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Case-study protocol for an integrated evaluation approach to study training, curricular and contextual factors impacting the success of a Measurement for Improvement training programme.

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1 **TITLE**

2 Case-study protocol for an integrated evaluation approach to study training,

3 curricular and contextual factors impacting the success of a Measurement for

4 Improvement training programme.

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1   **ABSTRACT**

2   **Introduction**

3   Measurement is an important element in quality improvement (QI) efforts and the

4   ability to understand and interpret quantitative and qualitative data are valuable skills

5   for healthcare staff and pivotal to the ability to implement and assess QI

6   programmes. It is important to evaluate the factors that determine success or failure

7   of teaching *measurement for improvement* to staff. The aim of this paper is to

8   present a methodology for an integrated evaluation framework to understand the

9   functioning and relative importance of characteristics of the training programme and

10 contextual factors that inhibit or enable the success of a measurement for

11 improvement training. This study will utilise the experiences of trainees, trainers,

12 programme, and site coordinators to address this aim.

13 **Methods**

14 The research will adopt a qualitative retrospective case-study design based on

15 constructivist-pragmatic philosophy. This paper presents an integrated approach

16 proposing a novel application of two pre-existing frameworks: The Model for

17 Understanding Success in Quality (MUSIQ) framework and the Kirkpatrick

18 Evaluation Model to evaluate an unexplored QI context and programme.

19 **Analysis**

20 A thematic analysis of the qualitative interview data and the documents collected will

21 be conducted. The thematic analysis is based on a four-step coding framework

22 adapted for the research study. The coding process will be conducted using Nvivo12

23 software and Microsoft Excel. The comparison between the two cases will be

24 performed using a meta-matrix.

3

Ethics and dissemination

The study has received exemption from full ethical review from the Human research ethics committee of our institution (LS-E-19-108). The results of the study will be disseminated in peer reviewed Journals.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- Study rigour will be ensured by using triangulation through multiple sources of data, including perspectives of multiple stakeholders, multiple data collection methods and double coding.
- The researchers aim to perform member checking with a broader audience through an interactive webinar.
- The study design is responsive to the current situation and explores the role of QI education and measurement for improvement in adapting to new ways of working during COVID-19.
- This study will deepen the understanding of contextual factors that impact QI and measurement programme success at various levels of the healthcare system.
- The major limitation is recall bias as the training programmes being evaluated were completed more than 2 years ago.

INTRODUCTION

Quality in healthcare is a subjective, complex and multi-dimensional concept which makes it difficult to define and measure (1). The common defining attributes of healthcare quality in research include the delivery of effective and safe care to attain desired outcomes and a culture of excellence (2). With the growing importance of Quality Improvement (QI) knowledge in healthcare, there is a developing research

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1   interest in the QI curricula content, the effectiveness of educational design and its

2   link with organisational performance (3). However, most QI programme evaluations

3   focus on the improvement of knowledge, skills and confidence of learners and do not

4   offer insights into clinical and long-term effects (4).

5   Existing models of training programme evaluation have a narrow focus; they are

6   effective in measuring the outputs but do not provide insights into the process that

7   leads to training effectiveness (5). The impact of contextual factors such as

8   environment, management support and leadership, organizational culture and data

9   infrastructure also remains largely unexplored (6). There is also ambiguity around

10   the quality and effectiveness of the programmes and how the concepts and methods

11   are taught (7).

12   One crucial aspect of improvement work is measurement. Measurement is an

13   important element in quality improvement efforts as change needs to be measured to

14   demonstrate improvement and to identify and respond to variation (8). Learning how

15   to measure quality is an important skill for healthcare staff in general and those

16   involved in quality improvement in particular.

17   A systematic literature review has revealed that there are no programme evaluation

18   studies focusing on measurement for improvement programmes (Khurshid, Z. A

19   systematic review and narrative synthesis: Determinants of the effectiveness and

20   sustainability of measurement focused Quality Improvement trainings). There is a

21   need to evaluate the effectiveness, sustainability and spread of measurement for

22   improvement programmes but there is uncertainty around evaluation outcomes and

23   methods. The overall purpose of this research is to explore training, curricular and

24   contextual factors that inhibit or enable the success of a measurement for

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1 improvement training by evaluating experiences of trainees, trainers, programme,

2 and site coordinators. This paper presents an integrated evaluation framework

3 developed to address this research aim. The research is expected to be completed

4 by September 30, 2021.

5 **METHODS**

6 **Theoretical underpinning**

7 The underlying assumption of the research is that to make sense of the problem, the

8 views of stakeholders about the training programme and the context need to be

9 assimilated, which aligns with the constructivist worldview. The constructivist

10 worldview asserts that humans construct meaning when they interact with the world

11 and are influenced by historical and social perspectives and context (9). Another

12 objective of the research is to investigate what works in a certain situation and why

13 and then use this knowledge to develop solutions, linking the research outcomes to

14 recommended actions which is a characteristic of the pragmatist worldview. The

15 pragmatist worldview believes in the presence of multiple forms of reality and that

16 theories are extracted from actions and then applied back in practice through an

17 iterative process (10). The research thus contains elements from pragmatist and

18 constructivist viewpoints which inform the study design.

19 This research does not initiate with a well-formed hypothesis but uses an inductive

20 approach to explore the research problem and identify themes and patterns that will

21 deepen the understanding of measurement for improvement programme

22 effectiveness, sustainability spread and evaluation methods (11). Out of the various

23 approaches to do case study research, a pragmatic constructivist approach which

24 asserts that reality is constructed socially and experientially and propagates the use

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3   1   of methods which focus on inductive reasoning and interpretation rather than testing
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5   2   hypotheses, aligns closely with the objectives of this research (12).
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8   3   This research explores complex contextual and human factors in a real-world
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10   4   healthcare setting making it suitable for a qualitative inquiry (13). It is a retrospective
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12   5   longitudinal study and includes data from different points in time from the same
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14   6   sample that was part of the training. This research question requires a research
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16   7   design that can capture the complexity of the healthcare system, the factors that
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18   8   impact programme development, implementation and evaluation and provide
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20   9   evidence for policy action.
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23   10   A case study design can capture the complexity of individual behaviour in
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25   11   institutional settings, factors that influence it, interrelationship of actions and
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27   12   consequences, perceptions about programme goals from the perspective of those
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29   13   who designed it and those who implemented it to provide an evidence base for
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31   14   decision-making and explain success or failure (14). Thus, a case study design will
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33   15   be adopted to capture the information required to adequately address this research
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35   16   question.
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38   17   Case-study methodology is a bridge between research paradigms and offers
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40   18   flexibility in epistemology, ontology and methodology by providing a well-defined
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42   19   boundary and structure within which appropriate methods can be applied to answer
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44   20   this complex research question (15). The aim of the study is to gain an in-depth and
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46   21   multifaceted understanding of the effectiveness, sustainability and spread of the
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48   22   measurement for improvement programme in the real-world context (16) which
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50   23   makes case study research a suitable choice. Figure 1 summarises the research
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52   24   design choices through an adaptation of Saunders' research onion (11).

7

1 **Framework Development Process**

2 Programme evaluation should not be considered just a set of techniques but utilized

3 as an integrated approach in the broader context which is intricately linked with

4 needs assessment, course design, course presentation, and transfer of training (17).

5 Programme evaluation can inform policy decisions however it often gets neglected,

6 with attention being narrowly focused on programme development and

7 implementation (18). This protocol presents an evaluation framework which

8 integrates these elements.

9 Research suggests that instead of focusing on the development of a standardised

10 appraisal tool for objective quality measurement, evaluation should be guided by the

11 underlying purpose (19). This research aims to retrospectively understand which

12 curricular, training, and contextual factors inhibit or enable the effectiveness,

13 sustainability and spread of the measurement for improvement training using a

14 customised framework. Medical educators can select from various individual

15 programme evaluation models or use a combination to develop a framework

16 appropriate to answer their evaluation questions (20). This research draws on two

17 evaluation models to develop a tool suitable for this case study: The Kirkpatrick

18 Evaluation Model (21) and Model for Understanding Success in Quality (MUSIQ)

19 (22).

20 **Kirkpatrick Evaluation Model**

21 Kirkpatrick's model measures the impact of training at four levels; reaction of

22 participants, participant learning, change in behaviour and impact on the

23 organizational results as a result of the training (21). The model employs

24 straightforward evaluation criteria and requires measurement of a limited number of

8

1 variables (23). The popularity of this model is attributed to its simplicity in outlining a

2 system for training outcome assessment and simplifying the complex evaluation

3 process; however, it is also criticised for being incomplete (24). The understanding

4 about factors which impact training effectiveness has grown over the years revealing

5 that contextual factors, individual characteristics, and training design elements play a

6 critical role in training success. However, the Kirkpatrick model does not account for

7 these factors (24).

8 The model's underlying assumptions are also a source of criticism as it assumes that

9 each succeeding level provides more information than the previous one, each level

10 is causally linked to the other and the correlation between the levels is positive (25).

11 It is independent of the learner's previous experience or learning, individual factors

12 and other environmental and contextual factors that can impact training success

13 (23).

14 The Kirkpatrick Model is outcome focused and a drawback of such models is that

15 although they provide a good understanding of what was achieved, they offer little

16 evidence about the process through which these outputs were achieved and the

17 related barriers and enablers. This emphasises the need to go beyond the

18 outcomes-focused Kirkpatrick model to understand how the programme works (26).

19 Despite the criticism, the Kirkpatrick model has remained a popular choice for

20 evaluating learner outcomes in training programmes (20) and has been used to

21 evaluate higher education programmes, methodology workshops, professional

22 development programmes and short duration courses (27). This research will rely on

23 the four levels presented by the model but will adapt it to the research question and

9

account for these criticisms through integrating the Model for Understanding

Success in Quality alongside the Kirkpatrick Model in a unified evaluation framework.

Model for Understanding Success in Quality (MUSIQ Model)

Context can be defined as the "why" and "when" of change and includes influential

factors from the outer setting and internal setting (28). Factors internal to the

organizational can include organizational size, teams, leadership, culture and

implementation environment while external factors can include regulatory

requirements, funding and professional organizations (29).

The systematic literature review conducted in the exploratory phase of the research

highlighted that success of developing data skills of healthcare professional for

quality improvement is not solely dependent on intervention design but also

influenced by context (Khurshid, Z. A systematic review and narrative synthesis:

Determinants of the effectiveness and sustainability of measurement focused Quality

Improvement trainings). Thus, success of a quality improvement intervention can

vary across implementation settings (30). Most studies evaluating quality

improvement programmes focus on the evaluation of the intervention and only few

incorporate methods to assess impact of contextual factors (31). The constructivist-

pragmatist research problem being investigated cannot be fully addressed without

incorporating context into the evaluation design.

There is an increased interest in understanding the role of context in quality

improvement initiatives and a number of frameworks and models have been

developed to address this (32). One such model is the Model for Understanding

Success in Quality (MUSIQ). The model acknowledges the system as a product of

individual parts and interrelationships. It identifies twenty-five contextual factors and

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3   1   their relative influence at various levels of the healthcare system (22). The model
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5   2   was later revised to expand the number of contextual factors to thirty-six (3). These
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8   3   new factors include external knowledge (general and project specific), portfolio
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10   4   management, specialist staff, microsystem capacity and patient engagement. The
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13   5   factors presented in this model are relevant to the research question and will be
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15   6   incorporated into the evaluation.
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18   7   The MUSIQ model is relatively new as it was published in 2012 and has been only
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20   8   used by a handful of studies to date. Therefore, there is insufficient evidence to draw
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23   9   conclusions regarding model usefulness, though studies have confirmed the
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25   10   observation of all original factors in the QI initiatives being studied (33). One reported
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27   11   the framework and underlying assumptions useful for interrogating the research
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30   12   question (34) and another reported that the model was useful in identifying
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32   13   contextual constraints (35).
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35   14   The Kirkpatrick model focuses on different outcome levels while MUSIQ adds
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37   15   another perspective of context at healthcare system level. The MUSIQ model offers
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39   16   the missing link to context and relationships in the Kirkpatrick model. The evaluation
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41   17   framework for this research focuses on integrating the two models to address the
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44   18   research question.
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46   19   **Integrated evaluation framework**
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49   20   Knowing what information to collect, whom to collect it from and when to collect are
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51   21   critical decisions in designing a comprehensive evaluation once the purpose of the
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54   22   evaluation has been established (36). The proposed framework presented in Table 1
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56   23   combines evaluation perspectives from the two models and will be used to guide
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59   24   data collection through semi-structured qualitative interviews and document analysis.
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11

1 A draft interview guide for collaborative trainees based on the evaluation framework

2 is attached in supplemental file 1.

3 **TABLE 1**

4 **Title:** Integrated evaluation framework

Model Components		Definitions
External Environment	External motivators	External factors that stimulate the organization to focus on the QI project
	Project sponsorship	External entities contributing personnel, expertise, equipment, facilities, or other resources for project
Organization	QI leadership	Senior leadership commitment to champion and support QI project
	Senior leader project sponsor	
	Culture supportive of QI	Values, beliefs, and norms of an organization that shape the behaviours of staff in pursuing QI
	Maturity of organizational QI	Sophistication of the organization's QI programmes
	Staff engagement	Steps taken by the organization for continued staff engagement in QI

QI support and capacity	Data infrastructure	Extent to which a system exists to collect, manage, and facilitate the use of data Effective use of technology
	Resource availability	Support for QI, including allocation of resources, finances and staff time
	Workforce focus on QI	Workforce development through training and engagement in QI
QI team and Microsystem	Team diversity	Diversity of team members with respect to professional discipline, personality, motivation, and perspective
	Physician involvement	Contribution of physicians to the QI team efforts
	Subject matter expert	Team member/members knowledgeable about measurement
	Prior QI experience	Prior experience with QI
	Team leadership	Team leader's ability to accomplish the goals of the improvement project by guiding the QI team
	Team norms	Team establishes strong norms of behaviour about QI goal achievement

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	Team QI skill/capability for improvement	Team's ability to use improvement methods to make changes
	Motivation to change	Extent to which team members have a desire and willingness to improve
	QI Accountability	Clearly stated and communicated responsibility and accountability in the project
Trigger (Training Event)	Participation and Reaction (Kirkpatrick Level 1)	Overall satisfaction with the programme, content, delivery, logistics, facilitators etc
	Knowledge, Skills and Attitudes (Kirkpatrick Level 2)	Improvement in knowledge and skills reported by participants immediately after the intervention
Outcomes/process & system changes	Behaviour Change (Kirkpatrick Level 3)	Confidence in measurement skills Maintaining and advancing the skills learned Continued Spread and involvement in QI
	Learning Networks	Development of QI networks among post-intervention
	QI Capacity development	Ability of participants to initiate and lead other projects Ability of participants to train/help other staff

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Change in Organizational Practice and/or Patient Outcomes (Kirkpatrick Level 4)	Sustainability in outcomes achieved Sustainability in practices Process changes as a result of the training event
Dissemination/spread	Spread of knowledge and improved practices to non-intervention units
Unintended consequences	Negative or positive, unanticipated outcomes

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Case Design

This research study will adopt a multiple case design (16). Multiple case design is suitable for this study because measurement for improvement training occurs at a common venue where it is attended by healthcare staff from diverse backgrounds and multiple organisations. Participants then return to their own organisations to apply their learning.

