for carrying out an inventory of needs using a standardised form of documentation of the QC process [translated from German][34].

This (negative) assessment (of QC work) could be an expression of resistance and reservations regarding the background of the project and gaining participants, and thus an implicit plea for voluntariness and self-determination as the most important characteristic of medical QC [translated from German][37].

The main focus of our analysis is on the characteristics of successful quality circle work that can be derived from theory, as they are also laid down in the above mentioned quality assurance guideline: group constancy and continuity, experience-based work on self-chosen topics, collegial group climate and goal orientation towards quality promotion in one's own practice [translated from German][14].

The participants of the circle determine the questions concerning the content themselves [translated from German][4].

It is important for a learner to be in control of his or her learning process, to be motivated, and to perceive meaningfulness[11].

At the beginning … GPs were induced to attend … with criticism. At first, … GPs participated somewhat reluctantly 'in order to avoid trouble', but over time most of them began to look forward to regular attendance and enjoyed … opportunity for an exchange … in a relaxed setting[53].

The rise of evidenced-based medical guidelines … decreases individual providers' autonomy. Physicians have raised similar concerns about threats to the autonomy of their profession …. It is within this context, … declining perceived autonomy for …. physicians, … we compare the participatory local and central expert approaches to QI[12].

Topic identification is collaborative, end-user driven and uses local data, literature review and input from small group members Groups are peer-led and membership is ...[27].

Context mechanism outcome configuration 6: 'size of the group affects communication'

Improved wording: If group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with all participants and follow their conversations (M).

All GPs participating in such peer groups, on average consisting of six to eight peers, located in southern Norway[13].

The mean group size was 7.4 ± 2.7[20].

Our group usually has 12 to 15 participants, an expert, and a facilitator. We are primarily composed of generalists and family physicians, but regularly invite a pharmacist and a representative from the sponsoring pharmaceutical company[6].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Groups of 4 to 10 family physicians form a PBSG in their own communities, meeting for an average of 90 minutes once or twice a month at an agreed upon time and place, allowing time off for holidays and summer vacations[10].

How can QCs be supported? (Table 2) Group sizes > 15 or < 5 - are problematic and participants need support [translated from German][14].

A maximum of 15 physicians in each geographical area were enrolled into each circle in the study[50].

Thus, it is a stable and voluntary group of five to eight doctors who meet about five times a year with a pharmacist, expert and facilitator, in a context of interdisciplinary continuing education [translated from French][46].

A quality circle is a stable group of 3–10 GPs with … 1 trained pharmacist. Pharmacists volunteer as facilitators and are responsible for motivating local GPs to participate. They … organize the practical … (e.g., rooms, agenda) and get the prescribing profiles of the participating GPs)[28].

GPs had to join as groups; c) groups had to be pre-existing; d) the preferred group size was three to six[11].

The effect of the educational asthma programme was partly modified by the group size; prescribing behaviour for (asthma) exacerbations improved more in smaller groups. The group size varied from 4 to 13 ……. This result is ……. an optimal group size of 5 to 6 group members[15].

Although the optimum number of participants for quality circles is between eight and 10, when necessary, up to 16 per circle were allowed[53].

These are groups of ~10 GPs who meet monthly to discuss topics related to clinical practice. Group membership was constant and members of the same practice were grouped together where possible[27].

Context mechanism outcome configuration 7: 'feeling safe and not vulnerable'

Improved wording: If participants trust each other (C), then they can disclose how they work and also the holes in their knowledge (O), because they feel safe rather than vulnerable (M).

I was surprised to see how willing people were to reflect on their own behaviour and practice ... and constantly comment like: "Well, did I really do that? I surely have to pull myself together". Very strong will, apparently, to make changes[9].

GPs generally experienced the CME group as a safe setting to present and discuss their feedback reports: It would have been more embarrassing if it had been in a large lecture hall or a large seminar[9].

A shared understanding of the complex decision-making involved in prescribing in general practice was reported by both GPs and tutors as essential for an open discussion in the CME groups[9].

GPs generally experienced the CME group as a safe setting to present and discuss their feedback reports[9].

After a while, it may become less needed, because participants may then feel more safe about discussing their own behaviour within the group as a whole[20].

…greater insights into and discussion of the physicians' own performance in a safe group of respected colleagues would be a powerful instrument to improve the quality of test ordering[24].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

What have you gained from participating in this practice-based small group learning project? small group support: the group works effectively together and as time progressed, I was able to participate more effectively as my confidence grew[41].

…. particularly when they involve participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases and provide feedback on performance[10].

In time, group members develop confidence and security in the group, rendering the disclosure of ignorance and ''blind spots of knowledge'' easier. Group members could either use the whole group or parts of it to assess their own learning needs[8].

It became evident that the only environment in which this intervention could flourish was one that was safe and interesting … [3].

GPs were also unlikely to take part if they felt that the sessions would make them feel unsafe[3].

Context mechanism outcome configuration 8: 'need for competence and self-actualisation'

If the facilitator supports participants and encourages them to tell their stories and share their experiences in a safe environment, e.g., by encouraging interactive responses, through discussions and by summarising statements, (C) then participants will be involved and share their positive experiences and failures (O) because they want to improve their professional competence, (M), gain professional confidence (M) and fulfil their professional potential (M).

…. that an improvement in prescription behaviour could be obtained in a group setting where the participants knew each other well and were used to discussing challenging topics related to their own clinical practices[54].

Both GPs and tutors experienced that sharing the experience of being a GP contributed to an open and constructive discussion[9].

Reflective thinking increased among GPs; they were able to reflect their individual prescription habits in the CME group. Inappropriate results could put some GPs in distress in front of the group (Frich et al., 2010)[9].

Another important topic of debate was how to deal with the frequent requests by patients to have inappropriate tests performed[55].

The decision to focus on clinical problems instead of tests was a good choice, since it allowed the feedback and group work to be linked to national evidence-based guidelines. GPs appreciated this approach, because it was also closely related to their everyday work routine[20].

There is some empirical evidence that participating in quality circles may increase GPs' job satisfaction[20].

Various members expressed a desire to keep up to date …. Others wanted to compare what they were doing with their peers, to confirm that they were practising safely …. Participants …stated that they wanted to be able to examine current evidence and to improve their critical appraisal skills[7].

The need to maintain the appearance of competence may be more compelling than the need to learn. Several strategies …. First, we tried to create as relaxed an atmosphere as possible. We arranged tables in a circle, removed all barriers …, and held the sessions with a meal[6].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The facilitator elicited interactive responses … with the aid of specific predetermined prompting questions and responses. The program participants resolved practice-based problems …. The best practices were determined by the group as a whole and conflict resolution was achieved with the mediation of the content expert, if required[56].

The cases were regarded as not only appropriate but also reflecting practical problems in office practice[56].

...the success of this format depends on availability of course material that reflects practice based clinical problems and on the important roles of specially trained facilitator[56].

The ability to change practice is enhanced if skills are endorsed by trusted colleagues and supported by published literature, and there is opportunity for practice and feedback[6].

The ability to change practice is enhanced if skills are endorsed by trusted colleagues and supported by published literature, and there is opportunity for practice and feedback[6].

An interactive small group can prompt moderately large changes in physician practice[10].

..comparison with one's peers was important, as was the support, confidence and reassurance that some gained from being part of the group[7].

I've gained more confidence because of spending time with these people. To go in [to PBSGL meetings], be with these fellow professionals, but it was completely calm, completely non-judgemental[5].

We recognize that many personal, professional, and social forces affect attendance at CME beyond the format itself[6].

Network (SIGN) on a variety of clinical and non-clinical topics. 'Modules are much better than SIGN guidelines because they are patient based and make you think about your own practice[7].

…discussion of personal stories might help participants tackle any doubts they may have on individual cases, and it might also enable attitudes to be highlighted and perhaps modified, through hearing the views and beliefs of others. …, the group members and the facilitator may …. offered each other educational support[7].

Comparison with one's peers was important, as was the support, confidence and reassurance that some gained from being part of the group[7].

Specific assistance and solutions for actual problems in their own practice are sought and willingly accepted. Finally, a decisive factor for the motivation to work in the case-oriented QZ is the emotional relief reported by all participants [translated from German][21].

It became clear that one's own actions are influenced less by the appropriate clinical knowledge than by one's own experiences, attitudes, and interaction with patients [translated from German][34].

Each participant described his or her own case of how a family doctor deals with their own sore throats or family members' complaints [translated from German][34].

The possibility of overcoming isolation in one's own practice, a way out of isolation, as well as the experience that others have similar problems structurally and they are not different from anybody else, seems an emotional relief. Even more, the reawakening that medical action (e.g. active listening to blood pressure measurement) can be helpful and positive [translated from German][21].

Exchanging experiences in QCs, GPs can work out and clarify the characteristics of the general practice, which improves knowledge transfer [translated from German][36].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

By working within a QC, I have received more emotional support for my daily practice. The QC work should offer help with disputes/arguments and emotional relief when, comes to, for instance, very expensive therapies [translated from German][37].

The basic message was that quality circles are necessary because they promote collegial cohesion more intensively than normal training events. It is extremely important for the individual to know that their colleagues share the same problems or experiences that he or she has [translated from German][18].

....it would be easier to conduct a conversation (e.g. when dealing with desired prescriptions); a topic that is always relevant for different indication areas and where many people seem to have benefited from the exchange of experiences and the group discussion. Probably, they felt strengthened by the support from colleagues and the enhanced self-image as GPs [translated from German][43].

....in the sense of a continuous, systematic, goal-oriented, facilitated exchange of experience on the basis of specific everyday actions in practice [translated from German][14].

At the first meeting the GPs discussed in groups how they diagnose the illness, and the underlying reasons they find important when deciding on treatment[57].

Subjects, topics and cases discussed in groups come from daily work and are highly relevant to practice. The small group will meet the demands of developing generalist knowledge as well as the expert role in general practice[8].

Small groups will have opportunities to discuss the ''art of medicine'', founded upon context, anecdote, patient stories of illness and personal experiences. Accepting emotional responses being mirrored by other group members corresponds in some respects to the process in Balint groups[8].

The group should act as a forum where its members can reflect freely upon all problems that bind them together in their profession[8].

…GPs regard the group as a place for social support, …., growth in the professional role …for protection against burnout. Although … main purpose of small group work is exchange …… of knowledge, social aspects should not be neglected because they will increase the motivation to continue with meetings[8].

The desire to be more competent and ''pride in performance'' are other key forces for change, while regulatory measures have little impact[8].

In addition, small group members have unique opportunities to discuss the way the individual patient experiences his or her illness through narratives, retold by the doctor[8].

The ways in which groups worked together in sessions seemed to be key to their success. …, group members sometimes seemed to strive to demonstrate their personal high standards of patient care. … the group challenged one such statement as unrealistic …[3].

Their expectations were mostly met as they found the time to ask questions and learn from both specialist and colleagues' opinions and knowledge. They found the time spent on clarifications, discussions and questions very useful[35].

Relevant factors identified in effective training initiatives include: the use of distributed practice techniques; the development of mentor-type relationships; the use of interactive learning and skills-based training, and the use of a format which enables doctors to discuss ongoing patients[58].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

With the collaborative learning of residency training no longer available, clinicians often adopt idiosyncratic approaches when they encounter patient-care situations that cause them to question the limits of their own knowledge, … how to distinguish between their own knowledge limits and that of the medical canon—…, clinical uncertainty[19].

Social constructivist learning theorists, medical educators, and primary care researchers identify the problematic patient case as a powerful professional learning opportunity. Whether and how one decides to take on these problems in the "swampy lowlands" of practice become, according to Guest, decisions about "deliberate practice"[19].

Context mechanism outcome configuration 9: 'previous knowledge is activated'

If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by telling their own relevant stories (O) because the process activates knowledge they already possess (M).

...an important element is the focus on daily, clinical GP problems. In our study GPs preferred to talk about clinical problems and tests linked to these problems, rather than to discuss abstract phenomena like total test ordering volume or the ordering of specific tests[20].

The improvement strategy concentrated on 3 specific clinical topics (cardiovascular conditions, upper abdominal complaints, and lower abdominal complaints) and the tests used for these clinical problems, because it was believed that the physicians would prefer to discuss specific clinical topics rather than specific tests[24].

The use of a case-based format encourages activation of previous knowledge, allowing better retrieval of knowledge in the clinical setting……. particularly when it involves participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases and provides feedback on performance[10].

11/2- to 2-hour discussion period follows, in which one or two of our GP learners will present a case from their practice on the topic[6].

Group members prepare cases from their office and present them in 3 to 4 minutes, to set the stage for discussion. …, we actively solicited group participation throughout the session. This encouragement was a major function of the facilitator early on[6].

Participants were encouraged to bring their own cases in relation to the topic. In this group, members were given tasks at the end of the meeting and fed back on these at the next meeting[41].

The theoretical basis for changing practice begins with the individual physician's experience of patient care[10].

PBSG modules are designed to engage family physicians "in learning activities that are self-directed and related to authentic practice problems.... The cases, linked with important information, are the keys to stimulating discussion around patient care issues[10].

The aim is not to solve the presented problems, rather the problems should act as a stimulus to encourage the group members to identify, discuss and address cases from their own experience too[7].

Virtually everyone participates in presenting a case, asking for advice or clarification, or describing their practice patterns[6].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

During discussions at the level of relationships (case discussion), the exchange is more intense than in the exchange of pure facts; one's own behaviour is better analysed and suggestions for training in one's own practice came up [translated from German][18].

In each session, a colleague presented a difficult clinical case, which was discussed in the group according to a clearly structured manual, they sought solutions together and in the final phase, the group suggested a new treatment plan, which the presenting colleague had to try to implement in his practice [translated from German][18].

By dealing with actual clinical cases, real difficulties in the participants' everyday practice become the subject of discussion in the quality circle instead of constructed problems. In systematic reconstruction, participants make the experiences conscious, so that intuitively applied - implicit guidelines can be made explicit [translated from German][21].

Case discussions were by far the most popular agendas in groups[8].

Group work is built on sharing and improving ''collective'' knowledge and well-functioning groups provide this in an atmosphere of joy and curiosity[8].

Context mechanism outcome configuration 10: 'immediate relevance for the practice'

Improved wording: If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O), because it relates to their everyday work and is therefore of immediate use (M).

...an important element is the focus on daily, clinical GP problems. In our study GPs preferred to talk about clinical problems and tests linked to these problems, rather than to discuss abstract phenomena like total test ordering volume or the ordering of specific tests[20].

The improvement strategy concentrated on 3 specific clinical topics (cardiovascular conditions, upper abdominal complaints, and lower abdominal complaints) and the tests used for these clinical problems, because it was believed that the physicians would prefer to discuss specific clinical topics rather than specific tests[24].

The use of a case-based format encourages activation of previous knowledge, allowing better retrieval of knowledge in the clinical setting.... particularly when it involves participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases and provides feedback on performance[10].

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In each session, a colleague presented a difficult clinical case, which was discussed in the group according to a clearly structured manual, they sought solutions together and in the final phase, the group suggested a new treatment plan, which the presenting colleague had to try to implement in his practice [translated from German][18].

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Case discussions were by far the most popular agendas in groups[8].

Group work is built on sharing and improving ''collective'' knowledge and well-functioning groups provide this in an atmosphere of joy and curiosity[8].

Context mechanism outcome configuration 11: 'cognitive dissonance'

If participants discuss and reflect on their work processes (e.g., based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance a negative emotional state triggered by conflicting perceptions that makes them reconsider their own way of working (M).

The identification of suboptimal pharmacological treatments to be targeted in this study, was based on previous research and active reflection and discussions based on own clinical experience from general practice[13].

In the continuing medical education group setting, each participant was confronted with, and had to reflect on, the baseline report on their own prescription practice. We believe that this was a key component for obtaining improved prescription habits[54].

We consider the key element in our study to be ''What happens to a general practitioner's prescribing behaviour when he or she reflects on his/her prescriptions?''[54].

Our intervention required general practitioners to expose their own antibiotic prescribing data in their continuing medical education group by using a structured pedagogical method, critically reflecting on the need for change together with an active listener[54].

Academic detailing involves educational outreach visits and incorporates external audit and supervision, and has a larger effect on prescribing than dissemination of educational materials, audit or feedback alone[9].

Peer group academic detailing was experienced as a suitable method to learn more about pharmacotherapy, though there were participants who argued that the scheme was time-consuming[9].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

GPs' "hits" for inappropriate prescriptions in the elderly, or an unfavourable antibiotic prescription profile, was the starting point for group discussions at the second meeting. Tutors reported that GPs tried to justify and explain their practice[9].

Our results are in concordance with research that suggests that GPs may feel disappointment if their prescribing practice conflict with their ideals[9].

One important outcome for the GPs was an experience of being more reflective in decision-making about prescriptions[9].

The older … were silent, because they had a prescription profile … far from … recommended. The young … dominated the discussion, and they were much more familiar with the guidelines … … the old felt distress when disclosing their profiles … have repeated their errors for … decades[9].

GPs were generally more embarrassed if they had hits they knew they should have avoided, such as prescribing flunitrazepam to elderly patients, compared to potentially harmful drug combinations that had not been highlighted in the recommendations[9].

The findings underscore that tutors have an important role in managing distress and contributing to an informal and relaxed atmosphere in peer academic detailing groups[9].

….and how to facilitate learning within a group setting[40].

Social interactions were used as an important motivator for change, as physicians learned how colleagues were handling test ordering problems and as they obtained information about the consequences of medical decision making in daily practice[55].

Personalized graphical feedback, including a comparison of each physician's own data with those of colleagues; dissemination of national, evidence-based guidelines, and regular meetings on quality improvement in small groups. The strategy focused on specific clinical problems and the diagnostic tests used for these problems[55].

The first was mutual personal feedback by peers, who worked in pairs at the start of the meeting. This was assumed to be a safe method of peer review[20]

A second important element is the fact that GPs are prepared to discuss personal, transparent data openly in a group of colleagues[20].

Compared with only disseminating comparative feedback reports to primary care physicians, the new strategy of involving peer interaction and social influence improved the physicians' test-ordering behavior. To be effective, feedback needs to be integrated in an interactive, educational environment[24].

90-minute standardized small-group quality improvement meeting about 2 weeks later at which one of the clinical problems was discussed based on the feedback reports and the guidelines … In these meetings social influence, which was an important vehicle to reach improvement on test ordering[24].

The second component was an interactive group education of national guidelines, to enable participants to relate their own and each other's test ordering behaviour with them[20].

The new strategy utilised peer influence among GPs, and gave GPs the opportunity to openly discuss their test ordering behaviour with colleagues[20].

They stated that this type of feedback definitely had added value, because comparison with colleagues made them more conscious of their own behaviour and motivated them to change. Their main criticism was the validity of the numbers of tests in the feedback and the absence of patient-related data[20].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Participants were shown the overall data on prescribing of antidepressants in the past year to illustrate that most anticholinergic antidepressants are prescribed to people aged over 60…. During the second visit a graph was provided showing personal performance[25].

…all doctors received a summary of their group's guidelines by mail, and two months after the intervention they received the results of the baseline measurement (see outcome variables) to reinforce the consensus reached[2].

Of the 40 GPs that reported having received individual feedback, 37 rated it as useful[2].

The purpose is to enable the transfer of evidence into practice through the use of facilitated small groups, using presented cases to encourage reflection on individual practice[7].

…it provides an opportunity to measure one's practice against that of one's peers. Direct, extended interaction with a local recognized... [6].

It is a relaxed, enjoyable evening in a friendly environment. …. This exchange allows for clarifications and redirections, leading to learning for both GP and expert. It is also an opportunity for the expert to learn of the tremendous competence that exists within GP practice[6].

Of greatest importance to GPs is the opportunity to measure their current practice patterns against that of their peers[6].

Individualized feedback with specific recommendations, especially when combined with education, generally have been more effective than single intervention[59].

One objective of the PBSG program is to encourage physician members to reflect on their individual practices and identify any gaps between current practice and the best available evidence. This is accomplished through discussion of real-life medical and patient problems in small groups of peers[10].

Through reflection, a gap between current practice and best practice is recognized. Distinguishing this gap presents an opportunity to identify learning objectives specific to the family practice setting[10].

Physicians who received feedback about personal prescribing or who used the PBSG process to discuss hypertension were more likely to change their prescribing than physicians in PBSG who reviewed a different condition. When feedback about personal prescribing was combined with the PBSG process, the effect … was even greater[10].

One of the key features of QCs is that working methods map the quality of care in one's own practice. First of all, this distinguishes QC work from further training in the classical style and second, it enables participants to identify real quality problems in their own practice [Translated from German][14].

A systematic procedure …: data in the feedback report were studied …, reasons for variation were discussed, … prices of drugs, evidence underlying drug treatment was considered, typical patient cases from practice were analysed and finally objectives for improvement were formulated, and specific plans for improvement were made[38].

With regard to taking a practical assessment of their own actions, some participants feared that they would only be burdened with additional work, but on the other hand they were also very curious to see what we were doing [translated from German][34].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

A case-related approach offers the opportunity to confront learned normative expertise and concrete actual action in one's own practice.....By comparing one's own perceptions and the viewpoints of other circle members, as well as by confronting assumed and real actions, e.g. by analysing video recordings, individual and collective defence strategies can become conscious. The deviations from one's own normative expertise and thus the problem of the implementation of existing theoretical knowledge into everyday practice become accessible for analysis [translated from German][21].

A basic problem of continuing medical education is the well-known mismatch between individual, existing specialist knowledge and putting this knowledge into everyday practice.....Quality circles as a form of QI, which among other things also serves the purpose of continuing medical education, can improve this situation [translated from German][21].

On the basis of documentation of one's own activities in daily practice (e.g., in the form of index card evaluations, video recordings, EDP extracts, documents that one has created oneself, etc.), it is possible to learn from your own actions [translated from German][21].

They (the modules) are didactically structured in a way that allow comparisons of systematic processes with the actual procedures in practice. This stimulates the participants and the principle of cooperative learning can be realised.... The participants should identify, name and document deviations from their medical actions. This also includes checking whether documentation and data material is available [translated from German][16].

The aim of the project was to make doctors' own prescription behaviour transparent and to highlight problem areas [translated from German][37].

Presentation of these predefined guidelines was meant to encourage the participating doctors to assess their own performance and to foster discussion and refinement of the moderator-manuals[31]

GPs see QCs on pharmacotherapy as a sensible and useful measure for optimizing their own prescription methods. They regard part 1 of the prescription mirror as the most important instrument of the quality circle work (i.e.: the feedback of one's own, specially prepared prescription data with the possibility to compare oneself with colleagues of the project group as well as a GP control group without intervention) [translated from German][43].

Quality circles comprise a practice-base strategy to improve professional performance, which is based on meetings in small groups of health professionals, provision of evidence-based information, written feedback on professional performance and exchange of best practices in improving patient care[38].

The intervention comprised of quality circles of primary care physicians, including repeated feedback on prescribing patterns … nine small group sessions in which the feedback, guidelines on appropriate prescribing and exchange of best practices in changing performance were discussed..... The report included evidence-based information on prescribing in targeted conditions[38].

What sources of information were used? Still considered a "classic", the oral case presentation was by far the most frequently used source of information in 56.2% (=15,313 meetings). Other methods such as index cards, note sheets, data from electronic medical records were used significantly less frequently (20%) [Translated from German][4].

Following the training meeting, CQC members collected baseline data on patients from their practices using the CQC-form to ascertain how they currently diagnosed and treated osteoporosis…. These profiles, displayed graphically with brief text summaries, permitted anonymous comparisons of individual circle members' practices[45].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Physician profiles were displayed graphically with a brief text summary. The profiles permitted anonymous comparisons of individual circle member data with their peers in their circle and with all the participating physicians in the project[50].

Based on the questionnaire responses, physician profiles were generated that showed how individual physicians treated patients …. The profiles permitted anonymous comparisons of individual circle member data with their peers … and with all the participating physicians …. The physicians' profiles were than compared to the Osteoporosis Canada guidelines[60].