In Ireland, the National Quality Improvement Team within the Health Service Executive (HSE) is responsible for partnering with health and social care services to promote sustainable quality improvement. The Measurement for Improvement (MFI) curriculum (37) is one such effort to train staff in handling quantitative and qualitative data for quality improvement. The curriculum identifies and outlines essential components of high-quality Measurement for Improvement (MFI) training to ensure a consistent standard of training for the Irish Healthcare staff (37). The purpose of this

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research is to apply the integrated framework to evaluate the measurement for

improvement curriculum.

Case selection

The bounded systems are the training collaboratives in which the training was

imparted. The trainees belonged to different organizations who came together for the

training and then implemented the skills in their own organizational contexts. The

research design therefore consists of two cases; the Pressure Ulcers to Zero

collaborative (PUTZ) and Clinical Microsystems collaborative, which delivered

measurement for improvement training. Phase 3 of the PUTZ collaborative took

place between November 2016 and February 2018. The aim of the collaborative was

to reduce ward acquired pressure ulcers by 50% in participating teams within six

months and sustain the achieved results at twelve months. The micro-systems

collaborative occurred in 2017 and its aim was to improve the quality of patient care

and work life of the emergency departments' staff participating in the collaborative.

Both collaboratives consisted of 3 training days and activity periods in between, with

measurement for improvement being an important component of the training content.

Researcher Reflexivity Statement

The leader researcher immersed herself in the work of the National Quality

Improvement Team of the Health Service Executive (HSE) Ireland to develop a

deeper understanding of their work, understand the context for measurement for

improvement and the aims and objectives of the training programmes. This

immersion and observation provided invaluable opportunity to the researcher to

observe and work on various other projects of the Evidence for Improvement team.

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1 **Patient and Public Involvement statement**

2 No patient involved

3 **Data Collection**

4 Data collection will be conducted using multiple sources of evidence through semi-

5 structured interviews with training participants, trainers and site coordinators and

6 document analysis. A case study database in the form of electronic files will be

7 maintained for the case study research. The database will have two main sections;

8 the evidence or data collected and reports of the investigators (16).

9 The study population will include healthcare staff who were trained, those who

10 delivered training, site coordinators of participating sites, leads of the two

11 collaboratives in the HSE. The research will use a purposive sampling strategy by

12 including participants who shared the common experience of the training (38).

13 Participation in the study will be on a voluntary basis and the researcher will describe

14 the nature of the study in detail to the participants and answer all questions prior to

15 any data collection. The National Quality Improvement Team will serve as a

16 gatekeeper for participant recruitment for trainees and send a letter to introduce the

17 researcher to participants. Those willing to participate would then contact the

18 researcher and written informed consent will be obtained.

19 The data collection will be conducted via semi-structured interviews and document

20 analysis. The interview method will allow the researcher to capture the words,

21 thoughts, feelings, perceptions, and experiences of the participants to answer the

22 research question (39). Information relevant to levels 1 and 2 of the Kirkpatrick

23 Model will be extracted through document analysis while level 3 and 4 along with

24 contextual factors (from MUSIQ framework) will be collected through interviews. The

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1   research aims to recruit all trainers, both leads of the two collaboratives in the HSE,

2   and 10 participants from each collaborative.

3   **Data Processing**

4   The interviews will be audio recorded and transcribed verbatim. A field journal will be

5   maintained by the researcher while interviewing which will be used to make a note of

6   researcher's assumptions, feelings and biases and reflections on the interviews.

7   After each interview, the recording will be analysed to improve the researcher's

8   performance as an interviewer. A case database will be maintained to store all

9   collected data.

10   **Data Analysis**

11   The data analysis of case studies involves a detailed description of the setting or

12   individuals and analysis of the data for themes or issues (40). A detailed description

13   of the training programme, sites and participants will be followed by a thematic

14   analysis of the qualitative interview data and the documents collected. The coding

15   and analysis framework is presented in Figure 2 (41). Coding process will be

16   completed using Nvivo12 (42) software. Causation coding to capture the mental

17   models of participants will be conducted in Microsoft Excel.

18   This qualitative analysis will rely on the same theoretical and analytical strategy to

19   study both cases and then the patterns found in each case will be compared (16).

20   The comparison between the two cases will be performed using a meta-matrix. Meta

21   matrices will help assemble the descriptive data of both cases in a standard format.

22   The next step will be to partition the data in the matrix in new ways, explore

23   relationships and the cluster the data so contrasts, and similarities emerge (43).

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Ensuring Rigour

Rigour will be ensured by using triangulation through multiple sources of data by including perspectives of multiple stakeholders and multiple data collection methods. Data collection and analysis methods and researcher reflexivity will be clearly documented to ensure transparency. At the analysis stage, a second researcher will perform double coding on a randomly selected ten percent of the interview transcripts (44). The researchers aim to perform member checking with a broader audience through an interactive webinar. The HSE regularly conducts QI webinars and this platform would be useful for reaching healthcare professionals interested in QI and enable the researchers to obtain and incorporate feedback from a wider audience into the results. The other method of dissemination would be through peer-reviewed journal articles which would also strengthen the study. To incorporate the impact of the COVID-19 pandemic on the research process and the work practices of healthcare staff, questions to explore the role of QI education and measurement for improvement in adapting to new ways of working are included in the interview topic guide.

DISCUSSION

Qualitative and quantitative data can be used to monitor and support improvement to enhance the quality of care (45) which makes measurement for improvement an essential skill for the healthcare staff. This research aims to explore training, curricular and contextual factors that can help in the development of effective and sustainable measurement skills in healthcare staff. To our knowledge, no previous studies have evaluated measurement for improvement programmes.

1   The purpose of research should be to expand the empirical and theoretical

2   understanding of the research area. Empirically, this research will deepen the

3   understanding of contextual factors that impact programme success at various levels

4   of the healthcare system as referred to in the MUSIQ model as type 1, 2 and 3

5   contexts (33). The longitudinal study will also evaluate the programme impact in

6   terms of long-term factors, referred to in level 3 and 4 in the Kirkpatrick model (21).

7   The research also incorporates and compares perspectives from different

8   stakeholders which will expand the knowledge base by identifying characteristics of

9   individuals, teams and organizations which make them more receptive to

10   measurement and QI programmes. Another key output of the research will be policy

11   recommendations for programme development, implementation, and evaluation for

12   future efforts.

13   Theoretically, it will contribute towards the current understanding of the two models.

14   It will add to the evidence base of MUSIQ model and confirm the existence or non-

15   existence of the contextual factors and relationships presented in the model. The

16   study uses MUSIQ model in a qualitative design while majority of the previous

17   studies have relied on quantitative approaches. It will study all four levels proposed

18   in the Kirkpatrick model which is less common in previous studies. The integrated

19   framework is a theoretical contribution to the field and the analysis will also reflect on

20   the useful and effectiveness of the approach.

21   There is a need for further research in the evaluation of quality improvement

22   programmes in terms of their immediate and long-term impacts. Measurement for

23   improvement is an important but less explored topic in programme evaluations and

24   there is need to expand the understanding of what to teach, how to teach and how to

25   evaluate programmes that aim to train healthcare staff in quantitative and qualitative

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1 data skills. Programme evaluation should be viewed as a driving force for future

2 programme design and policy. Instead of focusing on using standardised models,

3 this study takes a customised evaluation approach, appropriate to answer the

4 research question which is a theoretical contribution to the field. The study will

5 deepen the understanding of the training, curricular and contextual factors that

6 impact effectiveness, spread and sustainability of measurement for improvement

7 programmes.

8 **ETHICS AND DISSEMINATION**

9 The study has received exemption from full ethical review from the Human research

10 ethics committee of our institution (LS-E-19-108). The results of the study will be

11 disseminated in peer reviewed Journals.

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1 **AUTHORS' CONTRIBUTIONS**

2 ZK developed the methodology and prepared the initial draft in consultation with

3 ADB and EM. ADB and EM provided substantive feedback on the draft which was

4 revised by ZK. All authors have read and approved the final manuscript.

5 **FUNDING STATEMENT**

11 **COMPETING INTERESTS**

12 The authors have no competing interests to declare.

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1 **FIGURE TITLES AND LEGENDS**

2 **FIGURE 1**

3 **Title:** Research design choices through an adaptation of Saunders' research onion

4 **Legend**: Flow chart of Research design choices for the study through an adaptation

5 of Saunders' research onion

6 **FIGURE 2**

7 **Title:** Coding and Analysis Framework

8 **Legend:** Description of coding and analysis steps adapted from Johnny Saldana's

9 coding methodology

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Figure 1

Figure 2

First Cycle Coding
Attribute coding: Basic descriptive information
Descriptive coding: Basic topic of a passage of qualitative data
Structural Coding: Areas identified in the interview topic guide
In Vivo Coding: Verbatim coding
Process Coding: Action in the data
Values Coding: Participant's values, attitudes, and beliefs
Causation coding: Mental models participants
Magnitude Coding: Intensity, frequency, direction in coded data

Post Coding Transitions		
Reorganizing and reassembling data into categories	Code Mapping, Landscaping, and diagramming	Condensed list of categories

Second Cycle Coding
Axial coding: Identifying dominant codes, combining synonyms and redundant codes, selecting best representative codes
Pattern Coding: Explanatory or inferential meta codes to identify emergent themes

Meta-summary/meta-synthesis: Collecting, comparing, and synthesizing findings across the two cases

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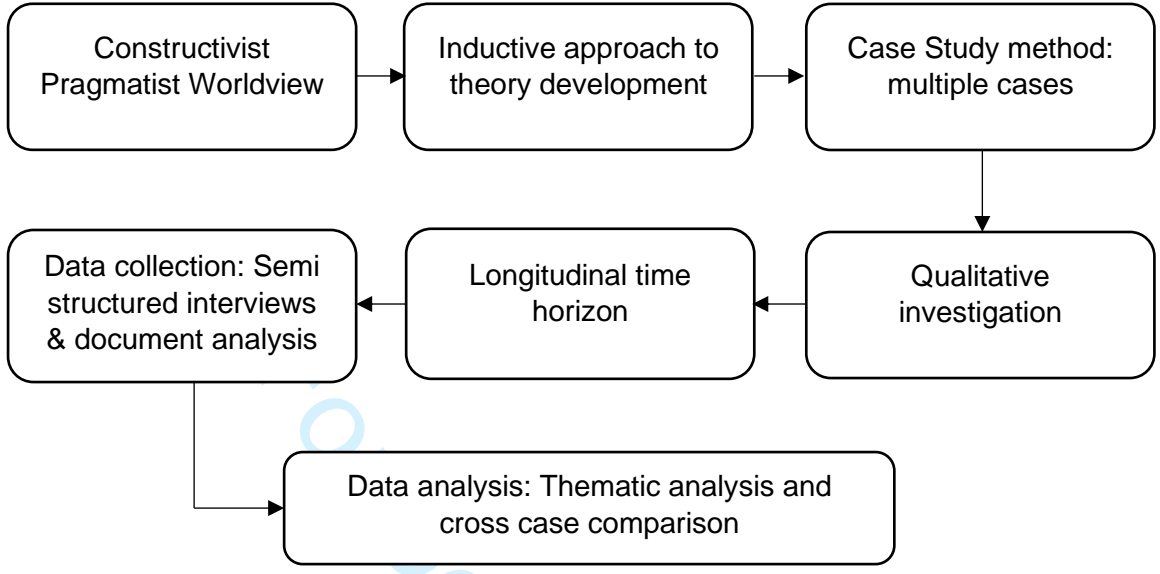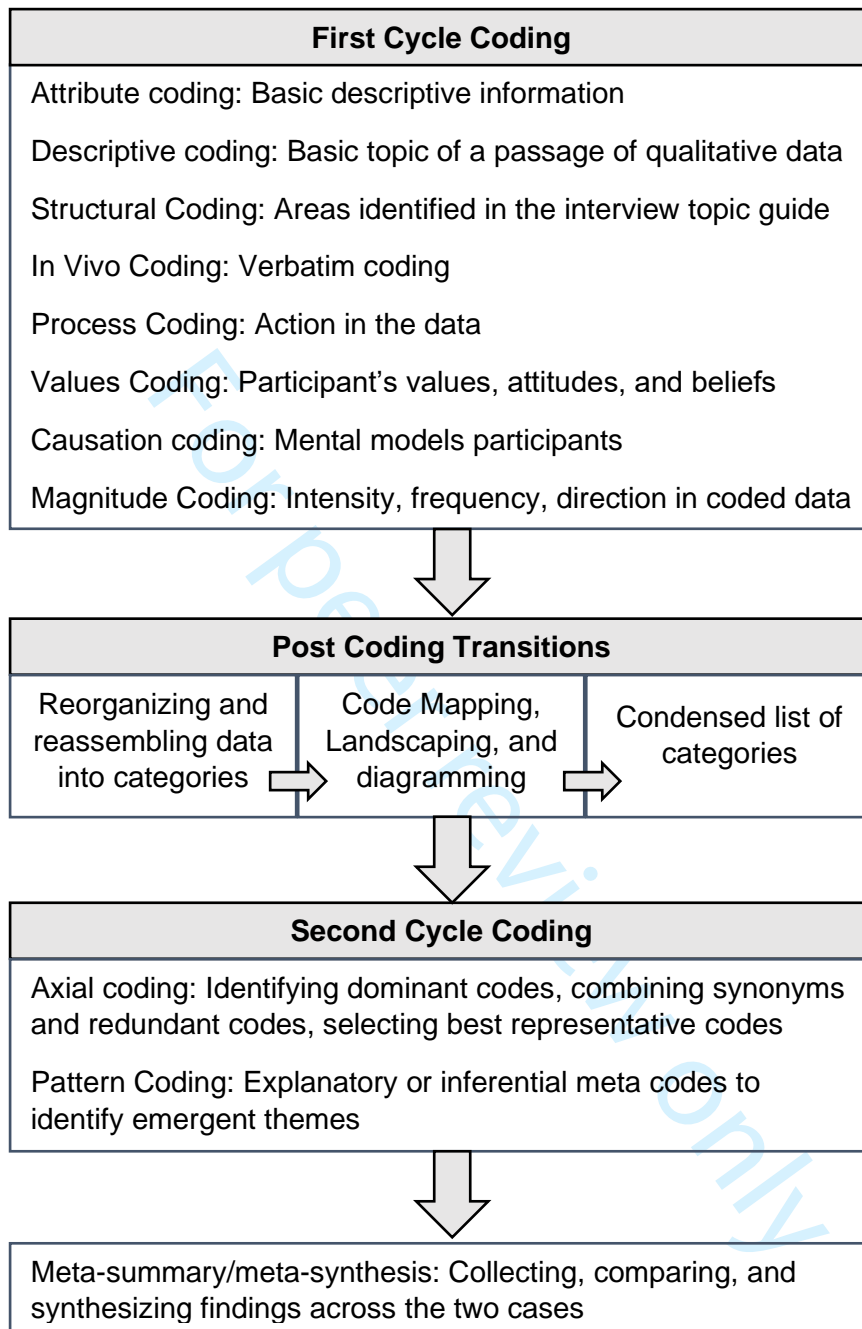42
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Supplementary File 1: Sample interview topic guide for collaborative trainees

Introduction

- What is your professional background and what is your current job role?
- How did you become a part of the PUTZ/microsystems collaborative?
- What were your expectations regarding learning measurement for improvement/QI during the training?
- Did you have any knowledge of or experience in using measurement/QI techniques prior to the collaborative?