The PPQC process includes a combination of several elements (e.g., local networking, feedback, interdisciplinary continuing education) that facilitate changes in prescribing practice GPs[28].

The pharmacist compares individual prescribing habits with treatment recommendations (clinical guidelines) and with the most up-to-date information on the efficacy of the medication [translated from French][46].

The GPs were asked to bring copies of the records for these patients to the meeting. During the meetings, the treatment of these specific patients was discussed, especially differences between what was prescribed according to the records and what was actually dispensed[11].

The combination of the written simulated cases with actual prescribing allows the GPs to reflect on their decisions as well as the background for these decisions, and is in line with suggestions to make drug utilization studies closer to the reality of practice[11].

.. their perception of a gap between their current knowledge and skills and those needed. … Cognitive feedback is feedback on the decision process, i.e., why or how a decision is made and not on the decision itself, i.e., which decision is taken (outcome)[11].

.. feedback regarding the written simulated case. ...feedback on actual decisions taken ..., the extent of use of the information factors ... and the agreement on decisions between individual members within the group[11].

Feedback was given on actual decisions… and factors taken into account when these decisions were made—so-called cognitive feedback—in our case, clinical judgment analysis (CJA)[47].

When looking at knowledge and attitudes, the largest improvements were indeed seen when the baseline performance was low[26].

… overview of the recommendations given in the guidelines. The major component … was to discuss individualized feedback on the decision process underlying treatment decisions, …. Using series of 18 case vignettes, factors triggering specific treatment decisions were identified …. The case vignettes were constructed to represent real patients ….[15].

Doctors may, during this active process, discover the consequences of new knowledge in relation to their own behaviour[57].

… to introduce independent information about polymedications, …. During these meetings, public health consultants also provided feedback information about prescribing patterns and cost. Quality circles (two in each area) met every 6 weeks and some GPs were trained and given documentation[48].

The current programme was multifaceted and included expert input, voluntary feedback, peer review, and specific recommendations for changes: all features generally associated with the successful implementation of changes in general practice[48].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

As GPs had previously found its provision of diagnostic and therapeutic guidelines feasible and effective, the steering group .. prepared educational material …. In addition to prescribing behaviour, costs of drugs prescribed and the use of generics in primary care, … were addressed[53].

They supplied statistics on all drugs prescribed by GPs under contract and the costs involved, so that the intervention provided a repeated written feedback to participants on their personal prescribing behaviour[53].

Most surprising was the reaction to the presence of these texts (clinical evidence) during the educational sessions. The researcher observed that GPs seized on the books with gusto when the facilitator brought them into view[3].

Context mechanism outcome configuration 12: 'social learning'

If the facilitator uses purposeful didactic techniques (e.g., brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection on the work process (C), then the group will create a learning environment that promotes knowledge exchange (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

The identification of suboptimal practice is, however, only the first step for quality improvements. Several educational strategies have been used to improve doctors' clinical practice, but substantial effects are only rarely reported[13].

… found evidence that educational intervention consisting of passive dissemination of clinical practice guidelines had little or no effect on practice. This corresponds with later reports … More active strategies, like educational outreach visits and multifaceted interventions, are more effective, but require more resources[39].

The elements of the intervention are discussions within the peer group, collection of individual prescription data, audit based on individual feedback reports, as well as a one-day regional work-shop[39].

The participating GPs experienced the CME group meetings as an important arena for learning. They reported picking up good advice from others and learning practical alternatives …. GPs said their prescription data would not mirror all learning effects: 'The whole point is to reflect more, ... '[9].

Peer group academic detailing was experienced as a suitable method to learn more about pharmacotherapy, though there were participants who argued that the scheme was time-consuming[9].

The participating GPs experienced the CME group meetings as an important arena for learning. They reported picking up good advice from others and learning practical alternatives …. GPs said their prescription data would not mirror all learning effects: 'The whole point is to reflect more, ... '[9].

GPs said that the feedback on their prescription profile motivated them for reflection, learning, and change. Critical reflections on own strategies help change attitude and behaviour[9].

…. facilitated the discussion within the CME group, where each GP exposed their own prescription patterns as presented in his or her report and potentials for improvements were discussed within the group[40].

The systematic approach of the quality cycle was used reasonably well, although practices did have some difficulties in gathering data and evaluating progress in the improvement projects[32].

An intensive small group education and peer review programme, which combined various strategies, was proved to influence aspects of knowledge, skills, opinions, and the presence of equipment according to the guidelines but on its own no significant influence on the provided care[30].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

It should be noted that a new skill is required for the recommended technique. It is possible that many midwives have not as yet learnt these skills. Small group CQI is not sufficient for the teaching of new techniques[33].

we found that small peer group CQI had a positive effect on changing clinical practice when no new skills had to be learnt, when the recommendations were considered to have more advantages than disadvantages, and when there was no 'ceiling effect' at baseline[33].

... of a strategy that combines a traditional feedback strategy with a multifaceted strategy, including feedback, dissemination of and group education on evidence-based guidelines, and small group quality improvement meetings in a local primary care physicians' group, using social influence as an important motivator for change[61].

A multifaceted strategy combining comparative feedback on tests ordered, group education on guidelines, and small group quality improvement meetings in a local GP group, with social influence as an important motivator for change, was expected to offer good prospects[20].

Compared with only disseminating comparative feedback reports to primary care physicians, the new strategy of involving peer interaction and social influence improved the physicians' test-ordering behavior. To be effective, feedback needs to be integrated in an interactive, educational environment[24].

At these meetings, test-ordering behavior and changes in routines were discussed, using social influence and peer influence as important motivators for change. Social influence from respected colleagues or opinion leaders seems to have a greater effect on practice routines than do traditional medical education activities ...[24].

Many test-ordering problems that physicians encounter in everyday practice, such as demands for tests by patients and changing guidelines, can be discussed and may be solved in an open and respectful discussion among colleagues[24].

Our intervention—which included a group education meeting with a consensus procedure and communication skills training[2].

...various strategies for implementing the guidelines were used: lectures, role playing, skills training, peer review of performance, group consensus discussions, and problem solving of hypothetical situations involving patients. The group education and review was done in two small groups ……..) and was supervised by an experienced GP[62].

An intensive small group education and peer review programme, which combined various strategies, was proved to influence aspects of knowledge, skills, opinions, and the presence of equipment according to the guidelines[62].

Either the facilitator or the expert is asked to recommend one or two relevant articles to follow up the discussion. The expert has frequently selected an article in advance, from knowledge of frequently asked questions in prior learning environments[6].

The group selects topics, directs the agenda, points out inappropriate comments or inappropriate practices in a constructive manner, and also leads group members back on topic. The conversation is free-flowing and highly interactive[6].

The group encourages other points of view to establish practice norms. This allows individual GPs to see where they may deviate from usual standards of care[6].

What have you gained from participating in this practice-based small group learning project – learning from colleagues: the group discussion allowed us to share our experience and management of various problems[41].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Group discussion allows for sharing of experiences and of thoughts about strategies for implementing practice changes and about overcoming anticipated barriers (Armson et al., 2007)[10].

Learning from and with colleagues is an important source of both new information and strategies for applying that information to practice[10].

Most GPs and PNs valued learning together. Several GPs from Group 1 said that they were consistently satisfied with the learning that took place in their group[5].

I think there is a mutual keenness to learn from each other[5].

A ''mutual keenness'' to learn from and about each other emerges as a crucial ingredient for learners to feel that their learning needs were being met given the multi-professional context[5].

'Learning from colleagues' (three comments) 'Has been very constructive and helpful[42].

....to work through cases together and massively furthered my learning.' 'Really useful (secondly) discussion with colleagues/peers regarding management of conditions in real practice[42].

This should not be done schematically according to a fixed schedule, but rather with the help of various methods that reflect the reality of everyday practice (e.g., case discussions, file card analysis, documentation with a study character, video, etc.). They can also be used in parallel [translated from German][34].

At the same time, our concept leaves room for case-related and problem-oriented learning using our own patient examples from practice [translated from German][36].

They (the modules) are didactically structured in a way that allows comparison of theoretical approaches with the actual procedure in practice and so the principle of cooperative learning can be realised [translated from German][16].

The principle of cooperative learning in the quality circle (everyone learns from everyone else) leads to increased flexibility and more pleasure in practice [translated from German][16].

Almost 73 % of the participants thus confirm that the intercollegial exchange in the Pharmacotherapy Quality Circle - as in all other quality circles (10-12) - can be regarded as one of the fundamental mechanisms of action [translated from German][43].

They particularly appreciate the opportunity to compare their own prescribing behaviour with that of their colleagues and to discuss it in the familiar setting of a small group. In addition to this intrinsic principle of quality circles of intercollegial, equal and non-hierarchical exchange in a familiar group (of so-called "peers"), the feedback of one's own prescription data with the possibility of comparing oneself with other colleagues and to measuring one's own progress in the context of a before-and-after comparison (evaluation) contributes significantly to the success of the project [translated from German][43].

Especially the expectation of a successful collegial exchange of experiences, which was most frequently mentioned at the beginning of the project, seems to have been fulfilled: The vast majority of participants emphasised that they had received helpful tips from colleagues who had helped them to implement changes [translated from German][44].

Regular ... reflection on common practice with other colleagues. ... individual feedback, ... discussed in the group under the guidance of a moderator ... benchmark activities... The core element of these circles is the conjoint discussion of evidence-... and management of patients on the basis of prescribing data....[63].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

... impact of physicians' views on the use of performance feedback, indicators and price comparisons. This set of views reflects both a willingness to reflect critically on one's professional performance and a positive attitude regarding the ideal of evidence-based medicine[38].

... an important component of the improvement strategy is an individual learning activity: reading and reflecting on the written feedback reports. This is consistent with insights from educational research, which showed that .... learning activity is an important predictor of the effectiveness of any educational programme for professionals[38].

It involved practice audits, feedback on performance by peers ..., interactive discussion of evidence, small-group educational workshops led by ... facilitators and supported by local osteoporosis specialists, diagnosis and treatment reminders (CQC-forms), and making personal plans for improving clinical management of osteoporosis in accordance with the OC 2002 guidelines[45].

The educational intervention consisted of eight key components: 1) audit and feedback, ...; 2) interactive small group discussions ...; 3) use of opinion leaders ...; 4) reminders, ...; 5) multi-professional collaboration and community building ...[50].

Our educational intervention consisted of eight key components and consisted of 1) audit and feedback, 2) interactive small group discussions 3) use of opinion leaders, 4) remainders, 5) multiprofessional collaboration with osteoporosis specialists, 6) nominal financial reimbursement to circle members, 7) patient medicated interventions 8) and educational material[60].

The key elements are local networking; feedback of comparative and detailed data regarding costs, drug choice, and volume of medical prescriptions; as well as interdisciplinary continuing education adapted to primary care needs[28].

(GPs)... depend less on factual knowledge than on their capacity to reflect in action, to be in control of ... learning process, to be motivated, and to perceive meaningfulness; ... it is beneficial ... when the social climate is supportive ...[11].

The intervention comprised several elements, ... the provision of individual feedback on the series of simulated cases ... and on actual prescribing, use of outreach visits, use of peer group discussions, and use of existing guidelines. ..., the sessions were especially tailored for each group[11].

Cognitive feedback is feedback on the decision process, i.e., why or how a decision is made and not on the decision itself, i.e., which decision is taken (outcome)[11].

The combination of the written simulated cases with actual prescribing allows the GPs to reflect on their decisions as well as the background for these decisions, and is in line with suggestions to make drug utilization studies closer to the reality of practice[11].

For UTI the usually high use of the non-recommended drugs was stressed and was related to the ... high use in the simulated cases and the cues that triggered these decisions... the identity of the individual doctor was disclosed at the request of the participating GPs[11].

Learning methods that have proven effective include interactive and problem-solving exercises combined with feedback on performance. Combined strategies that deal with different types of barriers seem to be more effective than single separate strategies[26].

Once the problem is acknowledged, one must learn and understand what caused the problem and how it can be solved. For this, elucidating and discussing the decision process underlying treatment decisions may be useful. To accept new information or practice recommendations the credibility of the source is of importance[15].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Problem based learning, …, places the emphasis on the learner's own initiative to discover problems and how to improve. By discussion in peer review groups the individual doctor's self-efficacy, defined as one's ability to organise and execute a course of action required to produce given results, is substantially increased[57].

Although academic knowledge is important, the fundament for professional development is reflection of one's own practice or, as Schön stated, ''reflection-in-action''. Until now, these aspects of learning have been mostly neglected, …[8].

The strengths of small CME groups are principally that learning is self-directed and based on relevant problems and ''reflection-on-action'', a pedagogic prerequisite for effective learning[8].

…, hardly any participants failed to contribute to the group discussions. … they thought that for a meaningful comparison of prescription costs such data must be correlated with morbidity and disorder distribution among patients. Every opportunity was taken to discuss various clinical aspects of patient management and pharmacotherapy[53].

…, CME should involve the learner actively and as we know from the protocols that there were hardly any participants who did not contribute to the discussions, we can say that our qualitative data support the general notion that quality circles are an appropriate CME format for practising physicians[53].

A defensive attitude of the GP, for instance, been linked to overprescribing, Quality improvement requires a reflective attitude of one's own knowledge and performance[64].

There is, however, adequate evidence that merely distributing a guideline without any additional intervention does not have an effect on prescribing behaviour[64].

Participants and facilitators saw the strength of the small groups as facilitating the learning of practical skills (e.g. through the use of role play[35].

Discussion is based on evidence-based topic notes prepared for each leader as well as individual prescribing and laboratory data related to the topic that is provided to each GP. Although the education groups cover all aspects of clinical practice… [27].

Context mechanism outcome configuration 13: 'interdependence between health insurance companies and GPs'

If physician network organisations require continuous QC activities (C), then QCs will negotiate priorities and design creative solutions (O) because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M).

The physicians in the Rhine-Main network of physicians committed themselves to participating in QCs when they joined the contract. In QCs, they discuss prescription patterns for specific clinical situations and adapt (guidelines) to local conditions [translated from German][22].

The participation of German GPs in QCs is mandatory in order to be part of government-funded disease management programmes (DMPs) or to be part of pilot projects with health insurance funds[23].

The principle of 'quality circles' is now also used for clearly defined quality promotion purposes: The Associations of Statutory Health Insurance Physicians (KVs) of Hesse, Saxony-Anhalt and Lower Saxony started off with structured QC programmes to demand rational pharmacotherapy. In the meantime, QCs have become a requirement in numerous contracts (for disease management, family doctor-centred care, etc.) [translated from German][14].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The QCPs were designed as a measure of quality assurance in pharmacotherapy and, as doctors were expected to encounter various problems in educating their patients in the use of generics, to offer them a forum for discussing these with their peers[53].

…. Specifically, we suggest that centrally organized experts make the strategic decisions about best practices based on evidence but local site staff members make tactical decisions about how best to implement the plan based on what fits local circumstances, needs, and cultures[12].

… interrelationships that exist among a particular organization's technologies, tasks, goals, stakeholder characteristics, and environment …. Participation provides one of the best methods for obtaining valuable information about .. local conditions[12]

Context mechanism outcome configuration 14: 'threat to professional autonomy'

If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and think they lack autonomy in their clinical role (M).

In general, efforts are being made to improve practice performance by developing guidelines. Guidelines are intended to help general practitioners to tailor the care of individual patients to generally accepted scientific findings. However, guidelines are not sufficiently implemented. The reason for this is probably the lack of practicability and low relevance of the guidelines for family doctors. In addition, they give general practitioners too little room for their own medical decisions [translated from German][65].

… much pressure about their prescribing budgets that they participated … as an attempt to appease their prescribing adviser. This resulted in poor attendance and a reluctance to participate …. This defeated the notion of reaching and establishing a consensus that was 'owned' by the practice as a whole[3].

…., it emerged that it could be difficult for GPs to match top-down initiatives with everyday practice. The difficulty, which is another form of pressure, was expressed well by one GP who explained in the interview[3].

The structure of each session demanded a firm commitment … to a common management strategy for …, we found that GPs were reluctant to do this. This reluctance appeared to arise from a sense of threat to their perceived need for clinical autonomy —… [3].

The concept of clinical autonomy is highly valued and it has been argued that in British general practice, prescribing is the principal battleground on which the cause of clinical autonomy is being defended[3].

An understanding of what GPs mean by clinical autonomy and how it affects their ability to reach explicit consensus on clinical management decisions is crucial if practice prescribing is to become more cost-effective. Many GPs perceive guidance on cost-effectiveness … as an intrusion on their professional independence[3].

… GPs and facilitators pointed to the difficulty of reaching consensus on a best buy, ……. Some found the term 'off-putting' because of its financial connotations. This suggests that some GPs may feel that their management decisions should be based on wider considerations than those of cost-effectiveness[3].

GPs were also unlikely to take part if they felt that the sessions would make them feel unsafe or if they felt that the sessions were yet another 'top-down' managerial intervention, where the main intention was to reduce prescribing costs[3].

The majority of respondents in both regions expected to benefit from participation in QCs, but they were unwilling to accept the risk that QI could be misused for control or cost reduction [translated from German][1].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

In the discussion with facilitators, the QC participants' claim to be able to work in a self-determined and independent manner became apparent. For this reason, the National Association of Statutory Health Insurance Physicians (KBV) and the Associations of Statutory Health Insurance Physicians (KVs) have laid down the thematic and methodological autonomy of the circles as indispensable in their guidelines for quality circle work and have committed themselves to supporting them [translated from German][4].

Physicians have raised similar concerns about threats to the autonomy of their profession ... It is within this context, a time of declining perceived autonomy for individual physicians, that we compare the participatory local and central expert approaches to QI[12].

Context mechanism outcome configuration 15: 'interdependence among group members'

If participants maintain a learning environment based on trust that promotes knowledge exchange, assisted by facilitators who use professional techniques (e.g., contentious discussion, reaching consensus, and role play), (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as similar, and so act and negotiate cooperatively to achieve a common goal (M).

… that combining information from a peer detailer with reflection on one's own need for change together with trusted colleagues would improve prescribing patterns[54].

Balancing interests and concerns is an essential aspect of GPs' work[9].

The physicians discussed their feedback data, and if it appeared that a physician clearly ordered fewer tests than his/her colleagues, he/she made plans for ordering more tests[61].

interactive group education in which national guidelines were related to the individual physician's actual test-ordering behavior and an effort to reach a group consensus on the optimal test-ordering behaviour[24].

The personal interaction and mutual influence between colleagues implicitly resulted in an individual or group contract[24].

Psychological research into group behaviour has produced an inventory of factors that influence conformity with group standards. Unanimity provides more pressure to conform, while privacy makes it easier not to[25].

In presenting the evidence we used relative and absolute effects of antibiotics by means of the numbers needed to treat and the numbers needed to treat to harm. This discussion resulted in group consensus about indication and first choice antibiotics per disease[2].

…a learner-directed agenda of topics, presentation of information by trusted peers or local experts, and opportunity for practice and feedback. If the information comes from several sources—…—the perception of need for and the durability of change are enhanced[6].

Interactive approaches, however, can be effective, particularly when they involve participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases, provide feedback on performance, and offer opportunities for practising newly learned skills[10].

It is known that small groups can encourage active participation and deep learning as well as learning of group skills and the ability to express new ideas[7].

The acquisition of new knowledge, skills, and approaches to bridge this gap follows. Often, however, access to new information alone is not sufficient. Reflection and discussion are necessary to help physicians 1) identify areas where current practice requires change and 2) develop strategies to integrate this new approach[10].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

There was widespread agreement that the principal requisites for a good facilitator were experience and competence in small-group skills. One facilitator identified another skill: 'You've got to be able to hold the tension between comforting and challenging[7].

The decentralised approach at the local, internal level consists of collecting available knowledge from the everyday practice of the medical participants and formulating a workable consensus from this. The advantage of this method is that the physicians are actively involved in this process and are more motivated to implement the developed guidelines. In addition, this results in a stronger commitment and acceptance by the participants [translated from German][16].

The programme for the meetings was based on principles of quality improvement, which implied that a systematic procedure was followed: themes were selected, objectives were formulated, plans for improvement were made and implemented and changes were evaluated[29].

In more than 90% of the meetings, new health care aspects could be identified according to the facilitators' assessment [translated from German][14].

Facilitators ensure that participants not only focused on a specific topic, but also focus on their own actions in their own practices and that they identify blind spots in their daily work. Approximately 90% of the methods used are certified as having been able to reveal previously unknown aspects of care [translated from German][14].

Discussions concerning the progress made by incorporating strategies identified in the prior phases of the project were shared among the group. Based on the major findings from the profiles, members discussed additional measures that should be implemented in their practices to increase alignment with the 2002 guidelines[50].

An analysis of prescription attitudes in comparison with scientific and economic data and the search for alternatives in the drug market is then run by each PPQC to build its own consensus. An annual assessment is conducted for facilitating the continuing improvement of the process[28].

.. over time those GPs who, at first, were reluctant to prescribe generics changed their attitude, …. After 2 years of QCP participation ..., GPs confirmed that the prescribing of generics, where appropriate, had for them become common practice and that their efforts and the various discussions… had helped[53].

The reluctance of GPs to appear in agreement with one another does not mean that discussions are pointless or ineffective. For example, as we found in an earlier study, the process of sharing different management strategies for a particular clinical problem may result in marked changes in prescribing behaviour[3].

Context mechanism outcome configuration 16: 'identifying and removing barriers to change'

If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O) because participants help each other develop strategies to identify and overcome these barriers (M).

Therefore, it is recommended to address potential barriers to change when tailoring an intervention targeting change in medical performance[39].

it appears to be essential that throughout the implementation personal obstacles are addressed[30].

The implementation of new knowledge is facilitated by expressing and discussing how to overcome obstacles to its acceptance[25].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The barrier most often mentioned for changing the CHF treatment was related to perceived difficulties with changing treatment initiated by a specialist[2].

Cranney also identified some barriers to translating evidence into practice including: doubts about the applicability of data to particular patients, against attitudes and the absence of an educational mentor[7]. [Trustworthy data]

.. study feedback to individual doctors ... ... The recommendations needed to be reformulated to enable a quality assessment of patient treatment to be judged from prescription feedback. Such quality criteria were developed during group discussions between doctors participating in the study[57]. [Trustworthy data]

Within the group, members endeavour to identify specific barriers to these practice changes and to formulate implementation strategies to facilitate desired changes[10].

The acquisition of new knowledge, skills, and approaches to bridge this gap follows. Often, however, access to new information alone is not sufficient. Reflection and discussion are necessary to help physicians 1) identify areas where current practice requires change and 2) develop strategies to integrate this new[10].

Commonality and differences between local practices. Some participants commented that listening to ''how peers work'' was a benefit: Finding out what everybody is doing locally . . . it makes you think 'would that be better?'[5].

... an educational workshop, and facilitators led small group discussions that identify barriers to the management of osteoporosis and strategies to improve patient care, family physicians demonstrated greater odds of administering osteoporosis therapy appropriately over a two-year period[60].

Back at the practice, the difficulty is to apply the consensus reached in the group, while considering the particular situation of each patient[46].

Barriers within doctors relate to competence, motivation and attitudes, and personal characteristics such as learning style, whereas barriers within practices exist as doctors do not work entirely independently[26].

These results make clear that, although in the educational program a lot of attention was paid to overcome barriers within GPs, barriers within practice setting may not have been sufficiently addressed, preventing the correct implementation of the recommendations concerning asthma maintenance treatment in practice[15].

Once a doctor has accepted a new practice and has the intention to change, there still may be several barriers within the practice setting that prevent the actual implementation in practice. Discussing problems encountered in everyday practice may help to overcome such barriers to implementation[15].

Context mechanism outcome configuration 17: 'need for competence, autonomy and relatedness'

If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility and stewardship (O) because this fulfils their need for competence (being able to achieve specific objectives) (M), autonomy (a feeling of being in control of their own behaviour) (M), and relatedness (a sense of connection to a larger group) (M).

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

The decentralised approach at a local, internal level includes participants gathering experience from daily practice and formulating a feasible consensus solution. The advantage of this method is that GPs are actively involved in this process and therefore motivated to implement the (newly) developed guidelines. In addition, participants involved will be more likely to accept (new knowledge) and feel committed to implement it [translated from German][16].

Potential advantages of the local approach: it promotes buy-in, maximizes fit to local culture and circumstances, maximizes the ability to work out the details associated with implementation, and produces a highly rewarding experience[12].

… new knowledge is … facilitated through the "… working with it, discussing it, and connecting it with what is … known…. because physicians … generate … 1 question for every 2 patients … the opportunity to explore these questions in …groups can stimulate … ideas for future change[10].

… working on projects… is … of great advantage. Everyone is involved ...has to prepare something for the next meeting. The structure of the quality cycle committed us to make all steps …. You don't cling to ideas but …come to changes. Evaluation … is … important ….[30].

A higher appreciation of the quality of the group discussion led to more effect of the intervention on the treatment of asthma exacerbations and on the duration of treatment prescribed for uncomplicated urinary tract infections[15].

The quality of the group discussion as evaluated by the participants seems to be an important predictor of successful educational group meetings[15].

When studying how physicians learn and change their medical practice, disposing, enabling, and forcing factors can be identified. These are a mix of professional factors, such as the desire for competence, social factors such as working climate, and personal factors such as curiosity[11].

International and national guidelines are more difficult to implement than local or internally developed guidelines[26].

Only in The Netherlands, national guidelines were developed by GPs and intended primarily for their use. This guideline initiative has been quite successful and highly accepted, because it is initiated and "owned" by the GPs themselves[26].

… In addition to the pragmatic benefits of the local approach, participants also mentioned one psychological advantage: intrinsic reward. …the local approach might be rewarding because it promotes team camaraderie…. "It [the local approach] is more creative and it's fun ... I enjoyed it"[12].

Not surprisingly, they personally relished the level of participation that the local approach affords. It is possible that … high level of enthusiasm permeated the entire team. In fact, every person on this team reported enjoying the opportunity to participate at a high level on this project[12].

…potential advantages of the local approach: it promotes buy-in, maximizes fit to local culture and circumstances, maximizes the ability to work out the details associated with implementation, and produces a highly rewarding experience[12].

Whereas the effectiveness of many PBLI methods is unknown, social interaction, a key element in some PBLI approaches, appears to increase physician satisfaction with learning and improve certain practice and patient outcomes[19].

Context mechanism outcome configuration 18: 'intention to change'

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

If participants publicly announce their intention to change (C), then they are more likely to implement the change (O) because they and others in the group both think it is a good idea and believe they can carry it through (M).

It is crucial to the model that practice teams formulate goals for improvement and attempt to achieve these goals in small scale[32].

The third was the development of individual and group plans for change, to stimulate GPs to really put their plans into daily practice[20].

An example of such an individual commitment was, 'I will order fewer haemoglobin tests, because I realise that this test does not give much information in patients with vague complaints'[20].

Plans at group level were also made, e.g., the plan to use the …brochure to inform patients …, or … to follow the national guideline on delaying testing in patients with vague complaints. All results show that the quality circles were an essential element in the improvement strategy[20].

The strategy gives physicians an opportunity to discuss their test-ordering performance with colleagues on the basis of actual performance data, making the participants feel more committed to the agreements[24].

Groups can be more effective in accomplishing tasks… and publicly announcing behavioural changes results in more commitment than privately announced change[25].

In most groups, there had been a discussion of the optimal treatment, as well as of barriers to change treatment in line with the recommendations of the guidelines. The idea was that by sharing experiences and learning from peers, possible solutions to perceived barriers might be offered[2].

…a structured tool for promoting reflection on the topic discussed at the group meeting and for identifying plans for practice change. The commitment to change section of the log sheet appears[10].

… participants stated that they had applied some learning to their practice. They reported a general increase in awareness of conditions and also confidence in treating them[7].

I was surprised to see how willing people were to reflect on their own behaviour and practice... and constantly make comments like: "Well, did I really do that? I surely have to pull myself together". Very strong will, apparently, to make changes[9].

The third was the development of individual and group plans for change, to stimulate GPs to really put their plans into daily practice[61].

Groups can be more effective in accomplishing tasks, and publicly announcing behavioural changes results in more commitment than private change[25].

…. draws on 'the theory of planned behaviour' and other studies that have identified the pre-requisites of successful behaviour change in general practice reviewed by Veninga et al.2000[3].

Discussions in the QCs are often lively and then lead to the determination of a consensus that everyone is committed to implementing in the best possible way [translated from French][46].

The discussions within PPQCs are often lively and end in the determination of a common consensus that everyone makes a commitment to apply to the best of his or her ability[28].

Theories of adult learning stress the importance of motivation; the doctors must see the need and be willing to change their behavior to increase their professional competence[26].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Context mechanism outcome configuration 19: 'testing new knowledge'

If participants validate and test new knowledge in a QC, moderated by a skilled facilitator in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M).

Interactive approaches, however, can be effective, particularly when they involve participation in small peer groups that foster trust, promote discussion of evidence relevant to real cases, provide feedback on performance, and offer opportunities for practising newly learned skills[10].

Understanding application of new knowledge. The discussions helped members to consider translating evidence into practice: Sometimes you can read about things but are unable to see how to put it into practice and I feel PBSGL enables you to think how you can do that[5].

Innovative solutions to clinical problems can be shared, and nonstandard methods are highlighted in a nonthreatening way[6].

..., in some situations, evidence may not exist or local experts may disagree with the evidence. The facilitator can help by reinforcing the tenets of evidence-based medicine, by selecting methodologically sound overviews ..., and by asking the expert to address any evidence that exists for the recommendations made[6].

This means, for example, that the group is currently working on a new topic, while, analogous to steps d and e, checks are made whether changes have taken place in the doctor's actions (or in the actions of the entire practice team) with regard to the previous topic [translated from German][34].

Next, they examined empirical evidence concerning the validity of these solutions. To facilitate this process, teams had access to the large resource library that the research team had assembled[12].

Context mechanism outcome configuration 20: 'gaining confidence in an innovation'

If the group repeatedly practices implementing and adjusting to an innovation (C), then they trust their own competence and turn the innovation into a habit (O) because successful outcomes increase their confidence in their abilities (M).

A cyclic process ... is used which leads project teams through the improvement projects. This means that after having chosen a subject that requires attention, the team sets specific targets for the project, analyses the actual performance on the subject, makes and introduces plans for change, and evaluates progress[32].

One meeting may not be enough to actually change treatment, although that is the usual procedure in the peer review groups. Behavioural theories stress the importance of repetition, especially for changing routine behaviour[2].

Six months after the intervention, general practitioners again received feedback on their prescribing behaviour, based on insurance claims data comparing the period after the intervention (March to May 2001) with the same period before the intervention (March to May 2000)[2].

In general, GPs were excited to find in the second year that they had indeed changed in accordance with their plans, and they were then usually more motivated to implement further changes[61].

The intervention comprised repeated feedback on prescribing routines and an intensive programme of educational small group sessions, as described by Bahrs et al. (2001)[29].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

Suitable data illustrate everyday practice. Participants formulate and discuss possibilities for improvements within the collegial framework of the quality circle and implement these in a further step in their own practice. Renewed data collection then allows them to observe effects of the implemented measures and gain confidence. The results are input for a new discussion in the quality circle [translated from German][44].

The analysis that is carried out each year secures change, as they give the pharmacist the means to maintain motivation: each doctor receives detailed feedback on their successes and the progress still to be made in relation to a control group (doctors working without particular collaboration with pharmacists) and in relation to the good results of other colleagues [translated from French][46].

The constant feedback on progress achieved and the further possible improvements are other success factors[28].

The evaluations of the GPs' prescriptions are performed every year to provide concrete feedback and a source of motivation … to change prescription attitudes[28].

Doctors who were accustomed to discussing their prescribing in peer groups changed their behavior more as a result of such (iterating) peer group meetings than doctors who are not used to this approach[26].

In contrast to our pragmatic study, the interventions in most trials consist of multiple sessions on the same topic supervised by a researcher or an expert, a situation usually very different from real life[64].

These results demonstrate the need to look at repeating/reinforcing messages at 12–24-month intervals[27].

Context mechanism outcome configuration 21: 'repetition priming and automaticity'

If participants build a steady group and practice using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because responses improve with repetition: 'practice makes perfect' (M).

This favours change: Having regular practice meetings on quality improvement with all staff [30].

Successful projects might not only positively reinforce the introduction of CQI, but could also bring about a positive attitude to the other aspects of systematic and continuous quality improvement[30].

Regular meetings with the practice team was selected as a topic for improvement by several of the practices[51].

Finally, for the same reason we were unable to assess possible learning effects, which could mean that quality activities may become less time-consuming over time, even if the approach is directed to other clinical problems[61].

This schedule was repeated a year later, using the same three clinical problems, to assess whether a GP or GP group had implemented the plans for change and to initiate further improvements. This iterative aspect was another important feature of the strategy[20].

In general, GPs were excited to find in the second year that they had indeed changed in accordance with their plans, and they were then usually more motivated to implement further changes[20].

Our strategy also seems worthwhile because small-group quality improvement meetings can help build a local practice group focusing on quality improvement[24].

However, other studies have shown that repeated interventions are needed for sustained behavioural changes[25].

Supplemental material 8: literature based programme theory including illustrative quotes and complete list of supporting quotes

…one meeting may not be enough to actually change treatment, although that is the usual procedure in the peer review groups. Behavioural theories stress the importance of repetition, especially for changing routine behaviour[2].

The benefit from participation depended significantly on the frequency of the meetings. Real improvements to performance in daily care can only occur if there is an ongoing and regular quality circle process[31].

The benefit from participation depended significantly on the frequency of the meetings. Successful projects might not only positively reinforce the introduction of continuous QI, but could also bring about a positive attitude to the other aspects of systematic and continuous quality improvement[30].

The intervention comprised repeated feedback on prescribing routines and an intensive programme of educational small group sessions, as described by Bahrs et al. (2001)[29].

Assuming a straightforward dose–response relationship, it was expected that the groups were most effective when physicians participated in most sessions. Stronger effects were also expected, if the groups comprised of physicians who had more experience with learning in small peer groups …[38].

The quality circles (N=1,241) documented an average of 22 meetings (mean value: 21.96) (range: by definition min. 4, max. 127 meetings [translated from German][14].

The higher the attendance rate and the more experienced the GPs in a group were, the shorter the courses were prescribed for UTI after the intervention[15].

In principle, material learnt in brief training workshops decays quickly over time, whereas repetition on many occasions ensures greater retention[58].

Practitioners develop expertise when they move from their comfort zones to examine problems "at the upper limit of the complexity they can handle;" they learn, and iteratively gain mastery through cycles of reflecting on practice, obtaining feedback, and adjusting performance[19].

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CMO configuration 1: **'participants know what to expect'**

If the introductory workshop teaches the principles of QI in PHC and illustrates how QCs work (C), then potential members may be more willing to join QCs (O) because they know what to expect and feel that they can meet expectations(M).

So, I think that everything should be well organised and planned, and that you really have to understand what it's all about – as far as you can understand it without having gone through the process at least once [translated from Swiss German] (2).

CMO configuration 2: **'need for autonomy and obligation'**

If the administration at the national level or at the level of health insurance companies entrusts GPs with QI and autonomy (so they can decide how to implement it) (C), then GPs might participate in QCs (O) because they feel they can take on the responsibility and make a difference (M).

Yes, of course, these are specific drivers [to meet], and after all it [being member of a physician network] is like a commitment to participate in it [QC]… at the same as you may fear limitation in your professional autonomy etc… but there are rules and, if everybody sticks to these rules, it [QC] will work [translated from Swiss German] (3).

New CMO configuration at the organisational level: **'feeling they have a say'**

If an organisation, (e.g. a physician network organisation) has a decentralised policy that encourages the use of local knowledge (C), then the QC takes on tasks (O) because members feel that they have a say in QI in their practice (M).

I was asking myself what autonomy is and what it actually means ... so decentralised organisation means accepting local decisions and having a flexible administration. So not simply stubborn and rigid, but adaptable to local decisions, which are then taken by the QC, for example ... [translated from Swiss German] (2).

So, if I want to promote and do QCs, then it's in the nature of the QC that different groups come up with different solutions. And you have to be able to live with them and you also have to be able to endorse them as an organisation, otherwise the QC instrument wouldn't make sense [translated from Swiss German] (1).

CMO configuration 3: **'sharing similar needs'**

If the administration at the organisational level of QCs provides support (i.e. in training facilitators, data gathering, provision of evidence-based information), and the administration protects time and space and offers CME points and small financial incentives to QC participants (C), then the latter will meet in groups to exchange ideas (O) because GPs prefer learning in QCs (M); support generates positive expectations among participants (M), and GPs think QC meetings with their peers will be useful (M).

Yes, this kind of network allows high organisational and professional autonomy ... and this is a good start for QCs [translated from Swiss German] (2).

For me, protected time is more than just the aspect of time; it relates to work intensity before and after the meeting ... and not just that the telephone does not ring. I think you should not be disturbed ... and you have to plan that [translated from Swiss German] (3).

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CMO configuration 4: **'need for relatedness'** If a regular group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g. introduces people to each other, opens discussions, and clarifies and summarises statements (C), then group members will get to know each other and decide on rules that they are willing to follow, building a safe environment based on trust (O) because members want to be among and to interact with equals (M). *I think it is important that we define the basic arrangements, like time, place, etc. and the procedure; that makes us feel safe. And respect and standards must be established and discussed, again and again. If this is done over and over again, there is a possibility to improve everything and give the participants the opportunity to express themselves; I think this is important [translated from Swiss German] (6).* *With a glass of wine … it works best … The satisfaction in QCs, this concerns my own role, or my emotional situation, because I am basically more satisfied if I have a fulfilling QC with my colleagues [translated from Swiss German] (3).*
CMO configuration 5: **'need for autonomy and control'** If the group chooses its own topics and facilitator (C), then its members will feel they own the QC (O) because their need for autonomy - a feeling of being in control of their own behaviour - is satisfied (M). *So, I think it is important that they are always the same participants and that the place and time frame are clear, and the distribution of tasks. This simply promotes trust in QCs and, on the basis of trust, you can have discussions between one colleague and another. And it is important that the QC can choose both the facilitator and the methods they want to work with [translated from Swiss German] (4b).*
CMO configuration 6: **'size of the group affects communication'** If the group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with each other and follow all conversations (M). *When the group became too big, there were no interactions among participants any more. They all became listeners, and that was the main reason why we decided to split off and start a new QC [translated from Swiss German] (5).*
CMO configuration 7: **'feeling safe and not vulnerable'** If participants trust each other (C), then they can describe how they work and admit what they do not know (O), because they feel safe rather than vulnerable (M). *So, it takes a lot of courage to talk about a [clinical] case, especially if it didn't go really well. And if someone does tell such a story, then he is a role model, and others may have the courage to do the same and they gain trust on the one hand and, on the other hand, a certain feeling of togetherness [translated from Swiss German] (1).*
CMO configuration 8: **'need for competence and self-actualisation'** If the facilitator supports participants and encourages them to tell their stories and share their experiences in a safe environment, e.g. by encouraging interactive responses, through discussions and by summarising statements (C), then participants will become involved and share their positive experiences and failures (O) because they want to improve their professional competence (M), gain professional confidence (M) and fulfil their professional potential (M).

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It's about your professionality [as a doctor] and in a case discussion you gain knowledge and learn a lot. Doing that, the doctors are totally focused on their work. (4b). [adds:] that's why I have the feeling that such case discussions are an important basis for the process ... if they are all peers, and everyone has experienced similar situations before, they can empower each other [translated from Swiss German] (4a).
CMO configuration 9: **'previous knowledge is activated'** If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by telling their own relevant stories (O) because the process activates knowledge they already possess (M). *We discuss clinical cases, we show where we made decisions and mistakes ... and then we try to work out the principles, how to go on ... that's an important point, that you can relate difficult situations and the others support you and tell their stories [translated from Swiss German] (6).*
CMO configuration 10: '**immediate relevance for the practice'** If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O) because it relates to their everyday work and they can use it immediately (M). *In the last QC, the topic was euthanasia ... and I could use it immediately and was able to apply it. Discussing current cases ... I often realise that the problem is actually also about my patients and that the topic helps in my everyday life [translated from Swiss German] (5).*
CMO configuration 11: **'cognitive dissonance'** If participants discuss and reflect on their work processes (e.g. based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance (a negative emotional state triggered by conflicting perceptions) that makes them reconsider their own way of working (M). *Prescription data ... that would be very helpful if I had access to prescription patterns by simple means, or laboratory tests, just go and have a look [translated from Swiss German] (2).*
CMO configuration 12: **'social learning'** If the facilitator uses purposeful didactic techniques (e.g. brainstorming, contentious or consensus discussions, or role-play) to keep the group active and to reward exploratory behaviour during reflection on the work process (C), then the group will create a learning environment that promotes knowledge exchange (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M). *I think it has a lot to do with interactive learning; thanks to the support of evidence-based information, we are all at the same level of knowledge – right? Afterwards, we combine that with case discussions and that takes us further ... an important step ... [translated from Swiss German] (5).*
New CMO configuration at the group level: **'variety of characters stimulates reflection – cognitive dissonance'** If members of the group have individual character traits and describe different professional experiences but accept each other's views (C), then they can learn from each other (O) because individual attitudes and behaviours will contrast with the knowledge of their peers and cause cognitive dissonance that makes them reflect on their way of working (M).

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I can't remember if we've talked about this before. But there's one point missing (in the programme theory) and that's the story that the group should have a say about who joins in. If the group is too different and everyone pulls in a completely different direction, it becomes difficult in QCs but it gets difficult as well if differences between participants are too small [translated from Swiss German] (2). *But I think GPs are generally people who want to get together and improve something; so, they are somehow a selection, but a varied selection, otherwise it doesn't work either ... [translated from Swiss German] (5).* *Social learning is not without conflict but you have to be able to talk about different views without jumping down each other's throats... and talk about different views ... and that's sometimes a tightrope walk: how hard can I challenge someone – or do I have to treat someone gently? But I also think it depends on the person concerned – if it's someone who's anxious, I'll approach them rather gently as a facilitator [translated from Swiss German] (2).*
New CMO configuration at the individual level: **'threat to self-image – strong cognitive dissonance'** If individuals feel too strong a cognitive dissonance when integrating new knowledge (C), then they may disrupt group dynamics and halt the QC process (O) because their self-image is threatened and they fear the loss of their professional identity (M). *There are exceptions of, of individuals who cannot accept anything in any way and they are self-seeking and cannot learn anything new, who then, even if they participate, are not able to understand anything or to change practice [translated from Swiss German] (4a).* *And of course, with time, you trust each other. And you open up, and then I have to find out if people fit in or not; unfortunately, there are a few people who don't fit in. Then decisions have to be made, i.e. they have to leave, if they can't deal with the group or accept something new. Otherwise QCs can't work [translated from Swiss German] (6).* *If there is a disrupting feature in it, in the group, that hinders the group from norming, then I have to deal with it. For example, if someone always withdraws, then I have to ask the individual, in front of the group or maybe better in private [translated from Swiss German] (2).*
CMO configuration 13: **'positive interdependence between health insurance companies (or administration at the national level) and GPs'** If physician network organisations require continuous QC activities (C), then QCs will negotiate priorities and design creative solutions (O) because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M). *That is certainly a driver to improve quality, and the physician network or the responsible organisation must have the resources to apply these results and at the same time support the QCs, for example with scientific knowledge [translated from Swiss German] (2).*
CMO configuration 14: **'threat to professional autonomy'** If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and fear they lack autonomy in their clinical role (M). *No data*
CMO configuration 15: **'positive interdependence among group members'** If participants maintain a learning environment based on trust that promotes the exchange of knowledge, assisted by facilitators who use professional techniques (e.g. contentious discussion, reaching consensus and

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role play) (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as similar, and so act and negotiate cooperatively to achieve a common goal (M). *The reason why the group drafts such recommendations and continues to work on them is, I really think, so that the group says, 'okay' we need to discuss how to put it together and see if we can use it, and if a facilitator skilfully tackles that and steers the process in a good direction so the group participates, and then the group really does it and creates something new, they get the feeling that we've done it ourselves now [translated from Swiss German] (3).*
CMO configuration 16: **'identifying and removing barriers to change'** If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O) because participants help each other to develop strategies to identify and overcome these barriers (M). *But I don't think barriers are a big problem, because you hardly ever put up relevant barriers if you are there, participating in the QC, and address and solve them during the process [translated from Swiss German] (2*).
CMO configuration 17: **'need for competence, autonomy and relatedness'** If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility and stewardship (O) because this fulfils their need for competence (being able to achieve specific objectives) (M), autonomy (a feeling of being in control of their own behaviour) (M) and relatedness (a sense of connection to a larger group) (M). *And you're satisfied because you were involved, and so you can relate to the content [of the innovation], and that's probably why it works so well; it was well done and I can identify with it ... and support it ... and you feel like you developed it or helped develop it [translated from Swiss German] (4a).*
CMO configuration 18: **'intention to change'** If participants publicly announce their intention to change (C), then they are more likely to implement the change (O) because they and others in the group all think it is a good idea and believe they can carry it through (M). *And that gives me a feeling of significance and satisfaction in QCs, when I've done something like this. And also when I intend to use it [new knowledge] ... the facilitator helps me if he takes me through the PDCA cycle. In this phase, the facilitator is very important, important for planning, because he helps me when I have to plan; that is, when the members or at least one of them has decided to change behaviour [translated from Swiss German] (2).*
CMO configuration 19: **'testing new knowledge'** If participants validate and test new knowledge in a QC, moderated by a skilled facilitator in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M). *No data*
CMO configuration 20: **'gaining confidence in an innovation'** If the group repeatedly practises implementing and adjusting to an innovation (C), then its members trust their own competence and turn the innovation into a habit (O) because successful outcomes increase their confidence in their abilities (M).

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But to recognise whether the process actually leads to a change in my own behaviour, I have to have an outside indicator that shows it to me, time and again. In principle, this means that I have to have an external objective assessment of what I am doing and whether anything is changing – and this helps to change my behaviour and to gain confidence in the innovation [translated from Swiss German] (1).
CMO configuration 21: **'repetition priming and automaticity'** If participants build a regular group and practice using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because responses improve with repetition: 'practice makes perfect' (M). *It is a fact that you use the same techniques over and over again, in terms of methodology – and don't even notice it ... so, even if you don't notice it, it helps to improve quality in PHC, that's for sure, that's absolutely right [translated from Swiss German](3).*

Quotes of interviews in Phase III

Sources:

(1) CEO of a network of primary health care centres owned by health insurance company
(2) Tutor in a doctor-owned network of primary health care centres
(3) Member of the management board of a network of primary health care centres owned by health insurance companies
(4) (4a) and (4b) Two social scientists, representatives of the professional body Swiss Association of Medicine
(5) Researcher in a doctor-owned network of primary health care centres
(6) Executive for General Practice at a central hospital

Preconditions

Context mechanism outcome configuration 1: **'participants know what to expect'**

If the introductory workshop conveys the principles of QI in PHC and the workings of QCs (social persuasion) (C), this will increase future participants' motivation to join QCs (O) because they learn what to expect and may feel that they are capable of meeting expectations (increase of self-efficacy) (M).

Well, if it's set up that way, I'm sure it'll work. [translated from Swiss German] (3).

So, I think that everything should be well organised and planned, and that you really have to understand what it's all about – as far as you can understand it without having gone through the process at least once [translated from Swiss German] (2).