Effectiveness

- Looking back, how would you assess the suitability of the collaborative for your needs?
  - PROBES
  - Session content
  - Session format/logistics
  - Coaching and support
- If you can recall, which concepts were easier to understand for the team and which areas you struggled with?
- Did you find the measurement techniques to be useful to your work?
- What factors could have made the training more effective and usable for you?
- What challenges/barriers did you face while implementation?

Sustainability

- Do you think you have been able to retain the skills 2 years after the collaborative?
  - PROBES
  - Retention as a team
- Do you still use some or all the skills in your work? Could you give some examples?
- Do you think the training gave you an advantage over staff who did not attend the training?
- What motivated you to sustain this knowledge?
- What factors facilitated sustaining these skills in the long term?

- o PROBES
- o Support from senior and frontline managers
- o Data Infrastructure within organization
- o Resource availability
- o External and Internal motivating factors
- o Team capacity
- Would you like to remain involved in work that requires the use of these skills?
- Would you like to enhance your measurement/QI skills further?

Spread

- Have you shared your knowledge with colleagues in your own team and department? If yes, what means (formal or informal) used to spread this knowledge?
- Would you say all members of the team, regardless of their participation in the training, feel comfortable applying these skills?
- Have you shared your knowledge with those outside the team, department, or organization?
- What motivates you to share knowledge with others?
- Would you know others, within the organization or outside, who are experts in measurement and QI methods, and do you consult them if there is a need?
- What were the challenges in spreading knowledge?
- What were the enablers in spreading knowledge?
  - o PROBES
  - o Role of leaders
  - o Supportive culture of the organization
  - o Availability of resources

COVID-19

- Have there been any changes in the way you or your teamwork during the pandemic?
  - o PROBE
  - o Organizational level changes

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- Did your QI and measurement skills help you in changing and adapting to the new clinical pathways? Did you use any QI or measurement skills, approaches or tools during this time?
- What support in QI methods and knowledge could have made this transition easier for you?
- For the foreseeable future it is likely that training will be delivered virtually - what would be your opinion on distance learning for QI and measurement skills
- Is there anything else you would like to add that could help improve the training?

Standards for Reporting Qualitative Research (SRQR)*

http://www.equator-network.org/reporting-guidelines/srqr/

Page/line no(s).

Title and abstract

Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	Page 1
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	Page 3

Introduction

Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	Page 4
Purpose or research question - Purpose of the study and specific objectives or questions	Page 5

Methods

Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	Page 6
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	Page 16
Context - Setting/site and salient contextual factors; rationale**	Page 15
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	Page 17
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	Page 21
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	Page 17

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Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	Page 17 Supplemental file 1
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	Page 16 Page 17
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	Page 18
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	Page 18
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	Page 19

Results/findings

Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	NA
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	NA

Discussion

Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	Page 19
Limitations - Trustworthiness and limitations of findings	Page 4

Other

Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	Page 27
Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	Page 27

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

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**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Reference:
O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014
DOI: 10.1097/ACM.0000000000000388

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BMJ Open

Protocol for an integrated evaluation framework to study training, curricular and contextual factors impacting the success of a Measurement for Improvement training programme for healthcare staff in Ireland.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-047639.R1
Article Type:	Protocol
Date Submitted by the Author:	19-Aug-2021
Complete List of Authors:	Khurshid, Zuneera; University College Dublin, School of Nursing Midwifery and Health Systems De Brún, Aoife; University College Dublin, School of Nursing, Midwifery & Health Systems McAuliffe, Eilish; University College Dublin, School of Nursing, Midwifery and Health Systems
Primary Subject Heading:	Health services research
Secondary Subject Heading:	Medical education and training, Qualitative research, Research methods
Keywords:	Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, EDUCATION & TRAINING (see Medical Education & Training), QUALITATIVE RESEARCH

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Manuscripts

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6   2   Protocol for an integrated evaluation framework to study training, curricular and contextual
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9   3   factors impacting the success of a Measurement for Improvement training programme for
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12   4   healthcare staff in Ireland.
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12   **KEYWORDS**

13   Quality improvement, QI, programme evaluation, measurement for improvement, qualitative

14   research

15   **WORD COUNT**

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1 **ABSTRACT**

2 **Introduction:** Measurement for improvement is the process of collecting, analysing, and

3 presenting data to demonstrate whether a change has resulted in an improvement. This

4 makes measurement for improvement a core element in quality improvement (QI) efforts.

5 However, there is little to no research investigating factors that influence the development

6 and use of measurement for improvement skills in healthcare staff. The overall aim of this

7 research is to understand the training, curricular and contextual factors that influence the

8 success of measurement for improvement training by utilising the experiences of trainees,

9 trainers, programme, and site coordinators. This paper focuses on describing an integrated

10 evaluation framework to address this research aim.

11 **Methods and analysis:** This research will adopt a qualitative retrospective case-study

12 design based on constructivist-pragmatic philosophy. The Pressure Ulcers to Zero

13 collaborative (PUTZ) and Clinical Microsystems collaborative from the Irish health system

14 which included a measurement for improvement component have been selected for this

15 study. This paper presents an integrated approach proposing a novel application of two pre-

16 existing frameworks: The Model for Understanding Success in Quality (MUSIQ) framework

17 and the Kirkpatrick Evaluation Model to evaluate an unexplored QI context and programme.

18 A thematic analysis of the qualitative interview data and the documents collected will be

19 conducted. The thematic analysis is based on a four-step coding framework adapted for this

20 research study. The coding process will be conducted using NVivo12 software and Microsoft

21 Excel. A cross-case comparison between the two cases will be performed.

22 **Ethics and dissemination:** The study has received an exemption from full ethical review

23 from the Human research ethics committee of our institution (LS-E-19-108). Informed

24 consent will be obtained from all participants and the data will be anonymised and stored

25 securely. The results of the study will be disseminated in peer-reviewed Journals.

26

3

1 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

2 - Study rigour will be ensured by triangulating multiple data sources, including
3 perspectives of multiple stakeholders, multiple data collection methods and double
4 coding.
5 - The researchers aim to perform member checking with a broader audience through
6 an interactive webinar.
7 - The study design is responsive to the current situation and explores the role of
8 Quality Improvement (QI) education and measurement for improvement in adapting
9 to new ways of working during COVID-19.
10 - This study will deepen the understanding of contextual factors that impact QI and
11 measurement programme success at various levels of the healthcare system.
12 - The major limitation is recall bias as the training programmes being evaluated were
13 completed more than 2 years ago however this was countered by providing sufficient
14 time to participants to think about the programme before the interview and providing
15 the opportunity to contact the researcher afterwards if they recalled something
16 important later.

17 **INTRODUCTION**

18 Quality in healthcare is a subjective, complex, and multi-dimensional concept which makes it
19 difficult to define and measure (1). The common defining attributes of healthcare quality in
20 research include the delivery of effective and safe care to attain desired outcomes and a
21 culture of excellence (2). In his pioneering work on healthcare quality, Donabedian described
22 high quality healthcare as the type of care which maximises patient welfare while accounting
23 for the expected gains and losses using legitimate means (3). The concept of quality has
24 evolved since then. The Health Foundation defines healthcare quality as the ability of
25 healthcare services to deliver the desired health outcomes consistent with recent
26 professional knowledge, to individuals and populations (4). Similarly, there are various

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1 definitions of QI. One simple way to define QI is considering it an approach for improving

2 health service systems and processes through the routine use of health and programme

3 data to meet patient and programme needs (5). These definitions of quality and QI reveal the

4 central role of measurement for improvement in the improvement process. Measurement for

5 improvement refers to the process of collecting, analysing, and presenting quantitative and

6 qualitative data to demonstrate whether a change has resulted in an improvement (6).

7 Despite its importance, measurement for improvement is a less explored topic in QI research

8 and there is a need for further research in the area. With the growing importance of QI

9 knowledge in healthcare, there is a developing research interest in the QI curricula content,

10 the effectiveness of educational design and its link with organisational performance (7).

11 However, most QI programme evaluations focus on the improvement of knowledge, skills

12 and confidence of learners and do not offer insights into clinical and long-term effects (8).

13 Additionally, the measurement for improvement component is rarely evaluated.

14 Existing models of training programme evaluation often have a narrow focus; they are

15 effective in measuring the outputs (what works) but do not provide insights into the process

16 that leads to training effectiveness (how it works) (9, 10). This highlights the need for

17 evaluation approaches that explore the processes that led to improvements. The impact of

18 contextual factors such as environment, management support and leadership, organisational

19 culture and data infrastructure also remains largely unexplored (11). There is also ambiguity

20 around the quality and effectiveness of the programmes and how the concepts and methods

21 are taught (12). One crucial aspect of improvement work is measurement. Measurement is

22 an important element in QI efforts as change needs to be measured to demonstrate

23 improvement and to identify and respond to variation (13). Learning how to measure quality

24 is an important skill for healthcare staff in general and those involved in QI in particular.

25 A systematic literature review revealed that there are no QI programme evaluation studies

26 focusing on evaluating the factors that influence development and use of measurement for

27 improvement skills of healthcare staff (14). There is a need to evaluate the effectiveness,

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1   sustainability and spread of measurement for improvement programmes but there is

2   uncertainty around evaluation outcomes and methods. Measurement often gets

3   overshadowed by the overall focus on understanding QI and on outcomes, resulting in a

4   dearth of measurement for improvement research. Quality measurement is frequently

5   treated as an ancillary matter in healthcare systems' approach to QI (15). Research to

6   explore factors that will enable healthcare staff to embrace measurement for improvement

7   and appreciate its value in demonstrating outcomes is needed. In addition to this, many QI

8   teams are failing to fully implement measurement tools and techniques (16). Despite this

9   identified gap in measurement skills, there is little to no research exploring ways to develop

10 measurement for improvement skills in staff or to better understand the factors that influence

11 the development of these skills.

12 The overall aim of this research is to understand the training, curricular and contextual

13 factors that inhibit or enable the success of measurement for improvement training by

14 utilising the experiences of trainees, trainers, programme, and site coordinators. The

15 research will be conducted in the Irish health system using two QI collaboratives (Pressure

16 Ulcers to Zero and Clinical Microsystems) which included dedicated training on

17 measurement for improvement. This paper presents an integrated evaluation framework

18 developed to address this research aim. This research started in August 2020 and is

19 expected to be completed by December 2021.

20 **METHODS**

21 **Theoretical underpinning**

22 The underlying assumption of this research is that to make sense of the problem, the views

23 of stakeholders about the training programme and the context, which aligns with the

24 constructivist worldview. The constructivist worldview asserts that humans construct

25 meaning when they interact with the world and are influenced by historical and social

26 perspectives and context (17). Another objective of this research is to investigate what works

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1 in a certain situation and why and then use this knowledge to develop solutions, linking the

2 research outcomes to recommended actions which is a characteristic of the pragmatist

3 worldview. The pragmatist worldview believes in the presence of multiple forms of reality and

4 that theories are extracted from actions and then applied back in practice through an

5 iterative process (18). This research thus contains elements from pragmatist and

6 constructivist viewpoints.

7 This is an exploratory study that uses an inductive approach to explore the research problem

8 to understanding of measurement for improvement programme effectiveness, sustainability

9 spread and evaluation methods (19). Out of the various approaches to do case study

10 research, a pragmatic constructivist approach which asserts that reality is constructed

11 socially and experientially and propagates the use of methods which focus on inductive

12 reasoning and interpretation rather than testing hypotheses, aligns closely with this research

13 (20). This research explores complex contextual and human factors in a real-world

14 healthcare setting making it suitable for a qualitative inquiry (21). This research aim requires

15 a research design that can capture the complexity of the healthcare system, the factors that

16 impact programme development, implementation and evaluation and provide evidence for

17 policy action. A case study design can capture the complexity of individual behaviour in

18 institutional settings, factors that influence these, interrelationship of actions and

19 consequences, perceptions about programme goals from the perspective of those who

20 designed it and those who implemented it to provide an evidence base for decision-making

21 and explain success or failure (22). Thus, a case study design will be adopted to capture the

22 information required to adequately address this research question.