Context mechanism outcome configuration 2: **'need for autonomy'**

If the administration at the national level or at the level of health insurance companies entrusts GPs with QI and autonomy (puts them in control of how do it) (C), then GPs may consider participating in QCs (O) because they feel they can take on the responsibility and make a difference (M).

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You actually buy your network participation or membership through QC attendance. This is sort of obstructive because it results in a kind of obligation for the participants. But the opportunities that such a network offers with different QCs reduces the problem because you have different choices. You find people who you may want to work with in your area. This kind of organisation may fit your needs [translated from Swiss German] (5).

Yes, of course, these are specific drivers to meet, and after all it being member of a physician network is like a commitment to participate in QC…at the same as you may fear limitation in your professional autonomy etc… but there are rules and if everybody sticks to these rules will work [translated from Swiss German] (3).

The physician networks are very open as to QCs. They do not set any rules on what is done or dealt with in the QCs, there is simply a requirement that participants must conduct QCs [translated from Swiss German] (2).

In order to account for the interviews data, I developed an additional context mechanism outcome configuration at the organisational level: '**feeling of having a say'**

If an organisation, (e.g., a physician network organisation) has a decentralised policy that encourages use of local knowledge (C), then the QC takes on tasks (O) because they feel that they have a say in QI in their practice (M).

I was asking myself what autonomy is and what it actually means...so decentralised organisation means accepting local decisions and having a flexible administration. So not simply stubborn and rigid, but adaptable to local decisions, which are then taken by the QC, for example [translated from Swiss German] (2).

So, if I want to promote and do QCs, then it's in the nature of the QC that different groups come up with different solutions. And you have to be able to live with them and you also have to be able to endorse them as an organisation, otherwise the QC instrument wouldn't make sense [translated from Swiss German] (1).

For this reason, it is certainly beneficial if QCs are as decentralized as possible and adapted to local conditions; but I also think that depending on the network and organisation, certain formal requirements must be in place. And if someone joins this network, then they also accept the conditions to a certain extent [translated from Swiss German] (5).

If you recognize positive things that you can perhaps implement well within a short time, or sometimes slowly, then of course you have to; if you don't do that, you nip further initiatives in the bud, because then no further good suggestions will come if nothing is ever implemented. People lose motivation [translated from Swiss German] (3).

I think that if something like this is developed by a QC now, then there should also be appreciation from the organisation. [translated from Swiss German] (3).

If we want to discuss something and talk about it, about a vitamin or whatever, it doesn't matter, then the organisation should support it. It should be interested that we get prescription data to objectify our behaviour and also to show any progress that may result from the whole discussion. Or whatever, but I believe that the organisation should make this possible; that is important [translated from Swiss German] (3).

As I have described before, I believe we should have certain freedom to implement new things in an organisation. At the same time, it should be clear what is important to the organisation. Organisations should also provide knowledge and create a kind of platform for knowledge exchange [translated from Swiss German] (3).

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Establishing the group

Context mechanism outcome configuration 3: **'sharing similar needs'**

If the administration at the organisational level of QCs provides administrative support (i.e. training of facilitators, data gathering and provision of evidence-based information), protected time and space, CME points, and small financial incentives to QC participants (C), then they will meet to exchange ideas (O) because QCs are GPs' preferred learning style (M), support generates positive expectations among participants (M), and GPs think QC meetings with their peers will be useful (M).

Yes, such a network allows high organisational and professional autonomy...and this is a good start for QCs [translated from Swiss German] (2).

For me this (protected time) is more than just the aspect of time, it relates to the amount of the work before and after the meeting....and not just that no telephone rings. I think you should not be disturbed...and you have to plan that [translated from Swiss German] (3).

It benefits the participants a lot, that's no question. I just ask myself how do we manage to take away 1½ to 2 hours from the working day without increasing the amount of the work? Basically, this is probably an organizational problem. In an ideal world, we should have time to discuss things with each other and form a basis for identification, GP-based, mutual trust, a discussion of sensitive issues, and trying something new together [translated from Swiss German] (3).

The time in the QC, that is the time during which no phone calls should come in, and it should also have no influence on the amount of the work that day. It is a little easier with the internal staff, by that I mean the participants from here. Those with a longer journey have more difficulties [translated from Swiss German] (2).

I believe that 1½ hours should be enough for a QC according to our experience. It is extremely important that you are not disturbed. And the amount of work on the same day must not increase because of the QC. After all, this is an integral part of the work and also of the contract with the network [translated from Swiss German] (4b).

If I do it this way, it's probably easier later. For example, I have to know how much money is available from the network; this is important if the implementation of the ideas also involves costs [translated from Swiss German] (4a).

So really a fee to participate or a fee for the facilitator did not exist. And the further education points were not a big issue either. But now that we have that, a small fee and CME points is certainly beneficial. [translated from Swiss German] (2).

So, I think if participants know that there is adequate compensation for the time they spend, then it is an important complement to intrinsic motivation. And naturally also the CME points. [translated from Swiss German] (5).

Well, I just think it's very different how a QC forms. There are people at the end of their career who are almost burnt out and want to exchange ideas, in the sense of improving their well-being. And at the other end of the spectrum, there are newcomers or beginners who are at the beginning of their GP career and are intrinsically highly motivated; they simply want to exchange experiences and clinical information [translated from Swiss German] (5).

Sometimes the organisation or network is more important. In a network all participants have to take part in QCs because it is a standard. Or you take part because you become simply more and more interested. Sometimes it starts as an obligation and becomes an intrinsic motivation] (4b).

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Well, for me, if I look at it that way, there doesn't have to be a cause. I think the motivation to participate has to be there before, otherwise you wouldn't take part in QCs. But I think the logistical and practical support is important. First of all, the intrinsic motivation has to exist; obligation is an extra driver, as is administrative support; all that is important. [translated from Swiss German] (5).

So, I have the feeling that the incentives that are mentioned do not matter so much, but the philosophy and the attitude of the doctor. I believe that if he is committed to his profession, then a little money will simply speed up this process a little. [translated from Swiss German] (3).

I think it takes a basic motivation to understand the purpose of QCs and to invest 1½ hours to improve over and over again. I believe it takes a certain amount of reflection and openness to continue developing [translated from Swiss German] (3).

It simply needs something more, everything we have already discussed, but also something else; it is a kind of commitment to the profession and you want to feel comfortable in your position. [translated from Swiss German] (3).

I think intrinsic motivation is the basic requirement but it mostly takes an outside force to get different GPs to come together and actually take the time to do this [translated from Swiss German] (1).

Peer consulting is certainly a motivating factor for participating in QCs, but the networks create the structure to make it possible. Smaller monetary values only play a minor role, I think. [translated from Swiss German] (4b).

Personally, I would be motivated if I knew that someone with a lot of experience was facilitating the QC. But also, the subject-specific aspects are part of it, the peers know what they are talking about [translated from Swiss German] (4a).

In the beginning, we had no organizational help. In the course of time this has changed to the extent that two more QC participants joined the network because it is required that they participate, but it helps with organising them [translated from Swiss German] (2).

Yes, that they help to organize a room, that they help to take minutes, that they help us to develop our own initiative. You should also help us with the design of the content like evidence-based material [translated from Swiss German] (2).

So, it is important that there are rooms available that are easily accessible for everyone in terms of time. Up to now it has been over lunch. I think it is beneficial if there is some kind of catering available because most people go straight to the office afterwards. I think this logistical aspect is important [translated from Swiss German] (5).

There are certainly different needs in terms of location. Some people appreciate being able to do their QCs in the practice, others prefer to meet privately. Others may simply want a meeting room. We have sensed a variety of needs. Some really want to stay in their practice environment and others choose a completely different location [translated from Swiss German] (4b).

Context mechanism outcome configuration 4: **'need for relatedness'**

If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g., introduces people to each other, opens discussions, clarifies and summarizes statements (C), then group members will get to know each other and norm rules that they are willing to follow and build safe environment based on trust (O), because members want to be among and to interact with equals (M).

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I think it is important that we define the basic arrangements, like time, place, etc., and the procedure; that makes us feel safe. And respect and standards must be established and discussed, and again and again. If this is done over and over again, there is also the possibility of improving everything, and gives the participants the opportunity to express themselves; I think this is important [translated from Swiss German] (6).

There are important cornerstones such as time, duration, division of tasks and also the process of a QC; it is also important to determine norms of communication with each other regarding feedback and communication culture. These two things are actually prerequisites for trust and security as a basis for open communication. I have never experienced stormy times, as often described in group development. I think you have to come back to this and discuss together what the rules of the game are. And if it doesn't work out that way, you can simply ask: where is the problem [translated from Swiss German] (2)?

The QC takes place in an open circle and with a facilitator who opens the discussion. He clarifies statements and summarizes. The activities at the beginning usually consist of case discussions. The session should be as open as possible at the beginning and everyone who has something on their mind should have their say [translated from Swiss German] /2).

In existing QCs, I think it would be good if the rules of the game were reasonably clearly defined [translated from Swiss German] (2).

The facilitators spend a relatively large amount of time determining the timing of the sessions so that it is convenient for everyone. I think this is a rather delicate process in which the group does not always reach consensus immediately. But with time, this will become part of the process. It's relatively important that you do it together and no one gets left behind [translated from Swiss German] (2).

By the way, I always put the basic points up for discussion, also with regard to respect and communication culture. That works somewhat differently in every QC. Individual groups have, how shall I put it, their own character [translated from Swiss German] (2).

It's important to discuss respectfully how to deal with each other, etc.; this is not only important for the development of the group, but also for what comes later in the QC in terms of the QI process. Sometimes small groups of people form who like each other from the past and this is not always helpful [translated from Swiss German] (5).

It was enormously important to me that the general conditions were made clear: when do we meet? where do we meet? how often? Then it was important for me that this wasn't a one-man show, where the facilitator didn't just do all the work, but that he had the competence to lead the group and distribute the tasks [translated from Swiss German] (5).

I think it also has to do with the fact that you get to know people better over time. You know what they are like, and if they don't always get along so well with each other, I can still ask them to be respectful to each other in the specific case [translated from Swiss German] (5).

With a glass of wine… it works best...The satisfaction in QCs, this concerns my own role, or it concerns my emotional situation, because I am basically more satisfied if I have had a fulfilling QC with my colleagues [translated from Swiss German] (3)

You have to set the rules at the beginning and if the rules are there, it works; and if the rules are not there, then some people don't know what to do and how to do it, and then it doesn't work. And from this I can only confirm: you need the rules [translated from Swiss German] (1).

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Confrontation rarely happens, but when it does, it's usually not bad because it means that someone really .... that the group is really engaged and can participate in 'confrontation' at all. If someone is not involved, they will never get upset. And the moment someone gets upset, it means that they, the ones, who bring the topic into the group are extremely interested in what they do.... So, when it happens it is a very good step that leads to improvement. [translated from Swiss German] (1).

Actually, two things: one is that there is the framework we discussed before, and the other is that confidential things remain confidential. So that it really stays within the framework in which it's articulated and doesn't leave the room. [translated from Swiss German] (1).

This brings me to another aspect: because patient cases are discussed, it is very important that confidentiality and patient confidentiality are guaranteed. So, there must be a protected setting. I also have the feeling that this must be made very clear and that everyone in the circle agrees with it [translated from Swiss German] (4b).

I have the feeling that you have to do it as in a project team: in a new committee, you first agree on the joint procedure and record it in detail. In the session, they agree on how to communicate and how to organise things, and everyone has to say something about it or at least nod briefly [translated from Swiss German] (4a).

Context mechanism outcome configuration 5: **'need for autonomy and control'**

If the group chooses its own topics and facilitator (C), then they will feel they own the QC (O), because this satisfies their need for autonomy (a feeling of being in control of one' s own behaviour) (M).

So, I think it is important that they are always the same participants and that the place and time frame are clear, and the distribution of tasks. This simply promotes trust in QCs and on the basis of trust you can have discussions, from colleague to colleague. And that the QC can choose both facilitator and the methods they want to work with [translated from Swiss German] (4b).

Regarding autonomy, we are free to decide when, where and how long the QCs will last. In pilot tests, however, the duration has levelled off at 1½ hours. The network imposes certain conditions regarding certification. These require that we have to do a certain number of QCs per year and that we regularly review some topics but are free to choose the content [translated from Swiss German] (2).

Context mechanism outcome configuration 6: **'size of the group affects communication'**

If group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with all participants and follow their conversations (M).

When the group became too big, there were no interactions among participants anymore. They all became listeners, and that was the main reason why we decided to split off and start a new QC [translated from Swiss German] (5).

The principle is that less technology helps and that the group sits in a circle and thus communicates better [translated from Swiss German] (5).

Learning environment

Context mechanism outcome configuration 7: **'feeling safe and not vulnerable'**

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If participants trust each other (C), then they can disclose how they work and also the holes in their knowledge (O), because they feel safe rather than vulnerable (M).

So, it takes a lot of courage to talk about a [clinical] case, especially if it didn't go really well. And if someone does tell the story, then he is a role model, and others may have the courage to do the same and they gain trust on the one hand and, on the other hand, a certain feeling of togetherness [translated from Swiss German] (1).

It benefits the participants a lot, that's no question. I just ask myself how do we manage to take away 1½ to 2 hours from the working day without increasing the amount of work? Basically, this is probably an organizational problem. In an ideal world, we should have time to discuss things with each other and form a basis for identification, GP based, mutual trust, a discussion of sensitive issues, and trying something new together [translated from Swiss German] (3).

This is consistent and fits, I think this is exactly how the QC reveals knowledge gaps [translated from Swiss German] (3).

The QC takes place in an open circle and with a facilitator who opens the discussion. He clarifies statements and summarizes. The activities at the beginning usually consist of case discussions. The session should be as open as possible at the beginning and everyone who has something on their mind should have their say [translated from Swiss German] (2).

I have the feeling that QCs work and the chance of this increases if the QC takes place in a good atmosphere. Certainly, mutual trust is extremely important in the interaction. In the group, everyone has their own knowledge, which they make available to the group and thus increase the competence of the group [translated from Swiss German] (4a).

It would certainly be a good basis for discussion if you really had facts and not just the feeling of how you work with your patients, then you really have facts. But an atmosphere of trust is necessary so participants can discuss their data in the QC [translated from Swiss German] (4a).

Context mechanism outcome configuration 8: **'need for competence and self-actualisation'**

If the facilitator supports participants and encourages them to tell their stories and share their experiences in a safe environment by, e.g., encouraging interactive responses, discussions, and summarizing statements, (C) then participants will be involved and share their experiences and failures (O), because they want to improve their competency (a sense of self-efficacy to achieve specific objectives) (M) and gain professional confidence (M), and achieve professional self-actualisation (M).

It's about your professionality as a doctor and in a case discussion you gain knowledge and learn a lot. Doing that, the doctors are totally focused on their work (4b) adds: that's why I have the feeling that such case discussions are an important basis for the process...if they are all peers, and everyone has experienced similar situations before, they can empower each other [translated from Swiss German] (4a and b).

And the case discussions are a very good way of getting into the subject. I often do it this way. At the beginning, however, we always start with a general opening, when everyone who has something very urgent to recount can ask questions, especially if she needs an answer for her clinical work [translated from Swiss German] (5).

This part of the programme theory is certainly correct. I do believe that QCs can relieve worries and fears, maybe even help you get rid of worries because you can discuss difficult things and share experiences that are tough [translated from Swiss German] (3).

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The active participation in discussions of cases and personal experiences gives the feeling of group cohesion and a kind of understanding culture. There is also a feeling of openness and mutual support, and trust increases, a kind of collegiality. In this atmosphere, a collegial influence is possible and medical problems that are important to people are discussed [translated from Swiss German] (2).

This part of the programme theory also corresponds to my experience. I think the participants realize in these case discussions that they partly have the same problems. And this creates the feeling of belonging together as GPs and being in the same boat [translated from Swiss German] (5).

So, I think in the first part of the process, facilitators are very important because they stimulate people to actively participate. Facilitation is certainly important, but also the opportunity to discuss cases that are important to participants, that is basics [translated from Swiss German] (5).

Context mechanism outcome configuration 9: **'previous knowledge is activated'**

If participants exchange case stories and experiences while they actively listen to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by telling their own relevant stories (O), because the process activates knowledge they already possess (M).

We discuss clinical cases, we show where we make decision and mistakes... and then we try to work out the principles, how to go on... that's an important point, that you can relate difficult situations and the others support you and tell their stories [translated from Swiss German] (6).

So, in that setting, I think, you need your own case studies because otherwise, if someone doesn't talk about their own cases, then it's just another lesson in school and so the emotional involvement will be much, much lower and the interesting thing is, really, when someone gives something with heart and soul. And that lifeblood is then what motivates the others to participate [translated from Swiss German] (1).

Case discussions are important for the group. They are also exciting. We had chosen a broad topic in the QC that I facilitate. The topic of choice we made was actually an impossible one. We wanted to work on a guideline and then realized that it was completely useless. I then told the participants that they should simply take their own real-life examples for discussion, and that works well! [translated from Swiss German] (2).

Yes, exactly! You simply have to be open for any case vignettes that come from practice. They then form the basis for the topic that participants choose. For example, if someone asks you how to detect these 'damn' food allergies, what serological test to do. Then as a facilitator you have to get to the topic, so that everybody can understand and deepen their knowledge [translated from Swiss German] (5).

As a facilitator, I help the group to choose the relevant topics from the case discussions, which are then covered separately in a QC [translated from Swiss German] (5).

Context mechanism outcome configuration 10: **'immediate relevance for the practice'**

If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O), because it relates to their everyday work and is therefore of immediate use (M).

In the last QC, the topic was euthanasia… and I had immediate use of something and was able to apply it. Discussing current cases…. I often realize that the problem is actually also about my patients and that the topic helps me in my everyday life [translated from Swiss German] (5).

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It took some time before the discussion got going. At the end I asked them how they wanted to continue. The group was unanimous that they wanted to look at cases and then decide how to proceed based on the cases [translated from Swiss German] (2).

If the facilitator succeeds in actually uncovering the path of decision making, i.e. what the patient says and the doctor does with this... if he succeeds in working it out and communicating it in an emotional and lively way, then I think that something very important will happen. If the QC is like reading a textbook, then it won't help anyone. But if the group succeeds in tracing the path of a decision-making process and working out the critical aspects or pitfalls within the framework of this decision-making process, then the person who tells the case is personally affected. And in the moment when that person is personally affected and can express this, the rest of the group is usually also addressed and personally affected. And these are then the moments I recall, at least that's how I feel, and I will do that automatically, when I meet the next patient, and benefit from the discussion a great deal [translated from Swiss German] (1).

Context mechanism outcome configuration 11: **'cognitive dissonance'**

If participants discuss and reflect on their work processes (e.g. based on trustworthy data or exchange of personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may contrast with their peers' knowledge, causing cognitive dissonance that makes them reconsider their way of working (M).

Prescription data.... that would be very helpful if I had access to prescription patterns by simple means, or laboratory tests, just go and have a look [translated from Swiss German] (2).

This seems familiar to me. I think we are in a special situation in our physician network, where we actively work with guidelines [translated from Swiss German] (5).

Our physician network collects statistical evaluations on a practical level, where they present us with the results and benchmarks. Of course, confidence-building measures play an important role in this process so that the group can discuss the results together. I don't think that this requires so much skill from the facilitator, because the statistics are stimulating enough and everybody wonders why he is where he is, statistically [translated from Swiss German] (5).

I don't think statistics cause fear but motivate people to change their behaviour and for example prescribe more generics if a patient requires, for example, a proton pump inhibitor. [translated from Swiss German] (5).

For example, when I look at all my referrals, I can't recall why I wrote them. Then, when I discuss this with my colleagues, my colleagues can explain ninety nine percent of the time a plausible reason for the referral and I can learn from these discussions. [translated from Swiss German] (5).

Yes, when seven to ten different opinions have been expressed, then the group should use evidence-based information. They just have to look up what is going on and revise their views. Sooner or later you always arrive back at guidelines. [translated from Swiss German] (3).

Yes, somehow participants must recognize and bridge the gaps that appear in the discussion. The QC is a good place to reflect on whether something is correct or not, or whether you have handled a situation correctly or not [translated from Swiss German] (3).

It is important that the group first comes to an issue, where there is some dissent, isn't it? [translated from Swiss German] (3).

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Yeah, this is the part where the process moves into the QI. We don't just sit there and discuss cases; we reflect on them. I think about what I have heard and wonder whether I understood my colleagues correctly, it's all about self-reflection. I ask myself, is that true, do I do really do it that way, and why, and how could I do it better? Afterwards, the group then moves to the personal level of action, where quality in everyday practice improves. [translated from Swiss German] (4a).

I have the feeling that participants realize that someone else may be right, even if they don't admit it right away. I have the feeling that on the journey home or at home, or later at some point, especially facing similar cases, they think of the discussion. Yes, and then you do not automatically do what you have always done, but you start considering other possibilities for solving the problem. Then, participants may actually change their attitude and behaviour or consult a colleague or take a look in the books. [translated from Swiss German] (4a).

I believe it would be important to have data and to know what is going on in order to reflect on what we are doing and to improve the quality of our work [translated from Swiss German] (4a).

For example, if there is a topic that concerns a certain medication, then I hardly know how often I prescribed the drug in question. Then it's good if I can see in reality what I'm really doing. On the basis of routine data that can easily be compiled, GPs could find out how often they prescribe something, also compared to other colleagues in Switzerland [translated from Swiss German] (4a).

It would be good if we had prescription data on any clinical topic; you should be able to see what the reality is in practice on any topic. For example, we have done a feasibility study about drug interactions. Based on the data, GPs could recognise where the most common problems were and take action. [translated from Swiss German] (6).

Context mechanism outcome configuration 12: **'social learning'**

If the facilitator uses purposeful didactic techniques (e.g., brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection of the work process (C), then the group will create a learning environment that promotes knowledge exchange (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

I think it has a lot to do with interactive learning; thanks to the support of evidence-based information, we are all at the same level of knowledge - right? Afterwards we combine that with case discussions and that takes us further....an important step [translated from Swiss German] (5).

It is important in this phase as a moderator to actively request opinions from the group and not simply throw general questions at the group [translated from Swiss German] (2).

I think this exchange of knowledge in the group needs great trust and a safe climate. It's about confidence in dealing with discussions, in dealing with colleagues, so that they can show weaknesses. The others might think it's a funny story at first, but often they recognize themselves in it. The facilitator needs to ensure that the participants maintain respect and tolerance. After all, there are no false statements. A facilitator needs excellent training to be able to convey this feeling. And the training should be professional [translated from Swiss German] (3).

What helps me least, how shall I put it, are the quantifiable areas that can be measured as outcome. What helps me most is the path that leads to a decision. And measuring results afterwards is a tool for estimating roughly where I am moving to, but it has little to do with me as a person. But more importantly, I can develop professionally in a QC, I can learn how to take a decision and to make the process of decision making transparent [translated from Swiss German] (1).

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

If there is, perhaps, a need for clarification in the group. If some people say that they always do it for this or that reason and others reply that they judge the problem quite differently and therefore, they do it this way. It helps with evidence-based information and data that show how people really work. [translated from Swiss German] (4a)

So, whenever we look at our data, we start being distracted by exceptions and we lose the overall context, i.e. what is actually at stake. And when you have a sheet of numbers in front of you and you don't know how they came about; it becomes difficult to interpret. Misconceptions quickly happen and I have my doubts that if you just focus on a few small exceptions, that you see how GPs really work. Numbers should only be looked at in connection with case discussions [translated from Swiss German] (4b).

In order to account for the interviews data, I developed an additional context mechanism outcome configuration: '**Variety of characters stimulates reflection – stimulating cognitive dissonance'**

If members of the groups have individual character traits and describe differing professional experiences but accept each other's views (C), then they can learn from each other (O) because own attitudes and behaviours will contrast with their peers' knowledge and cause cognitive dissonance that makes them reflect on their way of working (M).

Social learning is not without conflict, but you have to be able to talk about different views without chopping each other's hand off.....and talk about different views...and that's sometimes a tightrope walk: how hard can I challenge someone - or do I have to treat someone gently? But I also think it depends on the person it concerns - if it's someone who's anxious, I'll approach them rather gently as a facilitator [translated from Swiss German] (2).

I can't remember if we've talked about this before. But there's one point missing, in the programme theory, and that's the idea that the group should have a say about who joins in. If the group is too different and everyone pulls in a completely different direction, it becomes difficult in QCs, but it gets difficult as well if the differences between participants are too small [translated from Swiss German] (2).

But I think GPs are generally people who want to get together and improve something.; so, they are somehow a selection, but a varied selection, otherwise it doesn't work either [translated from Swiss German] (5).

In order to account for the interviews data, I developed an additional context mechanism outcome configuration: **'threat to self-image' to account for the interviews data.**

If individuals cannot cope and integrate new knowledge (C), then they disrupt group dynamics and the QC process halts (O) because new knowledge threatens their self-image and they feel at risk of losing their professional identity (M)

There are exceptions of, of individuals who cannot accept anything in anyway and; they are self-seeking and cannot learn anything new, who then, even if they participate, are not able to understand anything or to change practice [translated from Swiss German] (4a).

And of course, with time, you trust each other. And you open up, and then you have to find out if people fit in or not; unfortunately, there are a few people who don't fit in. Then decisions have to be made, i.e. they have to leave; if they can't deal with the group or accept something new. Otherwise QCs can't work [translated from Swiss German] (6).

If there is a disrupting feature in the group that hinders the group from norming, then I have to deal with it. For example, if someone always withdraws, then I have to ask the individual, in front of the group or maybe better in private [translated from Swiss German] (2).

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

Adapting, creating and testing new knowledge

Context mechanism outcome configuration 13: **'interdependence between insurers / physician network organisations / national administrations and GPs'**

If national administrations require continuous QC activities (C), then QCs will negotiate priorities and design creative solutions(O) because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M).

I also think intrinsic motivation is an important point for someone to participate in a QC. But especially in our network, it is not only intrinsic motivation, it is also a requirement [translated from Swiss German] (5).

That is certainly a driver for improving quality and the physician network or the responsible organisation must then have resources to apply these results and at the same time support the QCs, for example with scientific knowledge [translated from Swiss German] (2).

I think I can sign up to these points of programme theory. In our case it is our network that forms and maintains the organization in the background, that supports the QC, but also requires participation [translated from Swiss German] (5).

I completely agree with the programme theory here and I think it points the finger at an important point. I could give you many examples to confirm this. You have to demand change to a certain degree [translated from Swiss German] (2).

It is the balance between autonomy and then still being able to demand something, even if it is mainly at the organisational level. As an incentive, small financial compensations for the participants come to mind [translated from Swiss German] (2).

The question is then, as many participants then of course may think, okay, I would like to devote myself to an important topic. But these topics should then also be important for the whole organisation and that may then have a stimulating effect [translated from Swiss German] (3).

Context mechanism outcome configuration 14: **'threat to professional autonomy'**

If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and not participate (O) because they feel unsafe and lack autonomy in their clinical role (M).

no data

Context mechanism outcome configuration 15: **'interdependence among group members'**

If participants maintain a trusting learning environment that promotes knowledge exchange, assisted by facilitators who use professional techniques (e.g., contentious discussion, reaching consensus, and role play), (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as similar, and act and negotiate cooperatively to reach a common goal (M).

I was just thinking about the means to challenge the QC. Basically, I think you can stimulate a discussion, even a controversial one. Then the group debates, thinks in a circular fashion, uses role play and they stimulate one other to find new solutions. [translated from Swiss German] (5).

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

At the beginning of a QC, there is hardly any consensus in a group regarding therapy. But then, if you work on it in circles and look at it from different perspectives, and are motivated to improve, then there is an incentive within the group to align [translated from Swiss German] (5).

The reason why the group drafts such recommendations and continues to work on them is, I really think so, that the group says, 'okay' we need to discuss how to put it together and see if we can use it, and if a facilitator skilfully tackles that and steers the process in a good direction so the group participates, and then the group really does it and creates something new, they get the feeling that we've done it ourselves now [translated from Swiss German] (3).

Sometimes you don't understand it right from the start. But then you can say, okay, then I'll just try with a few patients for the next two or three months. Especially if something's a common problem. Then I can take a closer look at it again in the QC and slowly change my behaviour bit by bit [translated from Swiss German] (4a).

I can also well imagine the following happening, and it does in our case: someone reads an article and wants to discuss it in the group, because something new is recommended, something that should be changed in practice. But before I change something, I first want to know what my peers think about it. And I often see that it is only then that something new is actually introduced [translated from Swiss German] (4a).

Context mechanism outcome configuration 16: **'identifying and removing barriers to change'**

If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O), because participants help each other develop strategies to identify and overcome these barriers (M).

It is useful to identify barriers in advance, as for example in drug prescription projects. It increases the willingness to change. For example, there was a lot of resistance to the discussion of antidepressants, because most colleagues simply didn't want to change anything. It was good that we had discussed this in advance [translated from Swiss German] (5).

Innovations create opposition and nothing else is true. I think that's clear. And sometimes I have to bring it up, so that it becomes clear even before problems arise. We must then remain consistent and stick to our goal, even if we talk a lot about these barriers [translated from Swiss German] (2).

But I don't think barriers are a big problem, because you hardly ever put up relevant barriers if you are there, participating in the QC, and addressing and solving them during the process [translated from Swiss German] (2).

Context mechanism outcome configuration 17: **'need for competence, autonomy and relatedness'**

If participants create new knowledge and plan an implementations strategy (C), then they feel satisfaction, responsibility and stewardship (O), because this fulfils their need for competence (a sense of self-efficacy to achieve specific objectives) (M), autonomy (a feeling of being in control of one' s own behaviour) (M), and relatedness (a sense of connection to a larger group) (M).

We also have the feeling of togetherness when we go to the literature and read and discuss guidelines, but then agree that it is not always possible to follow them in all situations. We then somehow deviate somewhat from evidence-based medicine, but only for the good of the patient. We then feel on equal footing with the specialists, we work almost guideline compliant, and that creates professional identity [translated from Swiss German] (5).

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

It is important that the group jointly works through the pdca cycle. And then the facilitator - it doesn't always have to be just the facilitator, it can also be a participant - should make sure that you measure how it is and then again later, when everyone is changing in a similar way. Basically, this is the task of the facilitator, but the group acts as a regulating element for the individual, so that everyone participates, in the development and in the change of behaviour. And when the group has made progress, it feels good [translated from Swiss German] (3).

And you're satisfied because you were involved, and so you can relate to the content of the innovation, and that's probably why it works so well; it was well done and I can identify myself with it...and support it...and you feel like you developed it or helped develop it [translated from Swiss German] (4a).

Context mechanism outcome configuration 18: **'intention to change'**

If participants publicly announce their intention to change (C), then they are more likely to implement the change (O) because they and others in the group both think it is a good idea and they believe they can carry it through (M).

And that gives me the feeling of significance and satisfaction in QCs, when I've done something like this. And when I also intend to use [new knowledge... the facilitator helps me if he carries me through the PDCA cycle. In this phase, the facilitator is very important, important for planning, because he helps me when I have to plan; that is, when the members or at least one of them has decided to change behaviour [translated from Swiss German] (2).

Repeating the process

Context mechanism outcome configuration 19: 'testing new knowledge'

If participants validate and test new knowledge in a QC moderated by a skilled facilitator in a safe environment (C), then they feel safe to put that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M).

No data

Context mechanism outcome configuration 20: **'gaining confidence in an innovation'**

If the group iteratively practices implementing and coping with an innovation (C), then they trust their own competence and turn the innovation into a habit (O) because successful outcomes build up confidence in their abilities (M).

Is a sustainable change taking place? I think yes, but just, if I am completely honest, I have to tell you that I cannot always prove it. I just think that if it were documented, i.e. if the process in the QC were well documented, the change would be more sustainable. And when you see that it works, it is even more motivating and shows that the QC is a good thing [translated from Swiss German] (2).

But to recognise whether the process actually leads to a change in my own behaviour, I have to have an outside indicator that shows it to me, time and again. In principle, this means that I have to have an external objective assessment of what I am doing and whether anything is changing - and this helps to change my behaviour and to gain confidence in [translated from Swiss German] (1).

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

Right. Because that is the ultimate question: if I wanted to change something, then something should change and if nothing has changed, then it is somewhere on the way between wanting it and being stuck; but if I see that it starts working, it is very motivating and I continue [translated from Swiss German] (1).

Context mechanism outcome configuration 21: ‘**‘repetition priming and automaticity’**

If participants build a steady group and practice using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because successful responses increase with repetition: ‘practice makes perfect’ (M).

I facilitate a QC there and notice that the motivation has rather increased over the years because the participants have realized what benefits they get from it. But in the beginning people were extremely critical and passive. [translated from Swiss German] (2).

That is totally exciting, when you see that the participants choose the same or similar topics, but they deal with them in a very different way and they go deeper into the topic [translated from Swiss German] (2).

It is a fact that you use the same techniques, over and over again, in terms of methodology - and don't even notice it...so, even if you don't notice it, it helps [to improve quality in PHC], that's for sure, that’s absolutely right [translated from Swiss German](3).

But a lot of things are just as I have just described, and it is effectively the case that local autonomy is important for the implementation of innovations. The organisations must regard this as important, and the new knowledge must be available on a platform, so that it can be exchanged again and again, and looked at until it is established [translated from Swiss German] (3).

Well, I have had varying experiences; one is that you have to think in great detail and do the same procedure over and over again. But if, over a longer period of time, this same process has become established, and the thinking within the group becomes more similar, or they become, how should I put it, part of this, this, this basic cycle, then sometimes you can skip elements and make fairly rapid progress. It is a question of routine [translated from Swiss German] (1).

I can also see that it takes a long time and that it takes two or three QC sessions before an improvement is achieved. Therefore, you have to keep addressing the problem and thus initiate a repetitive process [translated from Swiss German] (4b).

Results of the focus group sessions

Focus group: summary of agreement / disagreement

Conference Workshop: April 24th

Participants: 21

Quality Circles: what works for whom and why

Adrian Rohrbasser / Sharon Mickan / Janet Harris

I. Read the summary statements

II. Think about your own groups while considering the statements

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

III. Consider the ones that are different in your group

IV. Add your comments to the statements

1 Statement

If an invitation to a meeting with general information on QCs addressing GP needs is issued and a facilitator, preferably a GP, introduces QCs and explains how they work

then the meeting takes place and people become familiar with the theoretical background of the QC model

provided that the venue is close to the working place and time convenient and/or CME Points are offered.

Agree ☐

Disagree ☒ / unsure Why? Please explain below:

4 out of 21 disagree or are unsure

Too many invitations: invitation has to be personal (not further explained although facilitator asked)

Facilitator needs a reward because of "more work"

2) Statement

If a GP, as part of the team, is introduced into the group as a facilitator

then QCs are more relevant to the participants and a sense of ownership is created

provided that the GP has completed 2 days' training in facilitating structured small group work

Agree ☐

Disagree ☒ /unsure Why? Please explain below:

5 out of 21 disagree or are unsure

Denmark: Flat democratic structure; all members have facilitator training and therefore they have an understanding of the role of a facilitator; role of facilitator rotates.

People feel safe when there is equality about facilitation

Swiss participant: the group needs a leader and training in leadership, continuous and updated training in leadership.

Germany: Facilitation needs qualification and training and financial compensation. Financial resources to train facilitators are important.

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

Facilitator should be a GP but other professionals may have the skills. Facilitators need respect and understanding for GP environment.

The leader must be accepted by the group – formal or informal -. Training in leadership should be part of GPs' training

Uncertain whether 2 days are enough: description of hours and content are needed.

Spain: content is more important than hours or days!

Talented Facilitators need to be able to motivate - clear leadership is required.

Shared facilitation is possible

Separate group leader and facilitator are also possible: separate group leader and separate facilitator during the meeting.

3) Statement

If objectives, both for the team as a whole and for individual team members are discussed, including the venue, duration and frequency of meetings, as well as individual tasks, such as writing the minutes then the group forms and develops a basic level of trust

provided that the facilitator introduces people to each other, opens discussions, clarifies and summarizes statements in a group arranged in a circle without barriers, such as screens.

Additional context features: professional and administrative autonomy are needed as well as rooms and equipment.

Agree ☐

Disagree ☒ / unsure Why? Please explain below:

2 out of 21

4) Statement

If social norms are discussed, for instance punctuality and how people interact with each other and if further tasks within the group are talked over

then group bonding develops and the level of trust increases

provided that professional and organisational autonomy are granted

Agree ☐

Disagree ☒ /unsure Why? Please explain below:

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

1 out of 21

5) Statement

If people can present their clinical cases and share their experiences

then people will be satisfied with the group process

provided that the facilitator ensures interactive responses and respects each member's contributions.

Additional context features: organizational barriers and excessive demands for the meetings have to be avoided.

Protected time is offered: the meeting takes place during working hours and participants are freed from clinical duties during the sessions.

Agree ☐

Disagree ☒ / unsure Why? Please explain below:

7 out of 21

It has to take place during working hours

Confidential atmosphere and mutual respect for each other

Sharing experiences is enough the beginning

After 2- or 3-years people become more expert in the process of QCs

People need a clear agenda (facilitator tried to clarify what that meant – could not be clearly explained)

Shared responsibility for the content is necessary; the whole group has to set the agenda and prepare the content

Each session is slightly different

Delegate ownership for different sessions (???)

Moderator has to ensure that the group works

You have to clarify roles and responsibilities

6) Statement

If the group discusses case reports and experiences

then people will participate actively and relate to the group

provided that the facilitator elicits open communication

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

Agree ☐

Disagree ☒ / unsure Why? Please explain below:

4 out of 21

Cases are accepted as common agendas

Safe environment and mutual respect for each other

Leader starts to show vulnerability and others will follow (leadership or facilitator = role model)

It is better to have big questions about new laws, policy and practice; a single case is not enough; the issue should affect all people

Sharing emotionally difficult cases: if difficult for one, then difficult for others: helping each other.

For instance, Critical Incidence feels like relief for others and is therefore seen as important.

Need to have mutual goal, how to define a purpose. Leaders and members have to define the goal.

You should negotiate the topic with all members

Needs of the group change over time

Democratic process

7) Statement

If the group discusses difficult experiences that burden participants

then others will appreciate their professional role and group identity increases

provided that confidentiality is guaranteed within the group and granted even at an organizational level

Agree ☐

Disagree ☒ Why? Please explain below:

1 out of 21

8) Statement

If clinical cases are presented and different opinions discussed

then interactive learning and personal reflection on action take place

provided that the facilitator involves all QC members with an appropriate balance between comfort and challenge, depending on what level of trust the group has reached.

Agree ☐

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

Disagree ☒ Why? Please explain below:

1 out of 21

9) Statement

If the group contemplates clinical cases and mirrors their practice by looking at diagnostic patterns or prescription habits and discusses emerging topics in the light of evidence-based information

And/Or

If the group reflects on video consultations or results of patient satisfaction surveys

And/Or

If the group meets up with a local opinion leader and reflects on clinical scenarios

then people increase their understanding and gain insight into gaps in knowledge

provided that the facilitator establishes and maintains a learning environment and acts cautiously when addressing performance.

Additional context features: the management supports QCs to improve performance by allowing autonomy while setting expectations. Access to scientific knowledge, practice guidelines, quality indicators, a performance management system and an electronic medical record are provided to mirror current practice.

Agree ☐

Disagree ☒ Why? Please explain below:

3 out of 21

It might increase

Need to look and analyse

Feedback is important to each other

Measurement and data triggers discussion

Data is an important tool

Need to learn about data / skills to analyse and interpret / trust data

Data is supported by AQA institute for discussion in QCs – it took a long time to build trust and confidence

After QC: people have to move towards agreement, consensus

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

10) Statement

If the facilitator uses different techniques to reflect practice, such as brain-storming, followed by contentious discussions and reaching a consensus, professional reprocessing of patient situations and role play, raising awareness of emotions, and purposeful use of local experts

then new knowledge is created

provided that the management accepts that acknowledging unstated beliefs about innovations is essential for creating new knowledge.

Additional context features: the management values QC contributions to the organization. Local adjustments of knowhow are allowed in order to customize knowledge and organizational pluralism is accepted.

Agree ☐

Disagree ☒ Why? Please explain below:

4 out of 21

Management: level above QCs

Change techniques to reflect gradually - group develops and learns different ways

You should stick to the same technique

Mature group will change ways of working more easily; choose technique to fit the problem

Check if right technique is used after the session

11) Statement

If participants in the group compare their experiences and current practice with each other and with evidence-based information using different facilitating techniques like contentious discussion and reaching a consensus

then new knowledge is validated and corroborated

provided that the management agrees on shared decisions when it comes to the use of new knowledge and accepts a certain degree of diversity in the organization.

Agree ☐

Disagree ☒ Why? Please explain below:

1 out of 21

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

12) Statement

If the facilitator helps the group or the individual to make a binding plan of what they want to change in the light of new knowledge

then participants make a commitment to change

provided that the management agrees on shared decisions when it comes to the use of that new knowledge.

Agree ☐

Disagree ☒ Why? Please explain below:

3 out of 21

Continuous reflection

As knowledge increases plans evolve

Plan also needs a follow up PDCA

Facilitate change

Binding plan – make participants aware of, engage, participate from start creates ownership

Nothing changes – need social, financial incentives to change

Long term commitment

13) Statement

If the group discusses factors that hinder or foster implementation of new knowledge or change of practice and carefully evaluates adjustments to local conditions

then people use that new knowledge at their working place

provided that the management supports social processes that form and circulate knowledge and accepts a certain degree of diversity in the organization

Agree ☐

Disagree ☒ Why? Please explain below:

1 out of 21

14) Statement

If the group compiles detailed information about how to follow progressive goals and continuously evaluate new knowledge

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

then new knowledge is systematically used and evaluated in the working place

provided that the management supports social processes that form and circulate knowledge and assists in carrying out the tasks

Agree ☐

Disagree ☒ Why? Please explain below:

4 out of 21

Not everyone will follow

Doing a little bit better is always good

Small change is achievable

Group may need different targets

Need monitoring feedback

Reflections

Differences in funded and free QCs

Nothing about financial support

Conference Workshop April 25th

12 Participants

Quality Circles: what works for whom and why

Adrian Rohrbasser / Sharon Mickan / Janet Harris

I. Read the summary statements

II. Think about your own groups while considering the statements

III. Consider the ones that are different in your group

IV. Add your comments to the statements

1) Statement

If an invitation to a meeting with general information on QCs addressing GP needs is issued and a facilitator, preferably a GP, introduces QCs and explains how they work

then the meeting takes place and people become familiar with the theoretical background of the QC model

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

provided that the venue is close to the working place and time convenient and/or CME Points are offered.

Agree ☐

Disagree x Why? Please explain below:

4 out of 12

Denmark: don't wend out invitations (what other ways of contacting and offering training – Facilitator tries to investigate – no answer) – no CME points should be offered

CME points are important, but not the most important reason to attend

A sent invitation is not enough – "it does not make sure that a person will attend"; link invitations to an existing system. Organisational structure makes the difference, for instance networks.

Use external motivator, for instance money to get there = trigger similar to CME points.

Need information to be informed about QC (facilitator asks for further explanations without success)

Convenient location is important

2) Statement

If a GP, as part of the team, is introduced into the group as a facilitator

then QCs are more relevant to the participants and a sense of ownership is created

provided that the GP has completed 2 days' training in facilitating structured small group work

Agree ☐

Disagree 4 Why? Please explain below:

4 out of 12

Facilitators don't have to be GPs

On order to receive CMEs, there has to be a moderator (=facilitator)

In Norway, training takes two years to become a facilitator and three years' of GP facilitation (not confirmed by other members und not confirmed in the literature)

Bottom up system in QCs creates natural leaders

The facilitator has to be part of the group: flat hierarchical structure creates sense of ownership

Members of the group offers to be facilitator

Not all groups have a facilitator; all are equal (Denmark)

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

Another Danish participant: the group leader is the administrative secretary, teacher and facilitator comparable to the role of a CEO

In Denmark, all participants attend moderator courses and can lead....

3) Statement

If objectives, both for the team as a whole and for individual team members are discussed, including the venue, duration and frequency of meetings, as well as individual tasks, such as writing the minutes then the group forms and develops a basic level of trust

provided that the facilitator introduces people to each other, opens discussions, clarifies and summarizes statements in a group arranged in a circle without barriers, such as screens.

Additional context features: professional and administrative autonomy are needed as well as rooms and equipment.

Agree ☐

Disagree x Why? Please explain below:

5 out of 12 disagree

You should not have any barriers like screens at all, they are distracters and should be removed

Physical arrangement of people is important, there has to be enough space

Rearrange classroom to interaction

4) Statement

If social norms are discussed, for instance punctuality and how people interact with each other and if further tasks within the group are talked over

then group bonding develops and the level of trust increases

provided that professional and organisational autonomy are granted

Agree ☐

Disagree x Why? Please explain below:

3 out of 12

Start with clinical discussions before you set norms!

Talk about basic rules at the first meeting

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

Address these topics – like social norms – after the group has been together – need trust to have a discussion.

1 sheet of paper = rules for the group = pass out in the 1st QC – these rules can be changed; after 3 – 4 meetings set a discussion to confirm the rules

As group norms grow, social control increases

If you discuss which rules the group has, it improves trust.

5) Statement

If people can present their clinical cases and share their experiences

then people will be satisfied with the group process

provided that the facilitator ensures interactive responses and respects each member's contributions.

Additional context features: organizational barriers and excessive demands for the meetings have to be avoided.

Protected time is offered: the meeting takes place during working hours and participants are freed from clinical duties during the sessions.

Agree ☐

Disagree x Why? Please explain below:

8 out of 12 disagree

Meeting doesn't not necessarily have to take place during working hours, really not necessary

It should be out of working hours evening or during lunch time

The group should decide on this

6) Statement

If the group discusses case reports and experiences

then people will participate actively and relate to the group

provided that the facilitator elicits open communication

Agree ☐

Disagree x Why? Please explain below:

1 out of 12

7) Statement

Supplementary material 9 revised programme theory including illustrative quotes and complete list of supporting quotes

If the group discusses difficult experiences that burden participants

then others will appreciate their professional role and group identity increases

provided that confidentiality is guaranteed within the group and granted even at an organizational level

Agree ☐

Disagree x Why? Please explain below:

1 out of 12

8) Statement

If clinical cases are presented and different opinions discussed

then interactive learning and personal reflection on action take place

provided that the facilitator involves all QC members with an appropriate balance between comfort and challenge, depending on what level of trust the group has reached.

Agree ☐

Disagree x Why? Please explain below:

1 out of 12

9) Statement

If the group contemplates clinical cases and mirrors their practice by looking at diagnostic patterns or prescription habits and discusses emerging topics in the light of evidence-based information

And/Or

If the group reflects on video consultations or results of patient satisfaction surveys

And/Or

If the group meets up with a local opinion leader and reflects on clinical scenarios

then people increase their understanding and gain insight into gaps in knowledge

provided that the facilitator establishes and maintains a learning environment and acts cautiously when addressing performance.

Additional context features: the management supports QCs to improve performance by allowing autonomy while setting expectations. Access to scientific knowledge, practice guidelines, quality

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indicators, a performance management system and an electronic medical record are provided to mirror current practice.

Agree ☐

Disagree x Why? Please explain below:

3 out of 12

Management is the level above the GP level (explanation ADR) Wrong word? Authority was proposed, accountability, government

Denmark: GPs are the managers! (facilitator points out that these GPs play a different role then – as mangers – even if it is the same person: for instance – QC during working hours – managerial decision even though it is taken be a GP in the role of the manager...)