23 Case-study methodology is a bridge between research paradigms and offers flexibility in

24 epistemology, ontology, and methodology by providing a well-defined boundary and

25 structure within which appropriate methods can be applied (23). The aim of this study is to

26 gain an in-depth understanding of the factors that influence measurement for improvement

27 skill development and use in the real-world context which makes case study research a

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1 suitable choice (24). Figure 1 summarises the research design choices in this research

2 through an adaptation of Saunders' research onion (19).

Framework development process

4 Programme evaluation should not be considered just a set of techniques but utilised as an

5 integrated approach which is intricately linked with needs assessment, course design,

6 course presentation, and transfer of training (25). It may be argued that considering these

7 programme evaluation elements may add to strength of a study. Additionally, programme

8 evaluation often gets neglected, with attention being narrowly focused on programme

9 development and implementation (26). This protocol aims to avoid these common pitfalls

10 and limitations and presents an evaluation framework which integrates these elements.

11 Research suggests that instead of focusing on the development of a standardised appraisal

12 tool for quality measurement, evaluation should be guided by the purpose (27). This

13 research aims to retrospectively understand which curricular, training, and contextual factors

14 inhibit or enable the effectiveness, sustainability and spread of the measurement for

15 improvement training using a customised framework. Medical educators can select from

16 various individual programme evaluation models or use a combination to develop a

17 framework appropriate to answer their evaluation questions (28). This research draws on

18 two evaluation models to develop a tool suitable for this case study: The Kirkpatrick

19 Evaluation Model (29) and MUSIQ (30). The following sections describe the selected

20 evaluation models and provide justification for their use.

Kirkpatrick evaluation model

22 Kirkpatrick's model measures the impact of training at four levels; reaction of participants,

23 participant learning, change in behaviour and impact on the organisational results (29). The

24 model employs straightforward evaluation criteria and requires measurement of a limited

25 number of variables (31). The popularity of this model is attributed to its simplicity in outlining

26 a system for training outcome assessment and simplifying the complex evaluation process;

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1 however, it is also criticised for being incomplete (32). The understanding about factors

2 which impact training effectiveness has grown over the years revealing that contextual

3 factors, individual characteristics, and training design elements play a critical role in training

4 success. However, the Kirkpatrick model does not account for these factors (32).

5 The model's underlying assumptions are also a source of criticism as it assumes that each

6 succeeding level provides more information than the previous one, each level is causally

7 linked to the other and the correlation between the levels is positive (33). It is independent of

8 the learner's previous experience or learning, individual factors and other environmental and

9 contextual factors that can impact training success (31). The Kirkpatrick Model is outcome

10 focused and a drawback of such models is that although they provide a good understanding

11 of what was achieved, they offer little evidence about the process through which these

12 outputs were achieved and the related barriers and enablers. This emphasises the need to

13 go beyond the outcomes-focused Kirkpatrick model to understand how the programme

14 works (34). Some areas of improvement identified by previous studies in the Kirkpatrick

15 Model include paying more attention to the teaching and learning methods (31) and utilising

16 all four levels of the model over a longer period, and mechanisms for exploring possible

17 causal links among the four levels (35).

18 Despite the criticism, the Kirkpatrick model has remained a popular choice for evaluating

19 learner outcomes in training programmes (28) and has been used to evaluate higher

20 education programmes, methodology workshops, professional development programmes

21 and short duration courses (36). This research will rely on the four levels presented by the

22 model but will adapt it to purpose of this research and account for these criticisms through

23 integrating the MUSIQ alongside the Kirkpatrick Model in a unified evaluation framework.

24 **Model for understanding success in quality (MUSIQ)**

25 Context can be defined as the "why" and "when" of change and includes influential factors

26 from the outer setting and internal setting (37). Factors internal to the organisation can

9

1   include organisational size, teams, leadership, culture, and implementation environment

2   while external factors can include regulatory requirements, funding, and professional

3   organisations (38).

4   The systematic literature review conducted in the exploratory phase of this research

5   highlighted that success of developing data skills of healthcare professional for QI is not

6   solely dependent on intervention design but also influenced by context (14). Thus, success

7   of a QI intervention can vary across implementation settings (39). Most studies evaluating QI

8   programmes focus on the evaluation of the intervention and only few incorporate methods to

9   assess impact of contextual factors (40). The constructivist-pragmatist research problem

10   being investigated cannot be fully addressed without incorporating context into the

11   evaluation design.

12   There is an increased interest in understanding the role of context in QI initiatives and

13   several frameworks and models have been developed to address this (41). One such model

14   is the MUSIQ model. The model acknowledges the system as a product of individual parts

15   and interrelationships. It identifies twenty-five contextual factors and their relative influence

16   at various levels of the healthcare system (30). The model was later revised to expand the

17   number of contextual factors to thirty-six. These new factors include external knowledge

18   (general and project specific), portfolio management, specialist staff, microsystem capacity

19   and patient engagement (30). The factors presented in this model are relevant to this

20   research question and will be incorporated into this evaluation.

21   The MUSIQ model is relatively new as it was published in 2012 and has been only used by a

22   handful of studies to date. Therefore, there is insufficient evidence to draw conclusions

23   regarding model usefulness, though studies have confirmed the observation of all original

24   factors in the QI initiatives being studied (42). One reported the framework and underlying

25   assumptions useful for interrogating the research question (43) and another reported that the

26   model was useful in identifying contextual constraints (44). The Kirkpatrick model focuses on

27   different outcome levels while MUSIQ adds another perspective of context at healthcare

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1   system level. The MUSIQ model offers the missing link to context and relationships in the

2   Kirkpatrick model. The evaluation framework for this research focuses on integrating the two

3   models to address the aim of this research.

4   **Integrated evaluation framework**

5   Knowing what information to collect, whom to collect it from and when to collect are critical

6   decisions in designing a comprehensive evaluation once the purpose of the evaluation has

7   been established (45). The proposed framework presented in Table 1 combines evaluation

8   perspectives from the two models and will be used to guide data collection through semi-

9   structured qualitative interviews and document analysis. A draft interview guide for

10   collaborative trainees based on the evaluation framework can be found in supplemental file

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1 **Table 1:**

2 **Title: Integrated evaluation framework**

Model Components	Definitions	
External environment	External motivators	External factors that stimulate the organisation to focus on the QI project
	Project sponsorship	External entities contributing personnel, expertise, equipment, facilities, or other resources for project
Organisation	QI leadership	Senior leadership commitment to champion and support QI project
	Senior leader project sponsor	
	Culture supportive of QI	Values, beliefs, and norms of an organisation that shape the behaviours of staff in pursuing QI
	Maturity of organisational QI	Sophistication of the organisation's QI programmes
	Staff engagement	Steps taken by the organisation for continued staff engagement in QI
QI support and capacity	Data infrastructure	Extent to which a system exists to collect, manage, and facilitate the use of data Effective use of technology
	Resource availability	Support for QI, including allocation of resources, finances, and staff time
	Workforce focus on QI	Workforce development through training and engagement in QI
QI team and Microsystem	Team diversity	Diversity of team members with respect to professional discipline, personality, motivation, and perspective
	Physician involvement	Contribution of physicians to the QI team efforts
	Subject matter expert	Team member/members knowledgeable about measurement
	Prior QI experience	Prior experience with QI

	Team leadership	Team leader's ability to accomplish the goals of the improvement project by guiding the QI team
	Team norms	Team establishes strong norms of behaviour about QI goal achievement
	Team QI skill/capability for improvement	Team's ability to use improvement methods to make changes
	Motivation to change	Extent to which team members have a desire and willingness to improve
	QI Accountability	Clearly stated and communicated responsibility and accountability in the project
Trigger (Training Event)	Participation and Reaction (Kirkpatrick Level 1)	Overall satisfaction with the programme, content, delivery, logistics, facilitators etc
	Knowledge, Skills and Attitudes (Kirkpatrick Level 2)	Improvement in knowledge and skills reported by participants immediately after the intervention
Outcomes/process & system changes	Behaviour Change (Kirkpatrick Level 3)	Confidence in measurement skills Maintaining and advancing the skills learned Continued Spread and involvement in QI
	Learning Networks	Development of QI networks among post-intervention
	QI Capacity development	Ability of participants to initiate and lead other projects Ability of participants to train/help other staff
	Change in Organisational Practice and/or Patient Outcomes (Kirkpatrick Level 4)	Sustainability in outcomes achieved Sustainability in practices Process changes as a result of the training event
	Dissemination/spread	Spread of knowledge and improved practices to non-intervention units
	Unintended consequences	Negative or positive, unanticipated outcomes

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Case design

This research study will use a multiple case design (24). A multiple case design is suited for this study because measurement for improvement training occurs at a common venue where it is attended by healthcare staff from diverse backgrounds and multiple organisations. Participants then return to their own organisations to apply their learning. In Ireland, the National QI Team within the Health Service Executive (HSE) is responsible for partnering with health and social care services to promote sustainable QI. The Measurement for Improvement (MFI) curriculum (6) is one such effort to train staff in handling quantitative and qualitative data for QI. The curriculum identifies and outlines essential components of high-quality Measurement for Improvement (MFI) training to ensure a consistent standard of training for the Irish Healthcare staff (6). The purpose of this research is to apply the integrated framework to evaluate the measurement for improvement curriculum.

Case selection

The bounded systems are the training collaboratives in which the training was imparted. The trainees belonged to different organisations who came together for the training and then implemented the skills in their own organisational contexts. This research design therefore consists of two cases; the Pressure Ulcers to Zero collaborative (PUTZ) and Clinical Microsystems collaborative, which delivered measurement for improvement training. The PUTZ collaborative took place between 2016 and 2018. The aim of the collaborative was to reduce ward acquired pressure ulcers by 50% in participating teams within six months and sustain the achieved results at twelve months (46). The micro-systems collaborative occurred in 2017 and its aim was to improve the quality of patient care and work life of the emergency departments' staff participating in the collaborative (47). Both collaboratives consisted of 3 training days and activity periods in between, with measurement for improvement being an important component of the training content.

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1 **Researcher reflexivity statement**

2 The lead researcher immersed herself in the work of the National QI Team of the Health

3 Service Executive (HSE) Ireland to develop a deeper understanding of their work,

4 understand the context for measurement for improvement and the aims and objectives of the

5 training programmes. This immersion and ethnographic observation provided invaluable

6 opportunity to the researcher to observe and work on various other projects of the National

7 QI Team. The researcher, therefore, developed an insider perspective about the operations

8 and culture of the health system, something which facilitated a better understanding when

9 participants described aspects of the system such as bureaucracy. However, one possible

10 drawback of this could be a preference for 'trainer' views due to the researcher's familiarity

11 with these individuals. To counter this, the researcher will structure the analysis into trainer

12 and trainee perspectives so that both perspectives are included in a balanced analysis. As

13 an additional quality step, the emerging findings will be presented to the research team to

14 challenge assumptions and increase trustworthiness.

15 **Patient and public involvement statement**

16 No patient involved

17 **Data collection**

18 Data collection will be conducted using multiple sources of evidence through semi-structured

19 interviews with training participants, trainers and site coordinators and document analysis. A

20 case study database in the form of electronic files will be maintained for this case study

21 research. The database will have two main sections; the evidence or data collected and

22 reports of the investigators (24).

23 The study population will include healthcare staff who were trained, those who delivered

24 training, site coordinators of participating sites, leads of the two collaboratives in the HSE.

25 The trainee population ranges from senior-level staff such as Assistant Directors of Nursing

26 to frontline staff such as healthcare assistants and nurses. This research will use a

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1   purposive sampling strategy by including participants who shared the common experience of

2   the training and had participated in the two collaboratives (48). This is purposely kept broad

3   as both collaboratives were completed more than two years ago as the researchers

4   anticipate challenges in recruiting participants. Participation in the study will be on a

5   voluntary basis and the researcher will describe the nature of the study in detail to the

6   participants and answer all questions prior to any data collection. The National QI Team will

7   serve as a gatekeeper for participant recruitment for trainees and send a letter to introduce

8   the researcher to participants The recruitment letter is available in Supplemental File 2.

9   Those willing to participate would then contact the researcher and written informed consent

10 will be obtained. The study consent form is available in Supplemental File 3.

11 The data collection will be conducted via semi-structured interviews and document analysis.

12 The semi-structured interviews will be conducted by the lead author. The interview method

13 will allow the researcher to capture the words, thoughts, feelings, perceptions, and

14 experiences of the participants to answer the research question (49). The first two interviews

15 will be used as a pilot to review the interview guide and make changes if required. The

16 collected documents will be used to inform participant reaction and learning (Kirkpatrick

17 levels 1 and 2). These documents will include (depending on the availability) the end of

18 collaborative reports and any feedback forms used during the collaboratives. Level 3 and 4

19 data along with contextual factors (from MUSIQ framework) will be collected through

20 interviews. This research aims to recruit all trainers, both leads of the two collaboratives in

21 the HSE, and 10 participants from each collaborative.

22 **Data processing**

23 The interviews will be audio recorded and transcribed and anonymised. Site pseudonyms

24 will be used. A field journal will be maintained by the researcher while interviewing which will

25 be used to make a note of researcher's assumptions, feelings and biases and reflections on

26 the interviews. After each interview, the recording will be analysed to improve the

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1   researcher's performance as an interviewer. A case database will be maintained to store all

2   collected data.

Data analysis

4   The data analysis of case studies involves a detailed description of the setting or individuals

5   and analysis of the data for themes or issues (50). A detailed description of the training

6   programme, sites and participants will be followed by a thematic analysis of the qualitative

7   interview data and the documents collected. The coding and analysis framework is

8   presented in Figure 2 (51). Coding process will be aided by the NVivo12 software which

9   provides a platform for data management, querying and visualisation (52).

10   This qualitative analysis will rely on the same theoretical and analytical strategy to study both

11   cases and then the patterns found in each case will be compared (24). The comparison

12   between the two cases will be performed. The involves analysing the data in new ways,

13   explore relationships and the cluster the data so contrasts, and similarities emerge (53).

Ensuring rigour

15   Rigour will be ensured by triangulating through multiple sources of data by including

16   perspectives of multiple stakeholders and multiple data collection methods. Data collection

17   and analysis methods and researcher reflexivity will be clearly documented to ensure

18   transparency. At the analysis stage, two other researchers will review codes collectively in

19   regular meetings (54). The researchers aim to perform member checking by contacting 10%

20   of the participants and sharing a summary of results. The researchers also aim to perform

21   member checking with a broader audience through an interactive webinar. The HSE

22   regularly conducts QI webinars, and this platform would be useful for reaching healthcare

23   professionals interested in QI and enable the researchers to obtain and incorporate

24   feedback from a wider audience into the results. The other method of dissemination would

25   be through peer-reviewed journal articles which would also strengthen the study. To

26   incorporate the impact of the COVID-19 pandemic on this research process and the work

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1 practices of healthcare staff, questions to explore the role of QI education and measurement

2 for improvement in adapting to new ways of working are included in the interview topic

3 guide.