Danish participant: There are different levels above the GP: medical association – they teach, supervise and facilitate

There is a different impact if a local opinion leader leads the QC

When there is no support, the group manages itself

10) Statement

If the facilitator uses different techniques to reflect practice, such as brain-storming, followed by contentious discussions and reaching a consensus, professional reprocessing of patient situations and role play, raising awareness of emotions, and purposeful use of local experts

then new knowledge is created

provided that the management accepts that acknowledging unstated beliefs about innovations is essential for creating new knowledge.

Additional context features: the management values QC contributions to the organization. Local adjustments of knowhow are allowed in order to customize knowledge and organizational pluralism is accepted.

Agree x

Disagree ☐ Why? Please explain below:

11) Statement

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If participants in the group compare their experiences and current practice with each other and with evidence-based information using different facilitating techniques like contentious discussion and reaching a consensus

then new knowledge is validated and corroborated

provided that the management agrees on shared decisions when it comes to the use of new knowledge and accepts a certain degree of diversity in the organization.

Agree x

Disagre e Why? Please explain below:

12) Statement

If the facilitator helps the group or the individual to make a binding plan of what they want to change in the light of new knowledge

then participants make a commitment to change

provided that the management agrees on shared decisions when it comes to the use of that new knowledge.

Agree x

Disagree ☐ Why? Please explain below:

13) Statement

If the group discusses factors that hinder or foster implementation of new knowledge or change of practice and carefully evaluates adjustments to local conditions

then people use that new knowledge at their working place

provided that the management supports social processes that form and circulate knowledge and accepts a certain degree of diversity in the organization

Agree x

Disagree ☐ Why? Please explain below:

14) Statement

If the group compiles detailed information about how to follow progressive goals and continuously evaluate new knowledge

then new knowledge is systematically used and evaluated in the working place

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provided that the management supports social processes that form and circulate knowledge and assists in carrying out the tasks

Agree ☐

Disagree x Why? Please explain below:

3 out of 12

Denmark: the results (data) should not be discussed in the group

Too optimistic, the group won't change as much as we (?) hope

Clarification of compile: minimal documentation about how to proceed (?)

Pre survey in each QC for each practice; post survey and qualitative data could show change

Workshops in Fischingen: Summary of participants' ideas about mechanisms of the programme theory

1. Summary statement: participation in the meeting is accepted when General Practitioners' needs are addressed and logistical barriers to attending are identified and tackled during the initial phase of the program.

Process outcome: People are familiar with the theoretical background of QC model

Activities: invitation to an informative meeting with general information on QCs, addressing GP needs. A facilitator, preferably a GP, introduces QCs and explains how they work.

Context: Venue is close to working place and time convenient; CME Points are offered.

Mechanisms: "Reasoning"

M1 People feel they have an important stake so participate

M2 People are engaged in their work, want to learn autonomously and therefore decide to participate

M3 People think the meeting will lead to self-satisfaction and reward.

M4 People seek new challenges in new areas and expect that these will increase their competence and help them relate to colleagues.

M5 Social pressure makes them participate because of membership in a network and the associated responsibilities of joining QCs.

M6 Health insurance companies identify GPs using resources inadequately and make them participate.

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2. Summary statement: involving GPs as facilitators as part of the team in QCs leads to interventions being more relevant to participants' needs and creates a sense of ownership by those delivering and receiving the intervention.

Process outcome: Group is facilitated in a professional way

Activities: A GP who is trained in facilitating structured small group work is introduced into the group

Context: A GP has completed 2 days' training in facilitating structured small group work

Mechanisms: "Reasoning"

M1 since it is a GP who facilitates the program among other GPs, it becomes more relevant to participants and creates a sense of ownership.

M2 a facilitator who is a GP gains more credibility - the facilitator is perceived by the participants to be 'one of us'

3. Summary statement: group bonding and a basic level of trust develop when the group autonomously decides on the structure of its meetings with the help of a trained facilitator in an open atmosphere without barriers.

Process outcome: Group Forming and basic level of trust

Activities: The facilitator introduces people to each other, opens discussions, clarifies and summarizes statements. Objectives, both for the team as a whole and for individual team members are discussed. Venue, duration and frequency of meetings are discussed, as well as individual tasks like writing the minutes.

Context: At an organizational level: professional and administrative autonomy are needed as well as rooms and equipment.

At a group level: group is arranged in a circle without barriers, such as screens

Mechanisms: "Reasoning"

M1 The group members feel familiar with what they are going to cover and are able to participate actively.

4. Summary statement: the social structure and the level of trust grow when the group autonomously decides on social norms like punctuality and feedback culture, with the help of a trained facilitator, provided that they are discussed and agreed upon in an open atmosphere without barriers.

Process outcome: Group Norming and increased level of trust

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Activities: The facilitator opens discussions in the group, clarifies and summarizes statements as they discuss the ground rules of how people interact with each other. People are introduced to each other at a deeper level and resolve possible differences. Social norms like punctuality and further tasks within the group are talked over.

Context: At an organizational level: professional and administrative autonomy are needed as well as rooms and equipment.

At a group level: group is arranged in a circle without barriers, such as screens

Mechanisms: "Reasoning"

M1 The group members feel familiar with the group and are able to relate to each other.

5. Summary statement: Presentation of own clinical cases in a well facilitated group increases the feeling of reassurance and being acknowledged in the group, and increases self-esteem. Protected time, no excessive demands and no organizational barriers are prerequisites of this process.

Process outcome: satisfaction with the group process.

Activities: People present their clinical cases and share their experiences. The facilitator ensures interactive responses and respects each member's contributions.

Context: There are neither organizational barriers nor excessive demands for the meetings. Protected time is provided: the meeting takes place during working hours and participants are freed from clinical duties during the sessions.

Mechanisms: "Reasoning"

M1 By reconfirming their practice among colleagues, the feeling of security and predictability is increased.

M2 A sense of affiliation to the group and being acknowledged grows when common experiences are shared.

M3 When colleagues actively listen to experiences, it increases self-esteem.

6. Summary statement: discussion of case reports makes the group active and creates a supportive and understanding culture among participants.

Process outcome: Active participation and relatedness to the group

Activities: the group discusses case reports and experiences with help of a facilitator, who elicits open communication.

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Mechanisms: "Reasoning"

M1 Family physicians are engaged in their work and focus on relevant, practical knowledge that is of immediate use to them.

M2 Common experience creates mutual understanding and gives a sense of collegiality.

7. Summary statement: discussion of difficult experiences and exchange of emotional responses provides recognition of professional roles and increases group cohesion if confidentiality is guaranteed at a group and organizational level.

Process outcome: Appreciation of professional role and increase in group identity.

Activities: the group discusses difficult experiences that burden participants. The facilitator leads the discussion and supports narrators through active listening techniques.

Context: Confidentiality is guaranteed and granted, even at an organizational level

Mechanisms: "Reasoning"

M1 Family physicians are engaged in their work and focus on relevant, practical knowledge that is of immediate use to them.

M2 Common experience creates mutual understanding and gives a sense of collegiality.

8. Summary statement: case discussions as a basis of challenging each other's position enable the group to reflect on their practice and to learn from each other in a cooperative atmosphere of mutual understanding.

Process outcome: Interactive learning and personal reflection on action

Activities: clinical cases are presented and different opinions discussed. The facilitator involves all QC members with an appropriate balance between comfort and challenge, depending on what level of trust the group has reached.

Mechanisms: "Reasoning"

M1 Previous knowledge is activated through case discussions.

M2 The group supports and rewards exploratory behaviour by giving the feeling of competency, which enables participants to describe what they actually do.

M3 People are motivated to imitate those peers who are more competent and then receive positive feedback.

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9. Summary statement: when facilitators use different prompting techniques, they allow the group to reflect on their practice and acknowledge gaps in knowledge. The facilitator cautiously addresses performance while the management provides appropriate and trustworthy data.

Process outcome: Understanding and insight into gaps of knowledge

Activities: The group contemplates clinical cases and mirrors their practice by looking at diagnostic patterns or prescription habits. Emerging topics are discussed in the light of evidence-based information. The facilitator establishes and maintains a learning environment and acts cautiously when addressing performance.

The group reflects on video consultations or results of patient satisfaction surveys.

The group meets up with a local opinion leader and reflects on clinical scenarios.

Context: the management supports QCs to improve performance by allowing autonomy while setting expectations. Access to scientific knowledge, practice guidelines, quality indicators, a performance management system and an electronic medical record are provided to mirror current practice.

Mechanisms: "Reasoning"

M1 Previous knowledge is activated through case discussions.

M2 The group supports and rewards exploratory behaviour by giving the feeling of competency, which enables participants to describe what they actually do.

M3 People are motivated to imitate peers who are more competent and receive positive feedback.

M4 Critical reflection on experience and practice enables practitioners to identify learning needs.

M5 Addressing performance may cause anxiety and frustration among participants.

10. Summary statement: The group creates new knowledge when they mirror and reflect current practice in a well facilitated learning environment, given that the management values their contributions.

Process outcome: Creation of new knowledge

Activities: The facilitator uses different techniques to reflect practice, such as brain-storming, followed by contentious discussions and reaching a consensus, professional reprocessing of patient situations and role play, raising awareness of emotions, and purposeful use of local experts.

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Context: Management accepts that acknowledging unstated beliefs about innovations is essential for creating new knowledge and values QCs' contributions to the organization. Local adjustments of knowhow lead to customized knowledge and fit into organizational pluralism.

Mechanisms: "Reasoning"

M1 Previous knowledge is activated through discussions of current practice

M2 People are motivated to imitate peers who are more competent and receive positive feedback.

M3 Critical reflection on experience and practice enables practitioners to identify new knowledge.

M4 Family physicians are engaged in their work and focus on relevant, practical knowledge that is of immediate use to them.

11. Summary statement: Provided that the management acknowledges and accepts QC contributions, the group appraises and modifies new knowledge when they compare their experiences with each other and with evidence-based information.

Process outcome: Validation of new knowledge

Activities: Participants of the group compare their experiences and current practice with each other and with evidence-based information, using different facilitating techniques, such as contentious discussion and reaching a consensus.

Context: the management agrees on shared decisions when it comes to the use of new knowledge and accepts a certain degree of diversity in the organization.

Mechanisms: "Reasoning"

M1 The group supports and rewards exploratory behavior by giving the feeling of competency, which enables participants to test new knowledge.

M2 Analytical reflection on experience and practice enables practitioners to critically appraise new knowledge.

12. Summary statement: When the group or individuals develop their plan of change it becomes a binding arrangement, provided that the management values their ideas regarding the use of new knowledge.

Process outcome: Commitment to change

Activities: the facilitator helps the group or the individual to make a binding plan of what they want to change in the light of new knowledge

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Context: the management agrees on shared decisions when it comes to the use of new knowledge

Mechanisms: "Reasoning"

M1 New knowledge that has been acquired in a learning environment influences individual perception concerning the perceived risks and benefits of making a change and allows a change of attitude and commitment to change (Health Belief Model)

M2 Individuals of a group take into account the social norms and practices of their peers when they take in knowledge and implement it (theory of reasoned action)

13. Summary statement: the use of knowledge or skills in the working place is fostered when the group is endorsed by the management in making local adjustments and in removing barriers to innovations.

Process outcome: Use of knowledge in the working place

Activities: The group discusses factors that hinder or foster implementation of new knowledge or change of practice and carefully evaluates adjustments to local conditions.

Context: The management supports social processes that form and circulate knowledge and accepts a certain degree of diversity in the organization.

Mechanisms: "Reasoning"

M1 People feel that they are in control of and empowered by the process.

M2 As people have developed new knowledge or skills themselves, they have confidence in their ability to take action.

M3 The commitment to change creates a sense of urgency to use new knowledge or skills.

M4 People believe that new knowledge or skills they developed themselves are relevant and important to them.

14. Summary statement: people can put new knowledge or skills into systematic use when they plan progressive goals they can follow under the guidance of a facilitator, in agreement with the management.

Process outcome: Systematic use of new knowledge in the working place and re-evaluation

Activities: Under the watch of the facilitator, the group compiles detailed information about how to follow progressive goals and continuously evaluate new knowledge.

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Context: The management supports social processes that form and circulate knowledge and assists in carrying out the tasks.

Mechanisms: "Reasoning"

M1 *Social support and guidance in using new knowledge increases the ability to take action*

M2 *Confidence in the group's ability to take action increases when they use progressive and iterative goals*

M3 *Anxiety is reduced when the group demonstrates desired behaviour.*

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1. Preconditions
a) 'Need for autonomy and obligation' If the administration at national level or at the level of health insurance companies entrusts GPs with QI and autonomy (so they can decide how to implement it) (C), then GPs might participate in QCs (O) because they feel they can take on the responsibility and make a difference (M). *So, we got more money, but it was for the government no value for money … well … extra value for the money. The only obligation was to participate in the local QC which had to gather four times a year, and you had to participate at … at least two of them every year to keep your accreditation. But you should have an obligation to improve your quality in your practice (1).*
New CMO configuration: 'Being embedded in a system of QI' If QCs are embedded in a QI system (an organisation that negotiates and signs contracts with governmental bodies or health insurance companies, trains and supervises facilitators, provides courses on QI in PHC, and easily accessed educational material, timely data on practice performance and protected time and space) (C), then participants will take on responsibility and work in a purposeful way (O) because they feel supported, empowered, and capable of meeting expectations (M). *… embedding QCs in a system … organising during working time is one ... training facilitators is another one, in a continuous way and honouring in one way or another, maybe financially, especially for the extra hours and the extra work they put into it, and ... offering GPs the possibility of easily gathering data about their own practice ... in a much shorter time, getting feedback on your practice from a national level and getting it in a systematic way ... brought into the peer review would be a good way (1).* *…so, you know the evaluation is mainly to help the person who is organising; the evaluation is really for the tutor, because they [the organisation] are structuring and organising the meetings and it is really seen as a support process … (2).* *I think our problem is at the level of the organisational context. We don't get any support, we don't have protected time, we don't get any help to ... implement new things and do quality improvement … administrative support does not exist …and we have too much to do … too many patients a day (5).*
b) 'Feeling they have a say' If an organisation, (e.g. a physician network organisation) has a decentralised *policy that* encourages use of local knowledge (C), then the QC takes on tasks (O) because members feel that they have a say in QI in their practice (M). *No additional data.*
c) 'Participants know what to expect' If the introductory workshop teaches the principles of QI in PHC and illustrates how QCs work (C), then potential members may be more willing to join QCs (O) because they know what to expect and feel that they can meet expectations (M). *so ... some of them will work well [depending on] whether there is somebody who is inspired and wants to take the lead and knows something about peer review, but most of them are just nice meetings to see colleagues and ... have somebody give a presentation or have some food and drink. So, you should really teach them first! (1).*

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…because they are paid for it and but … there has not been enough understanding in the medical corps to ... to do it and it usually comes on top of all the other ... (3).
2. Establishing the group
a) 'Sharing similar needs' If the administration at the organisational level of QCs provides support (i.e. in training facilitators, data gathering, provision of evidence-based information), protects time and space and offers CME points and small financial incentives to QC participants (C), then the latter will meet in groups to exchange ideas (O) because GPs prefer learning in QCs (M); support generates positive expectations among participants (M) and GPs believe that QC meetings with their peers will be useful (M). *And I think that ... the other thing that is important to the group is the CME / CPD points that they get and the funding from the government to attend meetings. That is all supporting the meetings as well (2).*
b) 'Need for relatedness' If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g. introduces people to each other, opens discussions, and clarifies and summarises statements (C), then group members will get to know each other and decide on rules that they are willing to follow, building a safe environment based on trust (O) because members want to be among and to interact with equals (M). *…and we do that at dinner time so we can have some food together; we work, have dinner and we can enjoy food at the same time (4).* *… but it became clear that we started to get to know each other and each other's sensibilities and to dare to tell about how we handle things and we learnt how to handle each other in a respectful way. Now we have to see how it continues (1).*
c) 'Need for autonomy and control' If the group chooses its own topics and facilitator (C), then its members will feel they own the QC (O) because their need for autonomy - a feeling of being in control of their own behaviour - is satisfied (M). *…exactly big autonomy, the groups decide, there is no pressure from the political system and there is no pressure from anybody and that is why this system is so successful – the doctors can choose (2).*
d) 'Size of the group affects communication' If group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with each other and follow all conversations (M). *For instance, if … I think …15 people is too many … I think eight is enough and … the stress increases if there are more … the smaller the group is, the better the trust and talking (4).*

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e) 'Variety of characters stimulates reflection – cognitive dissonance'

If members of the group have individual character traits and describe different professional experiences but accept each other's views (C), then they can learn from each other (O) because individual attitudes and behaviours will contrast with the knowledge of their peers and cause cognitive dissonance (a negative emotional state triggered by conflicting perceptions) that makes them reflect on their way of working (M).

…. because you can learn from [other] people with more experience, ... you have a [another] way of thinking and [another] way of talking about stuff, situations, that are different I think, so I think it is about different knowledge (4).

f) 'strong cognitive dissonance threatens self-image'

If individuals feel too strong a cognitive dissonance when integrating new knowledge (C), then they may disrupt group dynamics and halt the QC process (O) because their self-image is threatened and they fear losing their professional identity (M).

Yes, we do, yeah, we have doctors who are ... difficult in the group, yes, and they are difficult because they have very firm views and they spend very little evidence on reality. Then it is very important that you have good group leaders and leadership … It is very few … you know trying to sabotage the group … and they don't tend to change behaviour (2).

3. Learning environment

a) 'Feeling safe and not vulnerable'

If participants trust each other (C), then they can describe how they work and admit what they do not know (O), because they feel safe rather than vulnerable (M).

…she told me, you know, one of the things I learnt from you, one of the things I experienced from you is that … opening up with difficult cases and showing that you don't know everything, is showing that you are vulnerable and not knowing what do with it …you build up trust because if you dare to do this, it gives us the confidence that we also can do that … (1)

We know each other very well, so I don't think anybody gets angry about this… and nobody … gets emotionally the wrong way… if you understand what I mean (5).

b) 'Need for competence and self-actualisation'

If the facilitator supports participants and encourages them to tell their stories and share their experiences in a safe environment, e.g. by encouraging interactive responses, through discussions and by summarising statements (C), then participants will be involved and share their positive experiences and failures (O) because they want to improve their professional competence (M), gain professional confidence (M) and fulfil their professional potential (M).

… and the fact that you can explain it to the others makes you realise that ... you have a bit anxiety about it and all the others tell you that this ok – not just because they want to comfort you … then you realise that you became nervous about something very quickly … even if you did something good after all… the group at this moment is very … a peaceful place and a good way of being with yourself and your own way of practising and it increases your self-esteem as well (4).

But sometimes it is about our problems ... our professional life … about our patient, about some case … diagnostics or prescriptions (5).

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c) 'Previous knowledge is activated'

If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by telling their own relevant stories (O) because the process activates knowledge they already possess (M).

It does satisfy us when we can discuss our own work and our own cases, and we feel closer in the group when we stimulate each other's thinking (4).

d) 'Immediate relevance for the practice'

If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O) because it relates to their everyday work and they can use it immediately (M).

... a lot of the doctors will start with a clinical case, but then come to an overview and then discussions and the next step is organising the GP surgery for that – it is quick wins (3).

e) 'Cognitive dissonance'

If participants discuss and reflect on their work processes (e.g. based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance that makes them reconsider their own way of working (M).

When for example a GP ... in a gr ... group is saying that he does a particular thing that is purely not right, not evidence-based or in fact is wrong, then the group are very good ... I think because they know each other... they do not agree with the doctor but they actually discuss it in the group and a few other doctors say what they would do which is usually different and they usually say ' you may consider this as a different way of doing it because if you do it your way, this is what I find happens...' and there is never an issue where somebody needs to feel bad, but they know that whatever they are currently doing is not what the others would (2).

f) 'Social learning'

If the facilitator uses purposeful didactic techniques (e.g., brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection on the work process (C), then the group will create a learning environment that promotes the exchange of knowledge (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

So, I think that the more experienced GPs bring in their cases into the groups and they discuss their experiences within the groups and I think this is very powerful for the group and the younger GPs bring in ... they have the latest evidence in their head and the guidelines and they bring it in .., and the mix of managing the patient with the evidence and the guidelines and the practical bit from the older GP who has the experience, I think this is really the powerful bit in the group and ... and this is where the learning really occurs (2).

Yes, ... in the beginning we thought this (sharing data) had to be in pairs or triplets because we thought that people were not willing to share, but that was quite wrong. They love to share! (3).

4. <u>Adapting, creating and testing new knowledge</u>

a) 'Positive interdependence between the administration at the national level and GPs'

If the administration at national level requires continuous QC activities (C), then QCs will negotiate

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priorities and design creative solutions (O) because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M). *It may be important for the emerging of QCs, that it becomes a mandatory thing [QI] and, after all, we have the same goals [as the health insurance companies] (4).*
b) 'Threat to professional autonomy' If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and fear they lack autonomy in their clinical role (M). *…no there are no demands, … that wouldn't help, there can be wishes, but we decide how we do it… it wouldn't work otherwise (3).*
c) 'Positive interdependence among group members' If participants maintain a learning environment based on trust that promotes the exchange of knowledge, assisted by facilitators who use professional techniques (e.g. contentious discussion, reaching consensus, and role play) (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as similar, and so act and negotiate cooperatively to achieve a common goal (M). *I think that a group … cannot just be presented with things like, 'here is the evidence, take it or leave it and goodbye' and I don't think that works. I think that people need to ... participate in the learning and they have to show what they are currently doing, whether it is the correct thing or not; it needs to be discussed and adjusted and shared within the group (2).*
d) 'Identifying and removing barriers to change' If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O), because participants help each other to develop strategies to identify and overcome these barriers (M). *And I think you have to have guidelines that are workable for doctors who are, you know, seeing 30 to 40 people every day and, if they want to implement change for the better, they have to be feasible and practical and I think the only way to do that is to consider what they are currently doing. And what the barriers are to new care (2).*
e) 'Need for competence, autonomy and relatedness' If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility and stewardship (O) because this fulfils their need for competence (being able to achieve specific objectives) (M), autonomy (a feeling of being in control of their own behaviour) (M) and relatedness (a sense of connection to a larger group) (M). *No data*
f) 'Intention to change' If participants publicly announce that they intend to change (C), then they are more likely to implement the change (O) because they and others in the group all think it is a good idea and believe they can carry it through (M).

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… and I think that is the opportunity to state it [intention to change] … not everybody participates in that … but … most people do … and they'd say look this is what I learned, this is new for me, this is what I am … going to change in my practice (2).
g) 'Testing new knowledge' If participants validate and test new knowledge in a QC, moderated by a skilled facilitator, in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M). *… and I think that the idea of a quality circle meeting trying make changes dramatically is not practical. I think doctors need to look at ideas and look at the practical parts to see what they can do and change slowly over time (2).*
5. Repeating the process
a) 'Gaining confidence in an innovation' If the group repeatedly practises implementing and adjusting to an innovation (C), then they trust their own competence and turn the innovation into a habit (O) because successful outcomes increase their confidence in their abilities (M). *… then we meet again after four months and usually the … their quality improvement project … didn't really happen or just a little bit, and we discuss the reasons for that and how we could amend that, etc. etc. (3).*
b) 'Repetition priming and automaticity' If participants build a regular group and practise using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because responses improve with repetition: 'practice makes perfect' (M). *… but the QC is really a double thing. It is about a theme but it is also about quality improvement. And the aim and goal is that they find it so rewarding that they use this this technique again and again … in their own surgeries and in their own groups (3).*

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Participants

(1) GP in a rural practice, teacher at the University of Ghent (GP from Belgium)
(2) GP in a rural practice, small group educator for 18 years (GP from Ireland)
(3) Certified facilitator in GP vocational training, active in quality improvement and patient safety (GP from Norway).
(4) GP working in an urban area, facilitating a QC, researcher (GP in training from France)
(5) GP in a rural practice, teacher for GP vocational training (GP from Croatia).