4 **DISCUSSION**

5 Data and measurement can be used to monitor and support improvement and to enhance

6 the quality of care, making measurement for improvement an essential skill for the

7 healthcare staff (55). This research aims to explore training, curricular and contextual factors

8 that can help in the development and use of measurement for improvement skills in

9 healthcare staff. To our knowledge, no previous studies have evaluated measurement for

10 improvement programmes. Additionally, many QI programmes are not appropriately

11 evaluated, peer-reviewed or published (56) therefore it is difficult to access any work on

12 measurement for improvement skills that may have been conducted before.

13 Theoretically, this research will contribute towards the current understanding of the two

14 models. It will add to the evidence base of MUSIQ model and confirm the existence or non-

15 existence of the contextual factors and relationships presented in the model. The study uses

16 MUSIQ model in a qualitative design while majority of the previous studies have relied on

17 quantitative approaches. It will study all four levels proposed in the Kirkpatrick model which

18 is less common in previous studies. The integrated framework is a theoretical contribution to

19 the field and the analysis will also reflect on the useful and effectiveness of the approach.

20 Although qualitative research may not be generalisable, this research will be one of the few

21 studies focusing on measurement for improvement and will reveal a multitude of avenues for

22 future research. The results will not only be of importance for QI/measurement training

23 design, but also for evaluation purposes and for healthcare organisations and systems.

24 There is a need for further research in the evaluation of QI programmes in terms of their

25 immediate and long-term impacts. Measurement for improvement is an important but less

26 explored topic in programme evaluations and there is need to expand the understanding of

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1   what to teach, how to teach and how to evaluate programmes that aim to train healthcare

2   staff in quantitative and qualitative data skills. Programme evaluation should be viewed as a

3   driving force for future programme design and policy. Instead of focusing on using

4   standardised models, this study takes a customised evaluation approach, appropriate to

5   answer this research question which is a theoretical contribution to the field. This approach

6   is expected to expand the empirical and theoretical understanding of factors that influence

7   the development and use of measurement for improvement skills in healthcare staff. Another

8   expected impact of this research will be to deepen the understanding of contextual factors

9   that impacted programme success at various levels of the healthcare system.

10   **ETHICS AND DISSEMINATION**

11   The study has received exemption from full ethical review from the Human research ethics

12   committee of our institution (LS-E-19-108). The results of the study will be disseminated in

13   peer reviewed Journals.

14   **AUTHORS' CONTRIBUTIONS**

18   **COMPETING INTERESTS**

20   **FUNDING STATEMENT**

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1 **FIGURE TITLES AND LEGENDS**

2 **FIGURE 1**

3 **Title:** Research design choices through an adaptation of Saunders' research onion

4 **Legend**: Flow chart of Research design choices for the study through an adaptation of

5 Saunders' research onion

6 **FIGURE 2**

7 **Title:** Coding and Analysis Framework

8 **Legend:** Description of coding and analysis steps adapted from Johnny Saldana's coding