Additional interviews: consolidation of the programme theory

Preconditions

'Need for autonomy and obligation'

If the administration at the national level or at the level of health insurance companies entrusts GPs with QI and autonomy (puts them in control of how to do it) (C), then GPs may consider participating in QCs (O) because they feel they can take on the responsibility and make a difference (M).

…we had quite a lot of criticism on the whole system because we did not feel it would really enhance quality and it was just used as a way of getting more money to the doctors without guarantees that quality would be enhanced, which is when we look back 25 years later, is exactly what happened. So, we got more money but it was for the government no value for money well extra value for the money. The only obligation was to participate in the local QC which had to gather four times a year, and you had to participate at ….at least two of them every year to keep your accreditation. But you should have an obligation to improve Your quality in your practice (1).

…., the only thing that is happening is at the national level the one who is responsible for the QC has to fill in after every QC who has been there and what was the subject of the meeting … exactly there are no demands (1).

It may be important for the emerging of QCs, that it becomes a mandatory thing (4).

We have as an obligation in contracts with our insurance to have …… … peer groups…… then … I don't know how many times we should meet, actually. But we don't have or get much money out of this (5)

'Feeling of having a say'

If an organisation, (e.g., a physician network organisation) has a decentralised policy that encourages use of local knowledge (C), then the QC takes on tasks (O) because members feel that they have a say in QI in their practice (M).

No data but confirming comments.

'Participants know what to expect'

If the introductory workshop teaches the principles of QI in PHC and the workings of QCs (social persuasion) (C), this will increase the motivation of future participants to join QCs (O) because they

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learn what to expect and may feel that they are capable of meeting expectations (M).

…they (QCs) are free to choose to what group they participate without any regulation and without any support of what is happening there without any control of what is happening there so ... some of them will work well (depending) whether there is somebody who is inspired and wants to take the lead and know something about peer review but most of them are just nice meetings to see colleagues and ... have somebody have a presentation or drink something and food. So, you should really teach them first! (1).

They get the knowledge about that from … … … the tutors, when they meet at these national workshops, of which there are three, they exchange ideas on useful quality tools and ways to use these tools among the groups and among the participants (2).

…because they paid for it and but ... there has not been enough understanding in the medical corps to ... to do it and usually comes on top of all the other …. (3).

'Quality Circles should be embedded in a system'

If QCs are embedded in a QI system (an organisation that negotiates and signs contracts with governmental bodies or health insurance companies, trains and supervises facilitators, provides courses on QI in PHC, and easy to access educational material, timely data on practice performance, and protected time and space) (C), then participants will take on responsibility and work in a purposeful way (O) because they feel supported, empowered, and capable of meeting expectations (M).

But ... what did not happen is that the system of local QCs was really embedded in a movement or a way that would support people who participate that would make sure that people who took the lead really would support the facilitator the right way (1).

…by making a plan I mean having enough support on the content level which is there but also at the organisational level m... making it possible (to support facilitators) I do believe that the facilitator is very important (1)

…, the facilitator is the …at the start we …had some facilitator training a... 20 years ago, for some of the people who were interested but then that stopped because it was not financed by the government, and not supported anymore, a... and now for about 15 years there has not been a good generic facilitator training for those people who want to take on responsibility. And the ones who do that, it will be in their spare time they will not be paid for doing that e awarded in another way (1).

I can only tell that in our university in Ghent, that is one of the eight universities in Belgium, we try to learn (teach) the students during the last year, to work in peer review groups and then in the continuous education, the vocational training, they have to meet every two weeks, in groups of fifteen, so in the training, this tradition is established and there you have experienced facilitators being there to support these groups. But once they leave the training, and they start working as a GP, mmm this facilitating stops and they have to look for their own peer review groups and what is often happening, is that they cluster together, and make ….they already know each other and they build a new group with those people who started in the same region at the same time. ... and sometimes those are the most interested and the most interesting groups and they do really nice things, but of older doctors, we really don't see that …that tradition (1).

I think peer review groups could be helpful in preventing burnout and finding on a local level way of cooperating to handle this problem of too much work ... even there if it is not supported or organised in a smart way from up, I think we will miss these chances (1).

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…(embedding QCs in a system)…mmm … organising during working time is one, … training facilitators is another one, in a continuous way in and honouring in one or another way, maybe financially, especially for the extra hours and the extra work they put into it, and ... offering in the best way , offering GPs the possibility of easily gathering data of their own practice and being able to discuss that with their peers and colleagues would be the best if not, ... having in a much shorter time getting feedback on your practice from a national level and getting it in a systematic way ... brought into the peer review would be a good way (1).

It was the college that was in charge of the assessment to check the quality of the education because the Irish college of GPs has always been in control of …. of the quality and standards of education. But I think that is a good thing because I think that if your government spends money for an education system then it has to deliver what is relevant for a doctor working in primary cate at the moment. In the assessments, they try to see who is attending and how often and how big the groups should be what kind of educational material is covered and …. the three national workshops that we have and funded by the HSE executive we have the …. have to approve the programme and the teaching and how they deal with the groups (2).

The evaluation ..and usually there is a supportive evaluation so I'd have ..the year before that I had ... people that a group of doctors and you have two doctors who are familiar with this small group work and they come and visit an area and they'd sit in these groups and they talk how you can approve and it is mainly a support for the tutor I think because you have to look at what you are doing and you also get feedback from three people who are not usually attending your small group meetings. It is usually a very supportive structure and if they feel that it is something that is not appropriate or something you should change again, they actually there is an opportunity to do that as well. This is usually not seen as a negative process as far to my knowledge (2).

….. ... so you know the evaluation is mainly to help the person who is organising; the evaluation is really for the tutor, because they are structuring and organising the meetings and it is really would be seen as a support process …really it… it ..unless there are big problems within that group and if there are big problems in that group you have the opportunity to discuss them with the team who is coming and actually very often you can actually clarify or solve problems that are occurring within the group. …..(interviewee moves through the room – inaudible) …and be quite supportive you know and most of us see this positive So but it is a lot of work when I had a team visiting me I had to write a report and have all the names of the GPs attending, I had to have the structure of the group clarified and show what curriculum we have covered the last number of years ... and discuss how the curriculum was selected and about the needs assessment and you also highlight how educational sessions are evaluated you do carry out evaluations on the teaching you are doing (2).

…. and now our association tried to talk with our minister of health and the director of health insurance about we want to …implement I quality indicators in our everyday work ….in our electronic medical records. so, we tried to talk about that…. but nobody really heard us. … And unfortunately, …. we have only support from the association of GPs and a little support from university, but from university every support was only words…it was not anything substantial (5).

… and then the next step will be … … talk with health insurance so they give us more money so we can buy some new equipment for our practices so we can work more quality oriented and that we can think about quality (5).

I think our problem is at the level of the organisational context. We don't get any support, we don't have protected time, we don't get any help to … implement something new and do quality improvement from the government… administrative support does not exist. ….and we have too much to do …. too many patients a day (5).

the QCs have become important at the university like the seventh and eighth year at the university ... when we do the specialisation about the GP or family medicine… but this is not very usual or common it is not nationally organised (4.)

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Establishing the group

'Sharing similar needs'

If the administration at the organisational level of QCs provides administrative support (i.e. training of facilitators, data gathering and provision of evidence-based information), protected time and space, CME points, and small financial incentives to QC participants (C), then they will meet in groups to exchange ideas (O) because QCs are the preferred learning style of GPs (M), support generates positive expectations among participants (M), and GPs think QC meetings with their peers will be useful (M).

…so obviously you get some CME credits you can use for accreditation (1)

…. some packets some information on a one topic or another in way so it can be used in QCs by the local people, often and this is working the best, is having someone who is coming with the information and carrying it into the QCs (1).

And I think that ... the other thing that is important to the group is the CME CPD points that they get and the funding from the government to attend meetings. That is all supporting the meetings as well (2).

...if you want to be recertified, every five years you have to document at least 20 hours in a QC (3).

'Need for relatedness'

If a steady group of members engages in socially enjoyable contact, led by a skilled facilitator who, e.g., introduces people to each other, opens discussions, clarifies and summarizes statements (C), then group members will get to know each other and decide on rules that they are willing to follow and so build a safe environment based on trust (O) because members want to be among and to interact with equals (M).

..this problem (no trust in the group because of competition about patient contacts) will be solved in a couple of years. When we started it was certainly that way but since about one in four is going to retire within the next five to ten years this will be solved and we get shortage of GPs and maybe that will make it easier for a peer review groups to have more trust and … and find each other to work together and to tackle new problems that may depend on shortage of GPs instead of too many (1).

…. it is the same, it is always the same 20 persons who are the member but once you will have 12 persons and the next time 6 will be the same but 6 will not have attended the last time and some come the next time again, so, the group is a fixed group, it is – of course, if you only have to participate twice a year, your group will not always be the same and it will vary a little bit, depending who is coming and who is not (1).

… but it became clear that we started to get to know each other and the sensibility of each other and to dare to tell about how we handle things and we learnt how to handle each other in a respectful way. Now we have to see how it continues (1).

I think ... the social aspect like you said you are right to discuss that because that is important. …. And I think that is an important part of the meetings (2).

And there is a rule in the group about honesty that if we discuss something that… that should stay in the group, it does not leave the group and that it stays in the group and I think that is respected because over the years there is much more honesty as the years go by (2).

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We do have a meeting now I think in September or October where the doctors get together in a meeting in the afternoon and then we have a social gathering and for each of the group meetings we have coffee or tea and something to eat before the meeting this is important I think because a lot of doctors come for their surgery and they are tired they are fed up and they can have a cup of coffee and a bit of a (inaudible because she laughs) and they are going into the small group as a better doctor. the social aspect I think is very important…and we have half an hour with coffee and sandwich and then we start the meeting (2).

We have ... we would have done these rules in the very beginning when we started the groups, now we know each other for so long that there is no need to ... I think people are very respectful for each other and not necessarily to like each other because there people in the group who do not like each other and I think a norm like that would be difficult I think the rule is to be respectful and even if you don't like the person or agree with them that you are not disrespectful (2).

we usually start with what we call the round where everybody tells what case is on their minds buggering them or causing them problems and if some of them is very important ... we save some time for the end of the group (3).

I think the group make their own rules for conduct and in my group, we revise them quite often, so if we had some incident that was not so nice, we try to find better ways of behaviour towards each other and then the facilitator has quite a lot of authority, and if the facilitator is not able to exercise that, they can get help from four or five facilitator coordinators at the medical association. then they will come and help us in the group itself (3).

There should be like in many other countries … at least the impression I get from for instance Sweden, the Netherlands, Australia, New Zealand, there is a lot of government support - but in Norway we actually do not have much at all. So, there should be much more understanding from the mostly national bureaus but also form the local authorities how important this is. There has not been enough understanding in the medical corps to ...h to do it and usually comes on top of all the other work and it is usually unpaid. So, we have to do it at night and during weekends (3).

…and we do that at dinner time so we can have some food together, we have dinner and we can enjoy food at the same time (4).

… I think if you know people a little bit you feel more comfortable … to talk with if there are too many people who you never seen before and never talked to before, then it is difficult to open up and talk about (4).

this year ... we try to have kind of rules to be more organised in the group, so I think we try to keep it working, and … I think that is the challenge, but we should think and have deeper reflection about what the real impact on our practice is (4).

'Need for autonomy and control'

If the group chooses its own topics and facilitator (C), then they will feel they own the QC (O) because this satisfies their need for autonomy, a feeling of being in control of one' s own behaviour (M).

And they discuss cases, and a topic is picked for the month and an education module occurs around a particular area the doctors bring patients they are looking after and there is a discussion about the cases and the topic area and it is facilitated either by the leader of the group or the tutor, the CME tutor in a particular area (2).

…the group decides to change the programme based on new things that are happening or changes in medicine that are happening and (inaudible) there is a general structure plan for the year but then it changes if something changes … if some group says they would like to cover this or that particular area, there are changes during the year. So, the programme adapts to the needs of the group (2).

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…exactly big autonomy, the groups decide there is no pressure from the political system and there is no pressure from anybody and that is why this system is so successful – the doctors can choose (2).

No there's is a group leader (facilitator), and they are free to elect him or her, and they have to fill in one sheet of paper, where they have to tell date and time and theme and list of attendees (3).

'Size of the group affects communication'

If group size exceeds 15 (C), then interaction among group participants decreases (O) because participants cannot keep up with all of the other participants and follow their conversations (M).

…the group would be 10 to 12 people at the most and they would have a group leader or a tutor in the group that is the facilitator in the group and these groups would meet regularly every month and they would know each other because they meet eight times a year. Knowing and trusting each other is really important when doctors talk about their patients (2).

For instance, if … I think …15 people are too many …I think 8 is enough. and … the stress increases if there are more…. the smaller the group is the better the trust and talking (4)

'Variety of characters stimulates reflection – cognitive dissonance'

If members of the groups have individual character traits and describe differing professional experiences but accept each other's views (C), then they can learn from each other (O) because individual attitudes and behaviours will contrast with their peers' knowledge and cause cognitive dissonance that makes them reflect on their way of working (M).

I think it would be logical and ... more (better) with more diversity and ... with more like an enrichment (4).

…. because you can learn from (other) people with more experience, … … you have a (another) way of thinking and a (another) way of talking about stuff, situations, that are different I think, so I think it is about different knowledge (4)

'strong cognitive dissonance threatens self-image'

If individuals feel too strong a cognitive dissonance when integrating new knowledge (C), then they can disrupt group dynamics and the QC process halts (O) because this threatens their self-image and they feel at risk of losing their professional identity (M).

Yes, we do yea, we have doctors who are ... difficult in the group, yes, and they are difficult because they have very firm views and they spend very little evidence on reality. Then it is very important that you have good group leaders and leadership … It is very few … you know trying to sabotage the group…. and they don't tend to change behaviour (2).

it is more about personal reasons ……. one (participant) is really expansive and always talking about her and compares everything with herself, and she pretends to know the way …. we can't really … function and discuss as we wanted to, you know; it feels like competition … I don't know what happens … at that moment but …I don't think we have a good atmosphere then (4).

Learning environment

'Feeling safe and not vulnerable'

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If participants trust each other (C), then they can describe how they work and admit what they don't know (O), because they feel safe rather than vulnerable (M).

... if they start any discussion, that is one of the problems, most of the time they just invite some external speaker a specialist or someone with a special interest to come and present something and afterwards they will have questions to speaker and perhaps discuss a little bit in between depending on the speaker and perhaps the facilitator if he really wants to facilitate but that is most of the time what is happening (1).

... (one of the important things) ... is building the trust and building the trust…? I had a very nice compliment of one of my colleagues after wards which we have been working together ...she told me you know one of the things I learnt from you one of the things I experienced from you is that mm opening up with difficult cases and showing that you don't know everything is showing that you are vulnerable and not knowing what do with it ...you build up trust because if you dare doing this gives us the confidence that we also can do that ... (1).

...one of my experiences but that we had in the practice last month I think it was that we took up the discussion about cases with the trainee and we realised by discussing cases that ... you often find gaps in your knowledge (1).

…and if people know each other within the group they are very honest and very open and they just ….and they discuss worries and concerns and there is a lot of that if the group is functioning well and everybody is feeling comfortable and there is a good level of trust in the group and they can talk about their cases (2).

…when a doctor gets upset, that has happened over my years and usually there is a kind of…within the meeting and they upset I would usually ... deal with that situation during the meeting and if they are upset and they are quiet and then I will actually go to them after the meeting but I will never let a doctor go home with issues that somebody got upset because the last thing I think a doctor should go through in small groups is ending up feeling upset or demoralised (2).

there is surprisingly ... huge openness and some people take it up and tell 'I have made a mistake and I ... feel bad about it' (3).

…we talk about cases we have social bonding; we are a group who feels safe, it is like a safe climate, we talk about ... our difficult situations (4).

We know each other very well, so I don't think anybody gets angry for this…and nobody .... gets emotionally the wrong way… if you understand what I mean (5).

'Need for competence and self-actualisation'

If the facilitator supports participants and encourages them to tell their stories and share their experiences in a safe environment, e.g., by encouraging interactive responses, through discussions and by summarizing statements, (C) then participants will be involved and share their positive experiences and failures (O), because they want to improve their competency, a sense of self-efficacy to achieve specific objectives (M), gain professional confidence (M) and achieve professional self-actualisation (M).

…having to share feelings of sometimes being powerless in certain situations was one of the things that built up the group the group feeling and which made everybody feel relieved, maybe not relieved but feeling confident and this is going to work (1).

There is no kind of structure that is imposed on the group and that makes the group actively by into the learning process because a lot of doctors bring information into the group and they bring learning from other places into the group that they have obtained so it is a very, it is a mix of learning from various places (2).

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... and people will actually discuss for instance difficult moments in cancer treatment or cancer care, people will bring stories about patients but they will often bring problems about members in the family and the difficulties of being a GP and having to cope with this, and the major problems about being a GP, and that is very powerful stuff because that is about the personal aspect of being a doctor (2)

that is an 'after' discussion – I often call this the hidden curriculum because I think that is very important, I think that ... a lot of doctors over the years have been in distress and it is important to talk about this (2).

the truth is that if you are a doctor and if you want to do a good job then you have to make quality improvement and patient safety a part of your profession ... broader knowledge (3).

And ... I think you learn a lot of basic things you need in order to be a g good doctor for your patients, you learn respect, you learn to hold yourself back to be able to let the other people speak and the other to take ... the front floor. Social control is quite important in many ways. … and you learn that much easier in a group than on your own (3).

...someone tells which was a typical situation for one of them, for one of us – sorry… and sometimes we choose…. for example, ... we usually choose something that happened yesterday or the day before (4).

We prefer the clinical cases that we are difficult and where we have questions or bad emotions and ... ... we prefer that kind of a (difficult) decision because we ..... because first, for the person who explains the situation; and this is a good way to be or to get rid of the pain and talk about that and for the others it is always interesting because most of the time one of us had already been or experienced ... or felt that pain or talked about a situation that is similar. …it is like ahh mutual understanding and we can understand and talk about it with each other, and it is ... a good feeling if you see other people had the same and we understand each other (4).

…but it is much more it is about personal feelings and points of views in life or fear ... or non-pleasant ... feelings or something with the people we have like difficult patients and our human relations with the patients, because no we don't have someone to summarise all the facts and all the feelings and ... there is no one who takes care of that what we do in the group (4).

I think it is important for psychological point of view not the feeling to be alone sharing your thoughts and experiences with friends and colleagues …. same GPs we have the same profession. I realise we are all in the same boat….it is also very stimulating to keep learning (4).

…and the fact that you can explain it to the others makes you realise that ... you have a bit anxiety about it and all the others tell you that this ok – not just because they want to comfort you …then you realise that you became nervous about something very quick …even if you did something good after all….the group at this moment is very …….. a peaceful place and a good way of being with yourself and your own way of practising and it increases your self-esteem as well (4).

But sometimes it is about our problems ... . our professional life…about our patient about some case ……diagnostics or prescriptions (5).

'Previous knowledge is activated'

If participants exchange case stories and experiences while actively listening to each other in the presence of a skilled facilitator in a safe environment (C), then they will share their knowledge by telling their own relevant stories (O) because the process activates knowledge they already possess (M).

well .in different way …. it can be telling about a case even analysing a critical incident, telling about critical incidents is important to us, that can be a discussion of a guideline, a ... that can be a well something new out of the literature, ... these are the ways we want to do it (1).

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it does satisfy us when we can discuss about our own work and about our own cases, and we feel closer in the group when we stimulate each other's thinking (4)

When we talk about cases, case discussions, that is the most efficient part of the hour, because every participant wants to …… talk about and tell something about … case … about cases we experience. Sometimes, we have so different opinions and I f someone saw us from the outside, then …. they would think this is a crazy group…. but (laughs) but I think it is constructive…and we learn from each other because … then, we talk about different aspects of the case (5).

'Immediate relevance for the practice'

If QCs use the technique of experience-based learning (C), then knowledge becomes more relevant to GPs (O) because it relates to their everyday work and is therefore of immediate use (M).

...a lot of the doctors will start with a clinical case, but then come to an overview and then discussions and the next step is organising the GP surgery for that -it is quick wins (3).

I think sometimes we … we have … it is more like an administrative part about the administration the administrative things about how to do the replacement of GPs, like all the papers and all the declaration stuff that is necessary for this ….it helps…. I think it is very helpful to talk about that (4).

We think about …when one participant tells a story… talks about the case and after that we talk about what we think …everyone in turn…we have only women participating in the group (laughs) …. we say what we think is correct and we talk about what each one of us would do in this situation, what we think she could do better…we look if we can find some evidence about that (medical facts) … and we can use it right after (5).

'Cognitive dissonance'

If participants discuss and reflect on their work processes (e.g., based on trustworthy data or personal experiences) during a professionally facilitated exchange of positive experiences or failures (C), then they discover knowledge gaps and identify learning needs and relevant topics (O) because their own attitudes and behaviours may differ from their peers', creating cognitive dissonance that makes them reconsider their own way of working (M).

…. the government …m is now offering … the possibility but it is quite informal it is not on a massive level they offer the possibility to discuss … some indicators on polypharmacy to be discussed with a … an expert of the government and ..... then they offer the results of the QC and individual results to the people who are participating there and then they start a discussion about polypharmacy and that is existing (1).

…well if you tell a story we are doing this in this way in our practice, … another practice could tell, well in our practice we see thigs differently and we do it another way and or it could be that … we help think about the situation with a difficult patient how you … you can handle it in a different way then somebody else will tell you, well, what do you think about that maybe this could be a way or this …have you considered this with this patient and ... perhaps you could take up and discuss with the patient how he feels about that ……. it is often gives you the opportunity when you get stuck with difficult patients and mmm to get new energy and to have …mmm to listen to the way other people would handle it can help to open up and take new initiatives instead of blocking and having the feeling that you don't get any further with the patient (1).

…it is not just an easy push on one bottom but hard work … on the other hand, we have a feedback from the government ... every two to three years which offers a lot of data about your prescription and about the population you treat and which you can use but that is always old data. We will now get one in the next months to come and that will contain data from 2015 it is now 2018!!! which will be analysed then so that is quite a problem (1).

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Yes, Yes, prescription habits so ... ... prescription habits at the moment in Ireland is ... so if you are a public GP and you have a GMS number, then you get feedback on prescribing actually only in one area at the moment and that is benzodiazepines and you get that every year on benzodiazepines but you do not get feedback on anything else (2).

When for example a GP ... in a gr ....group is saying that he does a particular thing that is purely not right not evidence based or in fact is wrong then the group are very good ...I think because they know each other... they do not agree with the doctor but they actually discuss it in the group and a few other doctors say what they would do which is usually different and they usually say ' you may consider this as a different way of doing it because if you do it your way , this is what I find happens...' and there is never an issue where somebody needs to feel bad but they know that whatever they currently are doing is not what the other would (2).

I think because when you have had doctors I the group for a long, long time and working in practice for a long time I think you have to consider what people currently are doing and what they accept as appropriate for their practices or for their work. and I think to introduce new guidelines and new evidence you have to look at what people are currently doing and to get people to accept a change and see why this change would be necessary as well and sometimes the change is not necessary for the group; if you don't know whatever they are currently doing ,and if they are not exchanging ideas within the group then ..that really...they are not learning then because ... I think my criticism of guidelines and evidence is that they are not always practical to implement (2)

We use some data extraction software from the electronic health record so that every doctor gets his own indicators ... in a report that tailors the theme (3).

We usually do it (comparing each other's data) as a plenary thing and I can always say as a facilitator what about indicator 13 and then we go around the table what figures do you have and how would you explain them and the huge differences between the results. so, there is a .... a special part of data report of the indicator we go through in each meeting and we ...when we have done that, they usually don't have use of the facilitator because the discussion is quite intense (3).