9 methodology

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Figure 1

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┌─────────────────────┐     ┌─────────────────────┐     ┌─────────────────────┐
│   Constructivist    │ ──> │ Inductive approach  │ ──> │  Case Study method: │
│ Pragmatist Worldview│     │ to theory development│     │    multiple cases   │
└─────────────────────┘     └─────────────────────┘     └─────────────────────┘
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│ Data collection: Semi│ <─ │  Longitudinal time  │ <─ │     Qualitative     │
│ structured interviews│     │      horizon        │     │    investigation    │
│ & document analysis │     │                     │     │                     │
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     ┌─────────────────────────────────────────┐
     │ Data analysis: Thematic analysis and    │
     │         cross case comparison           │
     └─────────────────────────────────────────┘
```

Figure 2

First Cycle Coding
Attribute coding: Basic descriptive information
Descriptive coding: Basic topic of a passage of qualitative data
Structural Coding: Areas identified in the interview topic guide
In Vivo Coding: Verbatim coding
Process Coding: Action in the data
Values Coding: Participant's values, attitudes, and beliefs
Causation coding: Mental models participants
Magnitude Coding: Intensity, frequency, direction in coded data

Post Coding Transitions		
Reorganizing and reassembling data into categories	Code Mapping, Landscaping, and diagramming	Condensed list of categories

Second Cycle Coding
Axial coding: Identifying dominant codes, combining synonyms and redundant codes, selecting best representative codes
Pattern Coding: Explanatory or inferential meta codes to identify emergent themes

Meta-summary/meta-synthesis: Collecting, comparing, and synthesizing findings across the two cases

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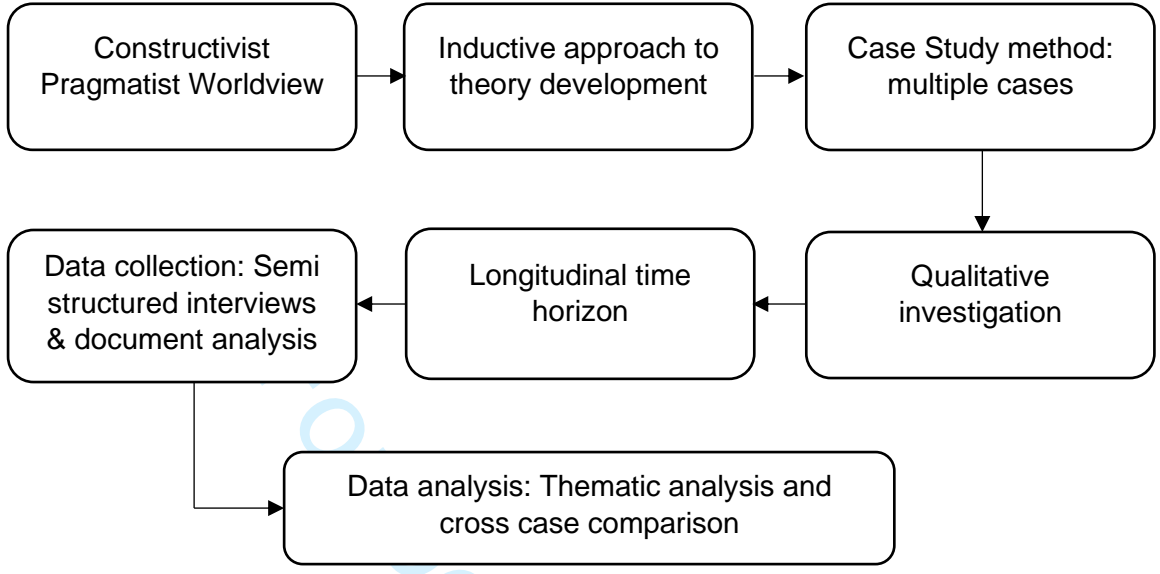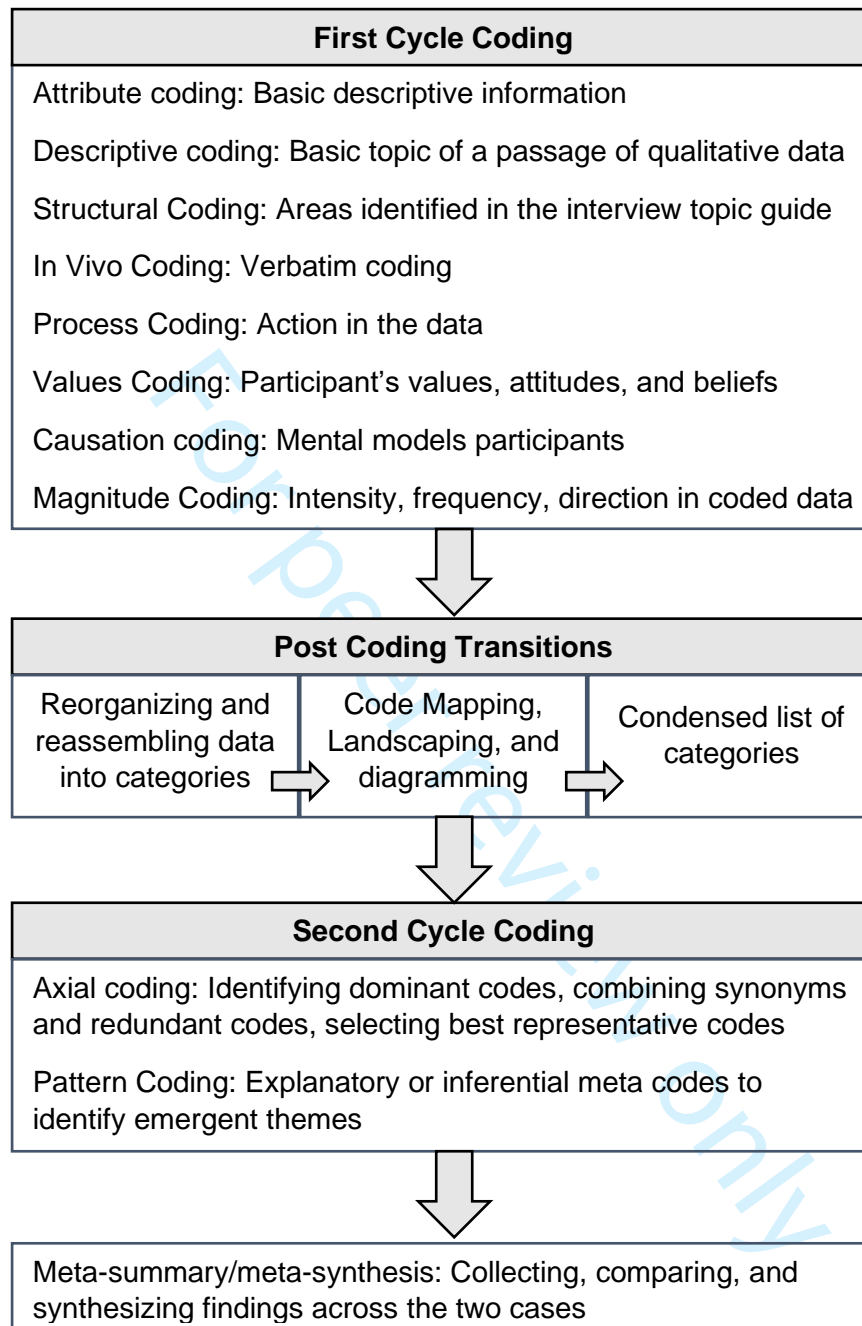**Supplemental File 1:** Sample interview topic guide for collaborative trainees

Introduction

- What is your professional background and what is your current job role?
- How did you become a part of the PUTZ/microsystems collaborative?
- What were your expectations regarding learning measurement for improvement/QI during the training?
- Did you have any knowledge of or experience in using measurement/QI techniques prior to the collaborative?

Effectiveness

- Looking back, how would you assess the suitability of the collaborative for your needs?
  - PROBES
  - Session content
  - Session format/logistics
  - Coaching and support
- If you can recall, which concepts were easier to understand for the team and which areas you struggled with?
- Did you find the measurement techniques to be useful to your work?
- What factors could have made the training more effective and usable for you?
- What challenges/barriers did you face while implementation?

Sustainability

- Do you think you have been able to retain the skills 2 years after the collaborative?
  - PROBES
  - Retention as a team
- Do you still use some or all the skills in your work? Could you give some examples?
- Do you think the training gave you an advantage over staff who did not attend the training?
- What motivated you to sustain this knowledge?
- What factors facilitated sustaining these skills in the long term?

- o   PROBES
- o   Support from senior and frontline managers
- o   Data Infrastructure within organization
- o   Resource availability
- o   External and Internal motivating factors
- o   Team capacity
- •   Would you like to remain involved in work that requires the use of these skills?
- •   Would you like to enhance your measurement/QI skills further?

Spread

- •   Have you shared your knowledge with colleagues in your own team and department? If yes, what means (formal or informal) used to spread this knowledge?
- •   Would you say all members of the team, regardless of their participation in the training, feel comfortable applying these skills?
- •   Have you shared your knowledge with those outside the team, department, or organization?
- •   What motivates you to share knowledge with others?
- •   Would you know others, within the organization or outside, who are experts in measurement and QI methods, and do you consult them if there is a need?
- •   What were the challenges in spreading knowledge?
- •   What were the enablers in spreading knowledge?
  - o   PROBES
  - o   Role of leaders
  - o   Supportive culture of the organization
  - o   Availability of resources

COVID-19

- •   Have there been any changes in the way you or your teamwork during the pandemic?
  - o   PROBE
  - o   Organizational level changes

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- Did your QI and measurement skills help you in changing and adapting to the new clinical pathways? Did you use any QI or measurement skills, approaches or tools during this time?
- What support in QI methods and knowledge could have made this transition easier for you?
- For the foreseeable future it is likely that training will be delivered virtually - what would be your opinion on distance learning for QI and measurement skills
- Is there anything else you would like to add that could help improve the training?

Supplemental File 2: Recruitment letter

Dear Colleague,

This letter is to introduce Zuneera Khurshid, a PhD student enrolled at University College Dublin (UCD) supervised by Professor Eilish McAuliffe, engaged by the National Quality Improvement Team (NQIT) to conduct research on the effectiveness and sustainability of Measurement for Improvement training and curriculum.

Zuneera's research aims to conduct a case study to assess the effectiveness and sustainability of Measurement for Improvement curriculum and training intervention at micro, meso and macro levels in healthcare staff. It intends to answer questions including:

- Identifying the essential components of successful measurement for improvement training.
- Identifying characteristics and experiences of learners which aid in successful acquisition, retention and application of measurement knowledge.
- Investigate the organizational and contextual factors that impede or facilitate the uptake and spread of measurement for improvement training

This letter is directed towards staff who have participated in the measurement for improvement training interventions. The researcher requests your time and patience to participate in interviews to help explore this research question. The researcher wants to inform you that:

- Participation in the research is voluntary and anonymous.
- If you are interested in participating in the research, you will be contacted by the researcher to explain the study and answer questions (if any).
- You will be provided with information sheets and consent forms before interviews.
- The interview will require approximately 40 minutes and the time and venue will be decided based on the convenience of the participant.
- The researcher intends to publish a research article based on the evaluation, but it will not disclose names or identities of participants.
- You may decline to answer any question, and you may withdraw from the interview at any time

Your participation will help the researcher to develop recommendations for the revision of the curriculum that will make it better suited to the needs of Irish Healthcare staff.

Thank you very much for your time,

The National Quality Improvement Team

Supplemental File 3: Consent forms

UCD School of Nursing, Midwifery and Health Systems
UCD College of Health and Agricultural Sciences

PARTICIPANT CONSENT FORM

Project: Evaluating the impact of Measurement for Improvement training

Participant Number: [ ]

Principal Investigator: Prof Eilish McAuliffe[1]

Researchers: Ms. Zuneera Khurshid[1], Dr Aoife De Brun[1], Dr. Jennifer Martin, Dr. Philip Crowley[2]

Please tick each

I have read the information sheet and understand that I will be involved in this research to explore the impact of measurement for improvement training on work practices.	
I understand that my participation in this study is voluntary and that I am free to withdraw my participation at any time without giving a reason.	
I understand that I will be taking part in a 40-minute one-on-one interview with a member of the research team, but that this is voluntary, and I can decline to take part if I wish. If I choose to take part, I know I can withdraw at any point up to or during the interview and can receive a copy of my transcript for my review after the interview.	
I understand that all data collected during the study will remain confidential, and I consent to my responses and personal information being stored in a locked filing cabinet and on password protected and encrypted computers located in the School of Nursing, Midwifery and Health Systems, University College Dublin	
I understand that if any disclosures are made that would indicate malpractice or misconduct at any point during the study or suggest that any individual was in danger of harm, this information will be disclosed to the appropriate personnel and the researcher would be obliged to report this to the unit manager at the earliest opportunity.	
My queries have been addressed to my satisfaction by the research team and I consent to take part in this study.	

_____   _____   _____

Name of participant   Date   Signature

_____   _____   _____

Name of person taking consent   Date   Signature

---

1. School of Nursing, Midwifery & Health Systems, University College Dublin

2. National Quality Improvement Team, Health Service Executive

BMJ Open

Protocol for an integrated evaluation framework to study training, curricular and contextual factors impacting the success of a Measurement for Improvement training programme for healthcare staff in Ireland.

SCHOLARONE™
Manuscripts

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1 **TITLE**

2 Protocol for an integrated evaluation framework to study training, curricular and contextual

3 factors impacting the success of a Measurement for Improvement training programme for

4 healthcare staff in Ireland.

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6 **CORRESPONDING AUTHOR**

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34   **email:** eilish.mcauliffe@ucd.ie

35   **KEYWORDS**

36   Quality improvement, QI, programme evaluation, measurement for improvement, qualitative

37   research

38   **WORD COUNT**

39   3876 (excluding title page, references, figures, and tables)

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3   **ABSTRACT**
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8   **Introduction:** Measurement for improvement is the process of collecting, analysing, and
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10   presenting data to demonstrate whether a change has resulted in an improvement. It is also
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12   important in demonstrating sustainability of improvements through continuous measurement.
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14   This makes measurement for improvement a core element in quality improvement (QI)
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16   efforts. However, there is little to no research investigating factors that influence
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18   measurement for improvement skills in healthcare staff. This protocol paper presents an
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20   integrated evaluation framework to understand the training, curricular and contextual factors
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22   that influence the success of measurement for improvement training by utilising the
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24   experiences of trainees, trainers, programme, and site coordinators.

Introduction: Measurement for improvement is the process of collecting, analysing, and presenting data to demonstrate whether a change has resulted in an improvement. It is also important in demonstrating sustainability of improvements through continuous measurement. This makes measurement for improvement a core element in quality improvement (QI) efforts. However, there is little to no research investigating factors that influence measurement for improvement skills in healthcare staff. This protocol paper presents an integrated evaluation framework to understand the training, curricular and contextual factors that influence the success of measurement for improvement training by utilising the experiences of trainees, trainers, programme, and site coordinators.

Methods and analysis: This research will adopt a qualitative retrospective case-study design based on constructivist-pragmatic philosophy. The Pressure Ulcers to Zero collaborative (PUTZ) and Clinical Microsystems collaborative from the Irish health system which included a measurement for improvement component have been selected for this study. This paper presents an integrated approach proposing a novel application of two pre-existing frameworks: The Model for Understanding Success in Quality (MUSIQ) framework and the Kirkpatrick Evaluation Model to evaluate an unexplored QI context and programme. A thematic analysis of the qualitative interview data and the documents collected will be conducted. The thematic analysis is based on a four-step coding framework adapted for this research study. The coding process will be conducted using NVivo12 software and Microsoft Excel. A cross-case comparison between the two cases will be performed.

Ethics and dissemination: The study has received an exemption from full ethical review from the Human research ethics committee of University College Dublin, Ireland (LS-E-19-108). Informed consent will be obtained from all participants and the data will be anonymised and stored securely. The results of the study will be disseminated in peer-reviewed Journals.

STRENGTHS AND LIMITATIONS OF THIS STUDY

3

ABSTRACT

Introduction: Measurement for improvement is the process of collecting, analysing, and presenting data to demonstrate whether a change has resulted in an improvement. It is also important in demonstrating sustainability of improvements through continuous measurement. This makes measurement for improvement a core element in quality improvement (QI) efforts. However, there is little to no research investigating factors that influence measurement for improvement skills in healthcare staff. This protocol paper presents an integrated evaluation framework to understand the training, curricular and contextual factors that influence the success of measurement for improvement training by utilising the experiences of trainees, trainers, programme, and site coordinators.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

3

72 • The proposed evaluation framework focuses on the long-term sustainability of

73 measurement for improvement skills in healthcare staff.

74 • The proposed framework is based on the current evidence and models used by

75 various QI studies and accounts for the contextual realities of the healthcare system.

76 • The study addresses current gaps in the methods and application of evaluation

77 frameworks and models in QI evaluation.

78 • The study design is responsive to the current situation and explores the role of

79 Quality Improvement (QI) education and measurement for improvement in adapting

80 to new ways of working during COVID-19.

81 The major limitation of this study is recall bias as the training programmes being evaluated

82 were completed more than 2 years ago.

83 **INTRODUCTION**

84 Quality in healthcare is a subjective, complex, and multi-dimensional concept which makes it

85 difficult to define and measure (1). The common defining attributes of healthcare quality in

86 research include the delivery of effective and safe care to attain desired outcomes and a

87 culture of excellence (2). In his pioneering work on healthcare quality, Donabedian described

88 high quality healthcare as the type of care which maximises patient welfare while accounting

89 for the expected gains and losses using legitimate means (3). Since then, the understanding

90 of quality has greatly evolved. The Health Foundation defines healthcare quality as the

91 ability of healthcare services to deliver the desired health outcomes consistent with recent

92 professional knowledge, to individuals and populations (4). Similarly, there are various

93 definitions of QI. One simple way to define QI is considering it an approach for improving

94 health service systems and processes through the routine use of health and programme

95 data to meet patient and programme needs (5). These definitions of quality and QI reveal the

96 central role of measurement for improvement in the improvement process. Measurement for

97 improvement refers to the process of collecting, analysing, and presenting quantitative and

98 qualitative data to demonstrate whether a change has resulted in an improvement (6).

4

99   Despite its importance, measurement for improvement is a less explored topic in QI research

100   and there is a need for further research in the area. With the growing importance of QI

101   knowledge in healthcare, there is a developing research interest in the QI curricula content,

102   the effectiveness of educational design and its link with organisational performance (7).

103   However, most QI programme evaluations focus on the improvement of knowledge, skills

104   and confidence of learners and do not offer insights into clinical and long-term effects (8).

105   Additionally, the measurement for improvement component is rarely evaluated.

106   Existing models of training programme evaluation often have a narrow focus; they are

107   effective in measuring the outputs (what works) but do not provide insights into the process

108   that leads to training effectiveness (how it works) (9, 10). This highlights the need for

109   evaluation approaches that explore the processes that led to improvements. The impact of

110   contextual factors such as environment, management support and leadership, organisational

111   culture and data infrastructure also remains largely unexplored (11). There is also ambiguity

112   around the quality and effectiveness of the programmes and how the concepts and methods

113   are taught (12). One crucial aspect of improvement work is measurement. Measurement is

114   an important element in QI efforts as change needs to be measured to demonstrate

115   improvement and to identify and respond to variation (13). Learning how to measure quality

116   is an important skill for healthcare staff in general and those involved in QI in particular.

117   A systematic literature review revealed that there are no QI programme evaluation studies

118   focusing on evaluating the factors that influence development and use of measurement for

119   improvement skills of healthcare staff (14). There is a need to evaluate the effectiveness,

120   sustainability and spread of measurement for improvement programmes but there is

121   uncertainty around evaluation outcomes and methods. Measurement often gets

122   overshadowed by the overall focus on understanding QI and on outcomes, resulting in a

123   dearth of measurement for improvement research. Quality measurement is frequently

124   treated as an ancillary matter in healthcare systems' approach to QI (15). Research to

125   explore factors that will enable healthcare staff to embrace measurement for improvement

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126 and appreciate its value in demonstrating outcomes is needed. In addition to this, many QI

127 teams are failing to fully implement measurement tools and techniques (16). Despite this

128 identified gap in measurement skills, there is little to no research exploring ways to develop

129 measurement for improvement skills in staff or to better understand the factors that influence

130 the development of these skills.

131 The overall aim of this research is to understand the training, curricular and contextual

132 factors that inhibit or enable the success of measurement for improvement training by

133 utilising the experiences of trainees, trainers, programme, and site coordinators. The

134 research will be conducted in the Irish health system using two QI collaboratives (Pressure

135 Ulcers to Zero and Clinical Microsystems) which included dedicated training on

136 measurement for improvement. This paper presents an integrated evaluation framework

137 developed to address this research aim. This research started in August 2020 and is

138 expected to be completed by December 2021.

METHODS

139 **METHODS**

140 **Theoretical underpinning**

141 The underlying assumption of this research is that the views of stakeholders about the

142 training programme and the context are required to make sense of this problem. This aligns

143 with the constructivist worldview. The constructivist worldview asserts that humans construct

144 meaning when they interact with the world and are influenced by historical and social

145 perspectives and context (17). Another objective of this research is to investigate what works

146 in a certain situation and why and then use this knowledge to develop solutions, linking the

147 research outcomes to recommended actions which is a characteristic of the pragmatist

148 worldview. The pragmatist worldview believes in the presence of multiple forms of reality and

149 that theories are extracted from actions and then applied back in practice through an

150 iterative process (18). This research thus contains elements from pragmatist and

151 constructivist viewpoints.

6

152   This exploratory study uses an inductive approach to understand the research problem of

153   measurement for improvement programme effectiveness, sustainability, spread and

154   evaluation methods (19). The pragmatic constructivist approach asserts that reality is

155   constructed socially and experientially and propagates the use of inductive reasoning which

156   aligns most closely with this research (20). This research explores complex contextual and

157   human factors in a real-world healthcare setting making it suitable for a qualitative inquiry

158   (21). This research aim requires a design that can capture the complexity of the healthcare

159   system, the factors that impact programme development, implementation and evaluation and

160   provide evidence for policy action. A case study design can capture the complexity of

161   individual behaviour in institutional settings, factors that influence these, interrelationship of

162   actions and consequences, perceptions about programme goals from the perspective of

163   those who designed it and those who implemented it to provide an evidence base for

164   decision-making and explain success or failure (22). Thus, a case study design will be

165   adopted to capture the information required to adequately address this research question.

166   Case-study methodology is a bridge between research paradigms and offers flexibility in

167   epistemology, ontology, and methodology by providing a well-defined boundary and

168   structure within which appropriate methods can be applied (23). The aim of this study is to

169   gain an in-depth understanding of the factors that influence measurement for improvement

170   skill development and use in the real-world context which makes case study research a

171   suitable choice (24). Figure 1 summarises the research design choices in this research

172   through an adaptation of Saunders' research onion (19).

173   **Framework development process**

174   Programme evaluation should not be considered just a set of techniques but utilised as an

175   integrated approach which is intricately linked with needs assessment, course design,

176   course presentation, and transfer of training (25). It may be argued that considering these

177   programme evaluation elements may add to strength of a study. Additionally, programme

178   evaluation often gets neglected, with attention being narrowly focused on programme

7

179 development and implementation (26). This protocol aims to avoid these common pitfalls

180 and limitations and presents an evaluation framework which integrates these elements.

181 Research suggests that instead of focusing on the development of a standardised appraisal

182 tool for quality measurement, evaluation should be guided by the purpose (27). This

183 research aims to retrospectively understand which curricular, training, and contextual factors

184 inhibit or enable the effectiveness, sustainability and spread of the measurement for

185 improvement training using a customised framework. Medical educators can select from

186 various individual programme evaluation models or use a combination to develop a

187 framework appropriate to answer their evaluation questions (28). This research draws on

188 two evaluation models to develop a tool suitable for this case study: The Kirkpatrick

189 Evaluation Model (29) and MUSIQ (30). The following sections describe the selected

190 evaluation models and provide justification for their use.

191

192 **Kirkpatrick evaluation model**

193 Kirkpatrick's model measures the impact of training at four levels; reaction of participants,

194 participant learning, change in behaviour and impact on the organisational results (29). The

195 model employs straightforward evaluation criteria and requires measurement of a limited

196 number of variables (31). The popularity of this model is attributed to its simplicity in outlining

197 a system for training outcome assessment and simplifying the complex evaluation process;

198 however, it is also criticised for being incomplete (32). The understanding about factors

199 which impact training effectiveness has grown over the years revealing that contextual

200 factors, individual characteristics, and training design elements play a critical role in training

201 success. However, the Kirkpatrick model does not account for these factors (32).

202 The model's underlying assumptions are also a source of criticism as it assumes that each

203 succeeding level provides more information than the previous one, each level is causally

204 linked to the other and the correlation between the levels is positive (33). It is independent of

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205 the learner's previous experience or learning, individual factors and other environmental and

206 contextual factors that can impact training success (31). The Kirkpatrick Model is outcome

207 focused and a drawback of such models is that although they provide a good understanding

208 of what was achieved, they offer little evidence about the process through which these

209 outputs were achieved and the related barriers and enablers. This emphasises the need to

210 go beyond the outcomes-focused Kirkpatrick model to understand how the programme

211 works (34). Some areas of improvement identified by previous studies in the Kirkpatrick

212 Model include paying more attention to the teaching and learning methods (31) and utilising

213 all four levels of the model over a longer period, and mechanisms for exploring possible

214 causal links among the four levels (35).

215 Despite the criticism, the Kirkpatrick model has remained a popular choice for evaluating

216 learner outcomes in training programmes (28) and has been used to evaluate higher

217 education programmes, methodology workshops, professional development programmes

218 and short duration courses (36). This research will rely on the four levels presented by the

219 model but will adapt it to purpose of this research and account for these criticisms through

220 integrating the MUSIQ alongside the Kirkpatrick Model in a unified evaluation framework.

221 **Model for understanding success in quality (MUSIQ)**

222 Context can be defined as the "why" and "when" of change and includes influential factors

223 from the outer setting and internal setting (37). Factors internal to the organisation can

224 include organisational size, teams, leadership, culture, and implementation environment

225 while external factors can include regulatory requirements, funding, and professional

226 organisations (38).

227 The systematic literature review conducted in the exploratory phase of this research

228 highlighted that success of developing data skills of healthcare professional for QI is not

229 solely dependent on intervention design but also influenced by context (14). Thus, success

230 of a QI intervention can vary across implementation settings (39). Most studies evaluating QI

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231 programmes focus on the evaluation of the intervention and only few incorporate methods to

232 assess impact of contextual factors (40). The constructivist-pragmatist research problem

233 being investigated cannot be fully addressed without incorporating context into the

234 evaluation design.

235 There is an increased interest in understanding the role of context in QI initiatives and

236 several frameworks and models have been developed to address this (41). One such model

237 is the MUSIQ model. The model acknowledges the system as a product of individual parts

238 and interrelationships. It identifies twenty-five contextual factors and their relative influence

239 at various levels of the healthcare system (30). The model was later revised to expand the

240 number of contextual factors to thirty-six. These new factors include external knowledge

241 (general and project specific), portfolio management, specialist staff, microsystem capacity,

242 and patient engagement (30). The factors presented in this model are relevant to this

243 research question and will be incorporated into this evaluation.

244 The MUSIQ model is relatively new as it was published in 2012 and has been only used by a

245 handful of studies to date. Therefore, there is insufficient evidence to draw conclusions

246 regarding model usefulness, though studies have confirmed the observation of all original

247 factors in the QI initiatives being studied (42). One reported the framework and underlying

248 assumptions useful for interrogating the research question (43) and another reported that the

249 model was useful in identifying contextual constraints (44). The Kirkpatrick model focuses on

250 different outcome levels while MUSIQ adds another perspective of context at healthcare

251 system level. The MUSIQ model offers the missing link to context and relationships in the

252 Kirkpatrick model. The evaluation framework for this research focuses on integrating the two

253 models to address the aim of this research.

254 **Integrated evaluation framework**

255 Knowing what information to collect, whom to collect it from and when to collect are critical

256 decisions in designing a comprehensive evaluation once the purpose of the evaluation has

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257 been established (45). The proposed framework presented in Table 1 combines evaluation

258 perspectives from the two models and will be used to guide data collection through semi-

259 structured qualitative interviews and document analysis. A draft interview guide for

260 collaborative trainees based on the evaluation framework can be found in supplemental file

261 1.

262 **Table 1:**

263 **Title: Integrated evaluation framework**

Model Components	Definitions	
External environment	External motivators	External factors that stimulate the organisation to focus on the QI project
	Project sponsorship	External entities contributing personnel, expertise, equipment, facilities, or other resources for project
Organisation	QI leadership	Senior leadership commitment to champion and support QI project
	Senior leader project sponsor	
	Culture supportive of QI	Values, beliefs, and norms of an organisation that shape the behaviours of staff in pursuing QI
	Maturity of organisational QI	Sophistication of the organisation's QI programmes
	Staff engagement	Steps taken by the organisation for continued staff engagement in QI
QI support and capacity	Data infrastructure	Extent to which a system exists to collect, manage, and facilitate the use of data Effective use of technology
	Resource availability	Support for QI, including allocation of resources, finances, and staff time
	Workforce focus on QI	Workforce development through training and engagement in QI

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QI team and Microsystem	Team diversity	Diversity of team members with respect to professional discipline, personality, motivation, and perspective
	Physician involvement	Contribution of physicians to the QI team efforts
	Subject matter expert	Team member/members knowledgeable about measurement
	Prior QI experience	Prior experience with QI
	Team leadership	Team leader's ability to accomplish the goals of the improvement project by guiding the QI team
	Team norms	Team establishes strong norms of behaviour about QI goal achievement
	Team QI skill/capability for improvement	Team's ability to use improvement methods to make changes
	Motivation to change	Extent to which team members have a desire and willingness to improve
	QI Accountability	Clearly stated and communicated responsibility and accountability in the project
Trigger (Training Event)	Participation and Reaction (Kirkpatrick Level 1)	Overall satisfaction with the programme, content, delivery, logistics, facilitators etc
	Knowledge, Skills and Attitudes (Kirkpatrick Level 2)	Improvement in knowledge and skills reported by participants immediately after the intervention
Outcomes/process & system changes	Behaviour Change (Kirkpatrick Level 3)	Confidence in measurement skills Maintaining and advancing the skills learned Continued Spread and involvement in QI
	Learning Networks	Development of QI networks among post-intervention
	QI Capacity development	Ability of participants to initiate and lead other projects Ability of participants to train/help other staff
	Change in Organisational Practice and/or	Sustainability in outcomes achieved Sustainability in practices Process changes as a result of the training event

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	Patient Outcomes (Kirkpatrick Level 4)	
	Dissemination/spread	Spread of knowledge and improved practices to non-intervention units
	Unintended consequences	Negative or positive, unanticipated outcomes

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Case design

266 This research study will use a multiple case design (24). A multiple case design is suited for

267 this study because measurement for improvement training occurs at a common venue where

268 it is attended by healthcare staff from diverse backgrounds and multiple organisations.

269 Participants then return to their own organisations to apply their learning. In Ireland, the

270 National QI Team within the Health Service Executive (HSE) is responsible for partnering

271 with health and social care services to promote sustainable QI. The Measurement for

272 Improvement (MFI) curriculum (6) is one such effort to train staff in handling quantitative and

273 qualitative data for QI. The curriculum identifies and outlines essential components of high-

274 quality Measurement for Improvement (MFI) training to ensure a consistent standard of

275 training for the Irish Healthcare staff (6). The purpose of this research is to apply the

276 integrated framework to evaluate the measurement for improvement curriculum.

Case selection

278 The bounded systems are the training collaboratives in which the training was imparted. The

279 trainees belonged to different organisations who came together for the training and then

280 implemented the skills in their own organisational contexts. This research design therefore

281 consists of two cases; the Pressure Ulcers to Zero collaborative (PUTZ) and Clinical

282 Microsystems collaborative, which delivered measurement for improvement training. The

283 PUTZ collaborative took place between 2016 and 2018. The aim of the collaborative was to

284 reduce ward acquired pressure ulcers by 50% in participating teams within six months and

285 sustain the achieved results at twelve months (46). The microsystems collaborative occurred

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286 in 2017 and its aim was to improve the quality of patient care and work life of the emergency

287 departments' staff participating in the collaborative (47). Both collaboratives consisted of 3

288 training days and activity periods in between, with measurement for improvement being an

289 important component of the training content.

290

Researcher reflexivity statement

292 The lead researcher immersed herself in the work of the National QI Team of the Health

293 Service Executive (HSE) Ireland to develop a deeper understanding of their work,

294 understand the context for measurement for improvement and the aims and objectives of the

295 training programmes. This immersion and ethnographic observation provided invaluable

296 opportunity to the researcher to observe and work on various other projects of the National

297 QI Team. The researcher, therefore, developed an insider perspective about the operations

298 and culture of the health system, something which facilitated a better understanding when

299 participants described aspects of the system such as bureaucracy. However, one possible

300 drawback of this could be a preference for 'trainer' views due to the researcher's familiarity

301 with these individuals. To counter this, the researcher will structure the analysis into trainer

302 and trainee perspectives so that both perspectives are included in a balanced analysis. As

303 an additional quality step, the emerging findings will be presented to the research team to

304 challenge assumptions and increase trustworthiness.

Patient and public involvement statement

306 There was no patient or public involvement in the study. The study collected data from

307 healthcare staff about their experiences of participating in a QI training programme and did

308 not require any data from patients or the public.

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Data collection

Data collection will be conducted using multiple sources of evidence through semi-structured interviews with training participants, trainers and site coordinators and document analysis. A case study database in the form of electronic files will be maintained for this case study research. The database will have two main sections; the evidence or data collected and reports of the investigators (24).