Firstly, I think they learn a lot about quality indicators and then you have to go into the matter why they differ so much. Why yours is so different from mine, and then you have to look at age spread of the population, my work, if I work a lot 'on call' for instance, which is different from sitting in the office all the time (3).

...yes, sometimes we choose difficult situations and sometimes we don't choose and we talk about the last situation we had the day before and sometimes like a simple disease that is not so difficult, so we talk about, because even if it seems to be easy we have different ways to do this and it is interesting to talk about even easy situations, because all the other do it in a different way (4).

We do have practice mirrors about hypertension, about diabetes and ... now we have some I work on some audit about prescription of warfarin, which gives a lot of interesting discussions (5).

... and I see only me ... is this ok or did do something wrong? but now we compared and compare two different practices in two different parts of Croatia and we have similar results, which surprised me (5).

We do that just like in case discussions; some of us have a little ...presentation ...we talk about guidelines or evidence-based information ....and we ahh we that .... colleagues talk about what they do in their practices and .... what she can do and why, ... giving the reasons...and after that we talk about ...every participant talks about what she does in practice and what they don't do and the reason why they don' do it (5).

'Social learning'

If the facilitator uses purposeful didactic techniques (e.g., brainstorming, contentious or consensus discussions, or role play) to keep the group active and to reward exploratory behaviour during reflection on the work process (C), then the group will create a learning environment that promotes

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knowledge exchange (O) because learning is a cognitive process in which participants observe and imitate their peers' behaviour to gain social approval (M).

So I think that the more experienced GPs bring in their cases into the groups and they discuss their experiences within the groups and I think this is very powerful for the group and the younger GPs bring in …they have the latest evidence in their head and the guidelines and they bring it in ..and the mix of managing the patient with the evidence and the guidelines and the practical bit from the older GP who has the experience I think this is really the powerful bit in the group and … and this is where the learning really occurs (2).

…and I (Facilitator and tutor) don't have the arrogance to believe that they leave that meeting and go and change their practice but they are certainly aware of that their practice is not what the …. the rest of the group's is (2).

…case discussions are important so cases are a huge part of the group and the other thing we would sometimes do is ... a role play we also have used video consultation playing video cases or other reals life scenarios and the other thing we should use is discussion groups. So, you know like working groups for example I have twelve people and if I have something new, I might split the group into groups of four and so people would work within these smaller groups and then they carry their points of views back to the whole group. And it is not an individual but the whole small group who feeds back, it is the group it is a safer place (2).

yes, ... in the beginning we thought this (sharing data) had to be in pairs or triplets because we thought that people were not willing to share, but that was quite wrong. they love to share (3)!

…but we like to learn and understand how the others do; so, it is a learning from each other, yes that is what it is [in French] (4).

Adapting, creating and testing new knowledge

'Interdependence between health insurance companies/physician network organisations and GPs'

If physician network organisations require continuous QC activities (C), then QCs will negotiate priorities and design creative solutions(O) because the tension between autonomy and obligation spurs the group to act and negotiate together to reach a common goal (M).

It may be important for the emerging of QCs, that it becomes a mandatory thing (QI) and after all, we have the same goals (as the health insurance companies) (4).

We have as an obligation in contracts with our insurance to have …… … peer groups…… then … I don't know how many times we should meet, actually. But we don't have or get much money out of this (5).

'Threat to professional autonomy'

If GPs feel that the QC programme is only a top-down managerial intervention to reduce costs (C), then they will not be motivated and will not participate (O) because they feel unsafe and think they lack autonomy in their clinical role (M).

…no there are no demands, that wouldn't help, we have to do and there can be wishes how, but we decide….it wouldn't work otherwise (3).

'Interdependence among group members'

If participants maintain a trusting learning environment that promotes knowledge exchange, assisted

Supplemental material 10 consolidated programme theory, including illustrative quotes and complete list of supporting quotes

by facilitators who use professional techniques (e.g., contentious discussion, reaching consensus, and role play), (C), then participants will adapt and generate new knowledge for local use (O) because they see themselves as being similar, and so act and negotiate cooperatively to achieve a common goal (M).

I think that a group …cannot just be presented with things like here is the evidence, take it or leave it and goodbye and I don't think that works, I think that people need to … participate and in the learning and they have to show what they are currently doing whether it is the correct thing or not; it needs to be discussed and adjusted and shared within the group (2).

'Identifying and removing barriers to change'

If participants, supported by skilled facilitators, address barriers to change (C), then they are more likely to implement the innovation (O), because participants help each other develop strategies to identify and overcome these barriers (M).

And I think you have to have guidelines that are workable for doctors who are you know seeing 30 to 40 people every day and if they want to implement change for the better they have to be feasible and practical and I think the only way to do that is to consider what they are currently doing. And what the barriers are to new care (2).

'Need for competence, autonomy and relatedness'

If participants create new knowledge and plan an implementation strategy (C), then they feel satisfaction, responsibility and stewardship (O), because this fulfils their need for competence (being able to achieve specific objectives) (M), autonomy (a feeling of being in control of their own behaviour) (M), and relatedness (a sense of connection to a larger group) (M).

No data but confirming comments.

'Intention to change'

If participants publicly announce their intention to change (C), then they are more likely to implement the change (O) because they and others in the group both think it is a good idea and believe they can carry it through (M).

…we ask the group to give a feedback on how they feel that would change them or their practice and the routine of care for their patients. So, they usually the group …we end the meetings with a feedback a summary and a feedback and a feedback from the group what it is they feel they want to change ... and I think that is the opportunity to …. not everybody participates in that…. but ... most people do ….and they'd say look this is what I learned this is new for me this is what I am ... going to change in my practice (2).

We talk about …how we shall we implement the guidelines and shall we implement this in our everyday process, what steps we can implement and how and what we cannot implement and why not……. … how do we need support from our hospital-based colleagues…? ... in some steps of the implementation of the guidelines…. and ... sometimes we need help of our medical association because in ... some steps when we talk about guidelines, we don't have the things (equipment) in our practice (5).

'Testing new knowledge'

If participants validate and test new knowledge in a QC, moderated by a skilled facilitator, in a safe environment (C), then they feel confident putting that knowledge to use in everyday practice (O) because they have had the opportunity to practise and familiarise themselves with the innovation (M).

Supplemental material 10 consolidated programme theory, including illustrative quotes and complete list of supporting quotes

..time to reflect on this practice is actually something that is very important and you have to figure out where the guidelines fit in and you reflect on what you are doing and the group and the process finds out the is correct the use of the guidelines and then for you as a practitioner you can look at that and see what practical that has changed over time and I think that the idea of a quality circle meeting is trying make changes dramatically is not practical I think doctors need to look at ideas and look at the practical parts to see what they can do and change slowly over time (2).

Repeating the process

'Gaining confidence in an innovation'

If the group repeatedly practices implementing and coping with an innovation (C), then they trust their own competence and turn the innovation into a habit (O) because successful outcomes increase confidence in their abilities (M).

... then we meet again after four months and usually the ...their quality improvement project ... didn't really happen or just a little bit, and we discuss the reasons for that and how we could amend that etc. etc. (3).

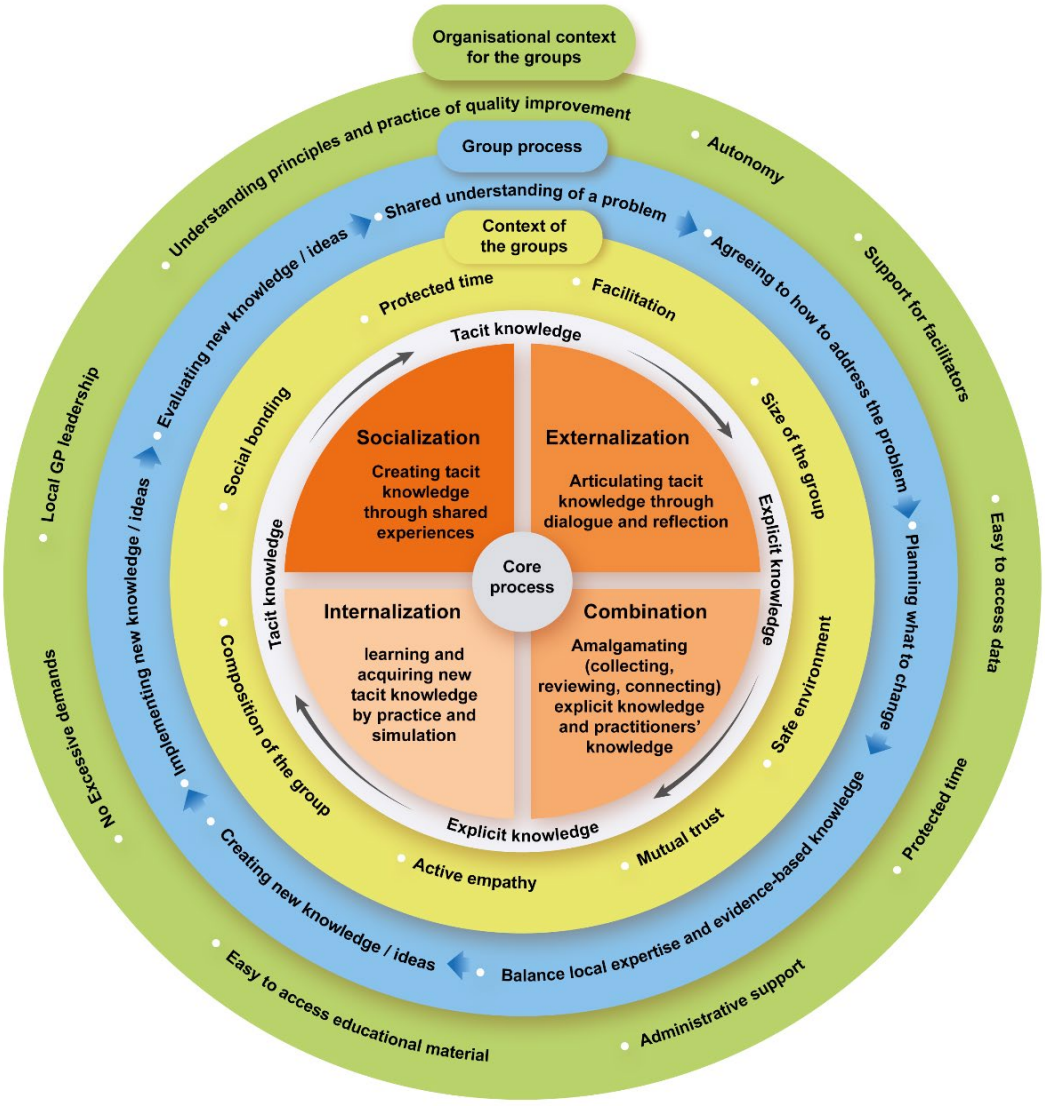
...and ... yes and then we present it and I also present it wherever we work and at the practices where we work (4).

'Repetition priming and automaticity'

If participants build a steady group and practice using QI tools (C), then they will successfully implement new knowledge into everyday practice (O) because successful responses increase with repetition: 'practice makes perfect' (M).

...but it is really a double thing. it is about a theme but it is also about quality improvement. And the aim and goal are that they find it so rewarding that they use this this technique again and again. ……in their own surgeries and in their own groups (3).

Supplemental material 11 Summary of the QC process and its implications



Legend:
The rings represent the levels of context and their associated processes. The core process is in the centre, illustrating the exchange of knowledge and the creation of innovations in QCs. The process is a spiral rather than a circle, because participants add experience and new knowledge at each turn of the cycle. The size and composition of the group, the social bonds between participants and their mutually benevolent attitude all foster mutual trust and create a safe environment in which participants can have frank discussions. Protected time and skilful facilitation lay the groundwork for a successful core process. At the next level, participants begin with a shared understanding of an issue and agree how to address it and what needs to be changed, ensuring the success of the group process. When QCs solve problems and innovate, they should balance local expertise (soft knowledge) with evidence-based information (hard knowledge); then they can generate new ideas to be tested and implemented in everyday practice. The QC process requires considerable professional and administrative support at the organisational level, so professional associations or university departments must teach QC members the principles and practices of QI and their use, and train and support facilitators. Organisations should also provide easy access to performance data and evidence-based material. Administrative organisations, whether health insurance companies or governmental organisations, should allow QCs to have professional and administrative autonomy and let them take the lead in QI, without placing excessive demands on the group or its members. The level of legislation required to entrust GPs with QI will vary depending on a country's health-care system, and could be enacted at national or local government level.

QUALITY STANDARDS FOR REALIST SYNTHESIS (for researchers and peer-reviewers)

1. The research problem

Realist synthesis is a theory-driven method that is firmly rooted in a realist philosophy of science and places particular emphasis on understanding causation and how causal mechanisms are shaped and constrained by social context. This makes it particularly suitable for reviews of certain topics and questions – for example, complex social programmes that involve human decisions and actions. A realist research question contains some or all of the elements of 'What works, how, why, for whom, to what extent and in what circumstances, in what respect and over what duration?' and applies realist logic to address the question. Above all realist research seeks to answer the 'why?' question. Realist synthesis always has explanatory ambitions. It assumes that programme effectiveness will always be partial and conditional and seeks to improve understanding of the key contributions and caveats.

Criterion	Inadequate	Adequate	Good	Excellent
The research topic is appropriate for a realist approach	The research topic is: • not appropriate for secondary research; and/or • does not require understanding of how and why outcomes are generated.	The research topic is appropriate for secondary research. It requires understanding of how and why outcomes are generated and why they vary across contexts.	Adequate plus: Framing of the research topic reflects a thorough understanding of a realist philosophy of science (generative causation in contexts; mechanisms operating at other levels of reality than the outcomes they generate).	Good plus: There is a coherent argument as to why a realist approach is more appropriate for the topic than other approaches, including other theory based approaches.
The research question is constructed in such a way as to be suitable for a realist synthesis	The research question is not structured to reflect the elements of realist explanation. For example, it: • only requires description; and/or • only requires a numerical aggregation of outcomes; and/or • only requires summary of processes; and/or • specifies methods that are inadequate to generate realist understanding (e.g. 'a thematic analysis of …')	The research question includes a focus on how and why the intervention, or programme (or similar classes of interventions or programmes - where relevant) generates its outcomes, and contains at least some of the additional elements, "for whom, in what contexts, in what respects, to what extent and over what durations".	Adequate plus: The rationale for excluding any elements of 'the realist question' from the research question is explicit. The question has a narrow enough focus to be managed within a realist review.	Good plus: The research question is a model of clarity and as simple as possible.

2. Understanding and applying the underpinning principles of realist reviews				
Realist syntheses apply realist philosophy and a realist logic of enquiry. This influences everything from the type of research question to a review's processes (e.g. the construction of a realist programme theory, search, data extraction, analysis and synthesis to recommendations). The key analytic process in realist review involves iterative testing and refinement of theoretically based explanations using empirical findings in data sources. The pertinence and effectiveness of each constituent idea is then tested using relevant evidence (qualitative, quantitative, comparative, administrative, and so on) from the primary literature on that class of programmes. In this testing, the ideas within a programme theory are re-cast and conceptualised in realist terms. Reviewers may draw on any appropriate analytic techniques to undertake this testing.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The review demonstrates understanding and application of realist philosophy and realist logic which underpins a realist analysis.	Significant misunderstandings of realist philosophy and/or logic of analysis are evident. Common examples include: • programme/intervention activities or strategies are confused with mechanisms • no attempts are made to uncover mechanisms • outcomes are assumed to be caused by the programme/intervention • relationship(s) between an outcome, its causal mechanism(s) and context(s) are not explained • some theory is provided but this is not explicitly linked to outcome(s)	Some misunderstandings of realist philosophy and/or logic of analysis exist, but the overall approach is consistent enough that a recognisably realist analysis results from the process.	The review's assumptions and analytic approach are consistent with a realist philosophy at all stages of the review. Where necessary a realist programme theory is developed and tested.	Good plus: Review methods, strategies or innovations used to address problems or difficulties within the review are consistent with a realist philosophy of science.

3. Focussing the review				
Because a realist review may generate a large number of avenues that might be explored and explained, and because resources and timescale are invariably finite, it may be necessary to 'contain' a review by progressively focusing both its breadth (how wide an area?) and depth (how much detail?). This important process needs to be considered from the start and may involve iterative rounds of discussion and negotiation with (for example) content experts, funders and/or users. It is typical and legitimate for the review's objectives, question and/or the breadth and depth of the review to evolve as the review progresses.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The review question is sufficiently and appropriately focussed.	The review question is too broad to be answerable within the time and resources allocated. There is no evidence that progressive focussing occurred as the review was undertaken.	Attempts are made by the review team to progressively focus the review topic in a way that takes account of the priorities of the review and the realities of time and resource constraints. Attempts are documented so that they can be described in publications as appropriate.	Adequate plus: The focussing process is iterative. Commissioners of the review are involved in decision-making about focussing. Decisions made about which avenues are pursued and which are left open for further inquiry are recorded and made available to users of the review.	Good plus: The review team draws on external stakeholder expertise to drive the focussing process in order to achieve maximal end-user relevance.

4. Constructing and refining a realist programme theory				
Early in the review, the main ideas that went into the making of a class of interventions (the programme theory – which may or may not be realist in nature) are elicited. This initial programme theory sets out how and why a class of intervention is thought to 'work' to generate the outcome(s) of interest. This initial programme theory then needs to be 're-cast' in realist terms (a rough outline of the contexts in which, populations for which, and main mechanisms by which, particular outcomes are expected to be achieved.) This initial tentative theory will be progressively refined over the course of the review.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
An initial realist programme theory is identified and developed.	A realist programme theory is not offered or; A program theory is offered but is not converted to a realist program theory at any stage of the review.	An initial program theory is identified and described in realist terms (that is, in terms of the relationship between contexts, mechanisms and outcomes). The refined theory is consistent with the evidence provided.	Adequate plus: An initial realist programme theory is set out at the start. The theory is refined iteratively as the review progresses.	Good plus: The relationship between the programme theory and relevant substantive theory is identified. Implications of the final theory for practice, and for refinements to substantive theory where appropriate, are described. The final realist program theory comprises multiple context-mechanism-outcome configurations (describing the ways different mechanisms fire in different contexts to generate different outcomes) and an explanation of the pattern of CMOs.

5. Developing a search strategy				
Searching in a realist review is guided by the objectives and focus of the review, and revised iteratively in the light of emerging data. Searching is directed at finding data that can be used to test theory, and may lie in a broad range of sources that may cross traditional disciplinary, programme and sector boundaries. The search phase is thus likely to involve searching for different sorts of data, or studies from different domains, with which to test different aspects of any provisional theory.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The search process is such that it would identify data to enable the review team to develop, refine and test programme theory or theories.	The search is incapable of supporting a rigorous realist review. Common errors include: • The search is driven by a methodological hierarchy of evidence (e.g. privileging RCTs) rather than the need to identify data to develop, refine or test program theory/ies • The search process is not informed by the objectives and focus of the review • The database(s) selected are narrow in the subject matter that they contain (e.g. limited to specific topics rather than extending to social science, psychology etc.) • Searching is undertaken once only at the outset of the review and there is no iterative component	Searches are driven by the objectives and focus of the review. The search strategy is piloted and refined to check that it is fit for purpose. Documents are sought from a wide range of sources which are likely to contain relevant data for theory development, refinement and testing. There is no restriction on the study or documentation type that is searched for.	Adequate plus: further searches are undertaken in light of greater understanding of the topic area. These searches are designed to find additional data that would enable further theory development, refinement or testing.	Good plus: the searching deliberately seeks out data from situations outside the program under study where it can be reasonably inferred that the same mechanisms(s) might be in operation.

6. Selection and appraisal of documents				
Realist review requires a series of judgements about the relevance and robustness of particular data for the purposes of answering specific questions within the overall review question. An appraisal of the contribution of any section of data (within a document) should be made on two criteria: • *Relevance* – whether it can contribute to theory building and/or testing; and • *Rigour* – whether the method used to generate that particular piece of data is credible and trustworthy. The selection and appraisal stage may need to run in parallel with the analysis stage.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The selection and appraisal process ensures that sources relevant to the review containing material of sufficient rigour to be included are identified. In particular, the sources identified allow the reviewers to make sense of the topic area; to develop, refine and test theories; and to support inferences about mechanisms.	The selection and appraisal process does not support a rigorous and complete realist review. For example: • Selection is overly driven by methodological hierarchies (e.g. the restriction of the sources to RCTs to the exclusion of other forms of evidence) • Sources are appraised using a technical checklist for a particular method (e.g. assessment of quality for an RCT) rather than by making a defensible judgement on the relevance and rigour of the source • Selection and appraisal processes are overly restrictive and exclude materials that may be useful for a realist analysis • Selection and appraisal processes are not sensitive enough to exclude irrelevant materials	Selection of a document for inclusion into the review is based on what it can contribute to the process of theory development, refinement and/or testing (i.e. relevance). Appraisals of rigour judge the plausibility and coherence of the method used to generate data.	Adequate plus: During the appraisal process limitations of the method used to generate data are identified and taken into consideration during analysis and synthesis.	Good plus: Selection and appraisal demonstrate sophisticated judgements of relevance and rigour within the domain.

7. Data extraction				
In a review, data extraction assists analysis and synthesis. Of particular interest to the realist reviewer are data that support the use of realist logic to answer the review's question(s) – e.g. data on context, mechanisms, and outcome configurations, demi-regularities, middle-range and/or programme theories.				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The data extraction process captures the necessary data to enable a realist review.	The data extraction process does not capture the necessary data to enable a realist review. For example: • Data extraction is undertaken mechanically and with no attention to how the data informs the review • No or very limited piloting has been undertaken to test aspects of the data extraction process and improve it	Data extraction focuses on identification and elucidation of context-mechanism outcome configurations and refinement of program theory. Piloting and refinement of the data extraction process has been undertaken where appropriate. Quality control processes are in place to check that all review team members apply common processes and standards in data extraction.	Adequate plus: Data extraction processes support later processes of analysis (e.g. by organising data into sets relevant for later analysis). The data extracted is comprehensive enough to identify main CMO patterns.	Good plus: The data extraction process is continually refined as the review progresses, so as to capture relevant data as the review question is focussed and/or program theory is refined.

8. Reporting				
Realist reviews may be reported in multiple formats – lengthy reports, summary reports, articles, websites and so on. Reports should be consistent with the publication standards for realist synthesis. (See RAMESES publication standards: Realist syntheses at: http://onlinelibrary.wiley.com/doi/10.1111/jan.12095/full or http://www.biomedcentral.com/1741-7015/11/21).				
Criterion	**Inadequate**	**Adequate**	**Good**	**Excellent**
The realist synthesis is reported using the items listed in the RAMESES Reporting standard for realist syntheses.	Key items are missing. For example • No defined research question • Limited or no reporting of the review's processes (i.e. methods used) • Limited or no explanations and justifications provided for any adaptations made on the realist review process • Insufficient detail is reported to enable readers to judge the plausibility and coherence of the findings	Most items reported. In particular the following items should be reported: • Rationale for review • Objectives and focus of review • All method section items (i.e. items 5 to 11 in the RAMESES publication standards: Realist syntheses)	All items are reported clearly and in sufficient detail for an external reader to understand and to judge the methods used and the plausibility and coherence of the findings.	Good plus: The report is well written and easy to understand. Additional materials are made available for external readers to investigate aspects of the review in more detail.

For details on how these quality standards were developed, please see:
Wong G, Greenhalgh T, Westhorp G, Pawson R..Development of methodological guidance, publication standards and training materials for realist and meta-narrative reviews: the RAMESES (Realist And Meta-narrative Evidence Syntheses - Evolving Standards) project. Health Serv Deliv Res 2014;2(30)

RCTs = randomised controlled trials