The study population will include healthcare staff who were trained, those who delivered training, site coordinators of participating sites, leads of the two collaboratives in the HSE. The trainee population ranges from senior-level staff such as Assistant Directors of Nursing to frontline staff such as healthcare assistants and nurses. This research will use a purposive sampling strategy by including participants who shared the common experience of the training and had participated in the two collaboratives (48). This is purposely kept broad as both collaboratives were completed more than two years ago as the researchers anticipate challenges in recruiting participants. Participation in the study will be on a voluntary basis and the researcher will describe the nature of the study in detail to the participants and answer all questions prior to any data collection. The National QI Team will serve as a gatekeeper for participant recruitment for trainees and send a letter to introduce the researcher to participants The recruitment letter is available in Supplemental File 2. Those willing to participate would then contact the researcher and written informed consent will be obtained. The study consent form is available in Supplemental File 3.

The data collection will be conducted via semi-structured interviews and document analysis. The semi-structured interviews will be conducted by the lead author. The interview method will allow the researcher to capture the words, thoughts, feelings, perceptions, and experiences of the participants to answer the research question (49). The first two interviews will be used as a pilot to review the interview guide and make changes if required. The collected documents will be used to inform participant reaction and learning (Kirkpatrick levels 1 and 2). These documents will include (depending on the availability) the end of

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338 collaborative reports and any feedback forms used during the collaboratives. Level 3 and 4

339 data along with contextual factors (from MUSIQ framework) will be collected through

340 interviews. This research aims to recruit all trainers, both leads of the two collaboratives in

341 the HSE, and 10 participants from each collaborative.

Data processing

343 The interviews will be audio recorded and transcribed and anonymised. Site pseudonyms

344 will be used. A field journal will be maintained by the researcher while interviewing which will

345 be used to make a note of researcher's assumptions, feelings and biases and reflections on

346 the interviews. After each interview, the recording will be analysed to improve the

347 researcher's performance as an interviewer. A case database will be maintained to store all

348 collected data.

Data analysis

350 The data analysis of case studies involves a detailed description of the setting or individuals

351 and analysis of the data for themes or issues (50). A detailed description of the training

352 programme, sites and participants will be followed by a thematic analysis of the qualitative

353 interview data and the documents collected. The coding and analysis framework is

354 presented in Figure 2 (51). Coding process will be aided by the NVivo12 software which

355 provides a platform for data management, querying and visualisation (52).

356 This qualitative analysis will rely on the same theoretical and analytical strategy to study both

357 cases and then the patterns found in each case will be compared (24). The comparison

358 between the two cases will be performed. The involves analysing the data in new ways,

359 explore relationships and the cluster the data so contrasts, and similarities emerge (53).

Ensuring rigour

361 Rigour will be ensured by triangulating through multiple sources of data by including

362 perspectives of multiple stakeholders and multiple data collection methods. Data collection

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363   and analysis methods and researcher reflexivity will be clearly documented to ensure

364   transparency. At the analysis stage, two other researchers will review codes collectively in

365   regular meetings (54). The researchers aim to perform member checking by contacting 10%

366   of the participants and sharing a summary of results. The researchers also aim to perform

367   member checking with a broader audience through an interactive webinar. The HSE

368   regularly conducts QI webinars, and this platform would be useful for reaching healthcare

369   professionals interested in QI and enable the researchers to obtain and incorporate

370   feedback from a wider audience into the results. The other method of dissemination would

371   be through peer-reviewed journal articles which would strengthen the awareness about this

372   study. To incorporate the impact of the COVID-19 pandemic on this research process and

373   the work practices of healthcare staff, questions to explore the role of QI education and

374   measurement for improvement in adapting to new ways of working are included in the

375   interview topic guide.

376   **DISCUSSION**

377   Measurement for improvement is an essential skill for healthcare staff as it can be used to

378   monitor and support improvement and enhance the quality of care(55). This research aims

379   to explore training, curricular and contextual factors that can help in the development and

380   use of measurement for improvement skills in healthcare staff. To our knowledge, no

381   previous studies have evaluated measurement for improvement programmes. Additionally,

382   many QI programmes are not appropriately evaluated, peer-reviewed or published (56)

383   therefore it is difficult to access any work on measurement for improvement skills that may

384   have been conducted before.

385   Theoretically, this research will contribute towards the current understanding of the two

386   models. It will add to the evidence base of MUSIQ model and confirm the existence or non-

387   existence of the contextual factors and relationships presented in the model. The study uses

388   MUSIQ model in a qualitative design while majority of the previous studies have relied on

389   quantitative approaches. It will study all four levels proposed in the Kirkpatrick model which

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390   is less common in previous studies. The integrated framework is a theoretical contribution to

391   the field and the analysis will also reflect on the useful and effectiveness of the approach.

392   Although qualitative research may not be generalisable, this research will be one of the few

393   studies focusing on measurement for improvement and will reveal a multitude of avenues for

394   future research. The results will not only be of importance for QI/measurement training

395   design, but also for evaluation purposes and for healthcare organisations and systems.

396   There is a need for further research in the evaluation of QI programmes in terms of their

397   immediate and long-term impacts. Measurement for improvement is an important but less

398   explored topic in programme evaluations and there is need to expand the understanding of

399   what to teach, how to teach and how to evaluate programmes that aim to train healthcare

400   staff in quantitative and qualitative data skills. Programme evaluation should be viewed as a

401   driving force for future programme design and policy. Instead of focusing on using

402   standardised models, this study takes a customised evaluation approach, appropriate to

403   answer this research question which is a theoretical contribution to the field. This approach

404   is expected to expand the empirical and theoretical understanding of factors that influence

405   the development and use of measurement for improvement skills in healthcare staff. Another

406   expected impact of this research will be to deepen the understanding of contextual factors

407   that impacted programme success at various levels of the healthcare system.

ETHICS AND DISSEMINATION

409   The study has received exemption from full ethical review from the Human research ethics

410   committee of University College Dublin, Ireland (LS-E-19-108). The results of the study will

411   be disseminated in peer reviewed journals.

AUTHORS' CONTRIBUTIONS

413   ZK developed the methodology and prepared the initial draft in consultation with ADB and

414   EM. ADB and EM provided substantive feedback on the draft which was revised by ZK. All

415   authors have read and approved the final manuscript.

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FIGURE TITLES AND LEGENDS

558

559 **FIGURE 1**

560 **Title:** Research design choices through an adaptation of Saunders' research onion

561 **Legend**: Flow chart of Research design choices for the study through an adaptation of

562 Saunders' research onion

563 **FIGURE 2**

564 **Title:** Coding and Analysis Framework

565 **Legend:** Description of coding and analysis steps adapted from Johnny Saldana's coding

566 methodology

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Figure 1

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Figure 2

First Cycle Coding
Attribute coding: Basic descriptive information
Descriptive coding: Basic topic of a passage of qualitative data
Structural Coding: Areas identified in the interview topic guide
In Vivo Coding: Verbatim coding
Process Coding: Action in the data
Values Coding: Participant's values, attitudes, and beliefs
Causation coding: Mental models participants
Magnitude Coding: Intensity, frequency, direction in coded data

Post Coding Transitions		
Reorganizing and reassembling data into categories	Code Mapping, Landscaping, and diagramming	Condensed list of categories

Second Cycle Coding
Axial coding: Identifying dominant codes, combining synonyms and redundant codes, selecting best representative codes
Pattern Coding: Explanatory or inferential meta codes to identify emergent themes

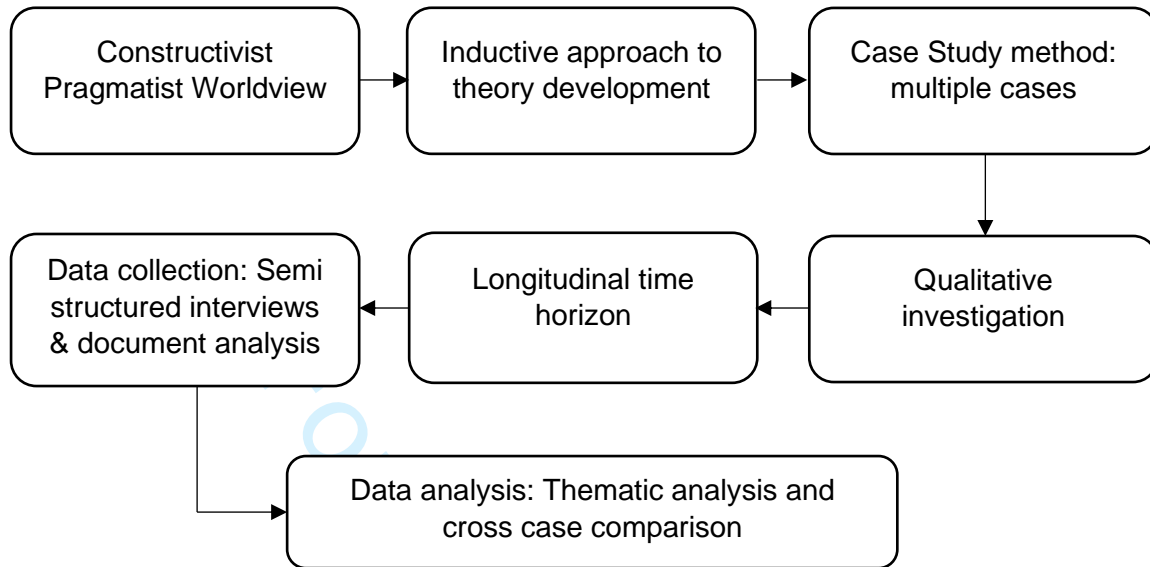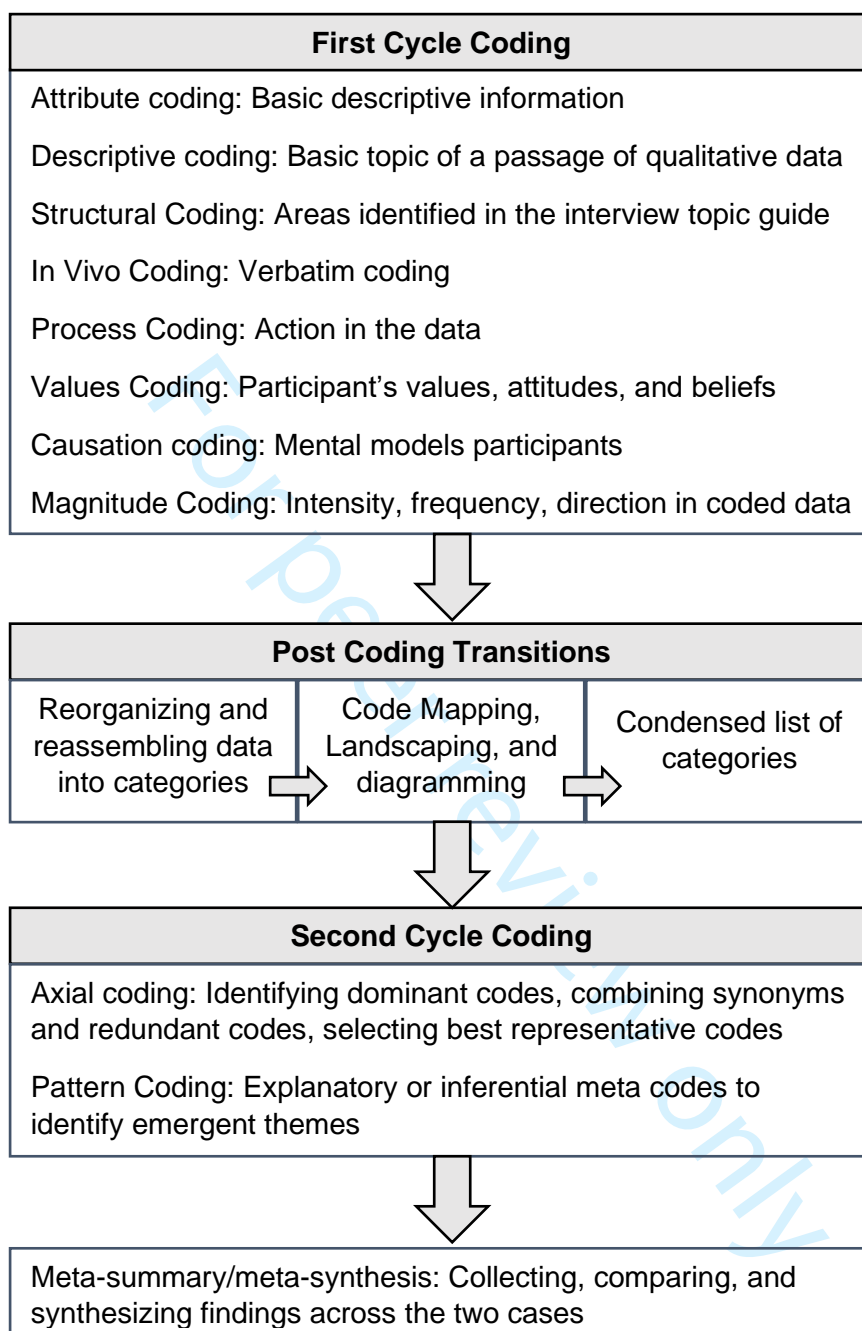| Meta-summary/meta-synthesis: Collecting, comparing, and synthesizing findings across the two cases |
| --- |

Supplemental File 1: Sample interview topic guide for collaborative trainees

Introduction

- What is your professional background and what is your current job role?
- How did you become a part of the PUTZ/microsystems collaborative?
- What were your expectations regarding learning measurement for improvement/QI during the training?
- Did you have any knowledge of or experience in using measurement/QI techniques prior to the collaborative?

Effectiveness

- Looking back, how would you assess the suitability of the collaborative for your needs?
  - o PROBES
  - o Session content
  - o Session format/logistics
  - o Coaching and support
- If you can recall, which concepts were easier to understand for the team and which areas you struggled with?
- Did you find the measurement techniques to be useful to your work?
- What factors could have made the training more effective and usable for you?
- What challenges/barriers did you face while implementation?

Sustainability

- Do you think you have been able to retain the skills 2 years after the collaborative?
  - o PROBES
  - o Retention as a team
- Do you still use some or all the skills in your work? Could you give some examples?
- Do you think the training gave you an advantage over staff who did not attend the training?
- What motivated you to sustain this knowledge?
- What factors facilitated sustaining these skills in the long term?

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- o PROBES
- o Support from senior and frontline managers
- o Data Infrastructure within organization
- o Resource availability
- o External and Internal motivating factors
- o Team capacity

- Would you like to remain involved in work that requires the use of these skills?

- Would you like to enhance your measurement/QI skills further?

Spread

- Have you shared your knowledge with colleagues in your own team and department? If yes, what means (formal or informal) used to spread this knowledge?

- Would you say all members of the team, regardless of their participation in the training, feel comfortable applying these skills?

- Have you shared your knowledge with those outside the team, department, or organization?

- What motivates you to share knowledge with others?

- Would you know others, within the organization or outside, who are experts in measurement and QI methods, and do you consult them if there is a need?

- What were the challenges in spreading knowledge?

- What were the enablers in spreading knowledge?
  - o PROBES
  - o Role of leaders
  - o Supportive culture of the organization
  - o Availability of resources

COVID-19

- Have there been any changes in the way you or your teamwork during the pandemic?
  - o PROBE
  - o Organizational level changes

- Did your QI and measurement skills help you in changing and adapting to the new clinical pathways? Did you use any QI or measurement skills, approaches or tools during this time?
- What support in QI methods and knowledge could have made this transition easier for you?
- For the foreseeable future it is likely that training will be delivered virtually - what would be your opinion on distance learning for QI and measurement skills
- Is there anything else you would like to add that could help improve the training?

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Supplemental File 2: Recruitment letter

Dear Colleague,

This letter is to introduce Zuneera Khurshid, a PhD student enrolled at University College Dublin (UCD) supervised by Professor Eilish McAuliffe, engaged by the National Quality Improvement Team (NQIT) to conduct research on the effectiveness and sustainability of Measurement for Improvement training and curriculum.

Zuneera's research aims to conduct a case study to assess the effectiveness and sustainability of Measurement for Improvement curriculum and training intervention at micro, meso and macro levels in healthcare staff. It intends to answer questions including:

- Identifying the essential components of successful measurement for improvement training.
- Identifying characteristics and experiences of learners which aid in successful acquisition, retention and application of measurement knowledge.
- Investigate the organizational and contextual factors that impede or facilitate the uptake and spread of measurement for improvement training

This letter is directed towards staff who have participated in the measurement for improvement training interventions. The researcher requests your time and patience to participate in interviews to help explore this research question. The researcher wants to inform you that:

- Participation in the research is voluntary and anonymous.
- If you are interested in participating in the research, you will be contacted by the researcher to explain the study and answer questions (if any).
- You will be provided with information sheets and consent forms before interviews.
- The interview will require approximately 40 minutes and the time and venue will be decided based on the convenience of the participant.
- The researcher intends to publish a research article based on the evaluation, but it will not disclose names or identities of participants.
- You may decline to answer any question, and you may withdraw from the interview at any time

Your participation will help the researcher to develop recommendations for the revision of the curriculum that will make it better suited to the needs of Irish Healthcare staff.

Thank you very much for your time,

The National Quality Improvement Team

Supplemental File 3: Consent forms

UCD UCD School of Nursing, Midwifery and Health Systems
UCD College of Health and Agricultural Sciences

PARTICIPANT CONSENT FORM

Project: Evaluating the impact of Measurement for
Improvement training

Participant Number:

Principal Investigator: Prof Eilish McAuliffe[1]

Researchers: Ms. Zuneera Khurshid[1], Dr Aoife De Brun[1], Dr. Jennifer Martin[2], Dr. Philip Crowley[2]

Please tick each

I have read the information sheet and understand that I will be involved in this research to explore the impact of measurement for improvement training on work practices.	
I understand that my participation in this study is voluntary and that I am free to withdraw my participation at any time without giving a reason.	
I understand that I will be taking part in a 40-minute one-on-one interview with a member of the research team, but that this is voluntary, and I can decline to take part if I wish. If I choose to take part, I know I can withdraw at any point up to or during the interview and can receive a copy of my transcript for my review after the interview.	
I understand that all data collected during the study will remain confidential, and I consent to my responses and personal information being stored in a locked filing cabinet and on password protected and encrypted computers located in the School of Nursing, Midwifery and Health Systems, University College Dublin.	
I understand that if any disclosures are made that would indicate malpractice or misconduct at any point during the study or suggest that any individual was in danger of harm, this information will be disclosed to the appropriate personnel and the researcher would be obliged to report this to the unit manager at the earliest opportunity.	
My queries have been addressed to my satisfaction by the research team and I consent to take part in this study.	

_____   _____   _____

Name of participant   Date   Signature

_____   _____   _____

Name of person taking consent   Date   Signature

1. School of Nursing, Midwifery & Health Systems, University College Dublin
2. National Quality Improvement Team, Health Service Executive

Standards for Reporting Qualitative Research (SRQR)*

http://www.equator-network.org/reporting-guidelines/srqr/

Title and abstract

	Page/line no(s). (Marked copy)
Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	Page 1
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	Page 3

Introduction

Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	Pages 4-6
Purpose or research question - Purpose of the study and specific objectives or questions	Page 6

Methods

Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	Page 6-8
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	Page 15
Context - Setting/site and salient contextual factors; rationale**	Page 5-6 Page 8-11
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	Page 15-16
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	Page 17, Page 19
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	Page 15-16

Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	Page 15-16, Supplemental Files 1, 2 and 3
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	Page 16
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	Page 17
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	Page 17
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	Page 17

Results/findings

Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	NA
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	NA

Discussion

Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	Page 18-19
Limitations - Trustworthiness and limitations of findings	Page 4

Other

Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	Page 19
Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	Page 19

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

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**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.