

A Systematic Review and Narrative Synthesis: Determinants of the Effectiveness and Sustainability of Measurement-Focused Quality Improvement Trainings

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Introduction: The ability of health care professionals to measure change is critical for successful quality improvement (QI) efforts. Currently, there are no systematic reviews focusing on continuing education for health care professionals in data skills for QI. The purpose of this systematic review is to define *effectiveness* and *sustainability* of QI programs for health care professionals containing a measurement skills component and to identify barriers and facilitators to effectiveness and sustainability.

Methods: The systematic review involved study identification, screening, full text review, and data extraction. Four electronics databases and grey literature sources were searched to identify studies published between 2009 and 2019 (11 years). A customized data extraction form was developed. Mixed methods appraisal tool was used for quality assessment and a thematic analysis was conducted for narrative synthesis.

Results: Fifty-three studies from 11 countries were included. Most study designs were quantitative descriptive (17/53) and used a blended learning approach (25/53) combining face-to face and distance learning modes. The programs included basic, intermediate, and advanced data skills concepts. Overall, studies reported positive outcomes for participant reaction, learning, and behavior, but reported variable success in sustainability and spread of QI.

Discussion: Studies discussed measurement as a key competency for clinical QI. Effectiveness definitions focused on the short-term impact of the programs, whereas sustainability definitions emphasized maintenance of outcomes and skills in the long-term. Factors that influenced effectiveness and sustainability of the included studies were strategic approach to QI, organizational support, intervention design, communication, accountability, leadership support, and learning networks.

Keywords: quality measurement, program evaluation, measurement for improvement, data skills, continuing professional development

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Health care organizations worldwide continue to test new systems and ways to enhance health care quality and patient safety.¹ Organizations are using continuing education programs in quality improvement (QI) methodologies to transform care and improve patient safety, reduce variations in care outcomes, and deliver sustainable changes in the health care system.² The use of such programs to improve health care has also gained considerable

popularity in the health care system.³ However, the health care system is complex and professional knowledge alone is not enough to engage in QI work to bring about change.⁴ Numerous QI training programs have been developed to train health care staff in QI methodology and application.

QI training can improve processes, staff knowledge, and health outcomes.⁵ Measurement is an important construct in all

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QI efforts because unless we measure, it is impossible to demonstrate whether the change has resulted in an improvement or not.⁶ For health care staff today, collecting, processing, and understanding data is a part of routine practice.⁷ This makes a strong case to train health care staff in quality measurement and to develop their expertise in the use of data.⁸

Although there are several systematic reviews evaluating QI training and curricula,^{9–11} none have focused on the evaluation of measurement for improvement training components. This systematic review differs from previous reviews by focusing on QI curricula and training programs containing a significant data skills component. The concepts of effectiveness and sustainability are critical to assessing the impact of teaching measurement skills to health care staff, but these concepts are underexplored in the QI literature. Effectiveness is a micro concept and refers to the assessment of the usefulness of an output at a certain point, with little reference to context. On the other hand, sustainability is a macro concept which extends over a longer period as the new ways of working or improved outcomes become the norm, with context being an essential element.¹² The purpose of this systematic review is to address this gap in literature and define effectiveness and sustainability of QI programs for health care professionals that have a data for improvement component and to identify the associated barriers and enablers.

METHODS

Protocol and Registration

Review protocol for this systematic review is registered on PROSPERO (ID: CRD42019122997). This study was approved by the IRB of our institution.

Eligibility Criteria

Studies were included if:

1. Conducted in health care setting
2. Intervention was QI-based training and included a measurement component.
3. Study was about development, evaluation, or implementation of the program
4. Population was health care staff or postgraduate students
5. Based on primary research

Studies were excluded if:

1. There was no measurement for improvement component in intervention
2. Conference proceedings
3. Population was undergraduate students

Information Sources

Systematic review protocols were scanned in Prospero and Cochrane library to ensure novelty of the review question. A scoping search of databases was conducted to inform the development of the search strategy. Databases were purposively selected to include health care and education sources. The databases were: PubMed, CINAHL Plus, ERIC (via ProQuest), and Web of Science. Grey literature sources included

two databases: OAIster and OpenGrey along with websites of leading organizations (see Supplemental File 1, Supplemental Digital Content 1, <http://links.lww.com/JCEHP/A103>). The reference lists of eligible studies were scanned to identify additional papers.

Search

The search strategy (see Supplemental File 2, Supplemental Digital Content 2, <http://links.lww.com/JCEHP/A104>) was optimized toward sensitivity rather than specificity because the scoping search revealed that measurement for improvement was integrated into QI studies rather than being delivered as a standalone training.¹³ The authors finalized the search strategy and databases iteratively. The systematic search of the literature was conducted in January 2019 and updated in June 2020. The search was restricted to papers published in last 11 years (Search date: January 1, 2009–December 31, 2019). Foreign language papers with English abstracts were considered at the initial stage but only included in full text review if a complete translation was available.

Study Selection

The systematic review consisted of four stages: study identification, title and abstract screening, full text review, and data extraction. Study screening was completed using Covidence tool.¹⁴ Two reviewers independently conducted title and abstract screening. The reviewers met regularly to resolve disputes. The full text review was also conducted independently by two reviewers and discrepancies resolved via discussion. The two reviewers consulted a third reviewer to assist in making the decision on one paper at the full text review stage. Because the studies were heterogenous, a narrative synthesis was performed.

The database search returned 6184 articles, which were imported into Covidence. The 2499 duplicates were removed, leaving 3685 studies eligible for screening. After screening, 110 studies were shortlisted for full text review. A total of 53 studies were included in the review. The PRISMA flow diagram is presented in Figure 1 and the checklist is attached in Supplemental Digital Content 3 (see Supplemental File 3, <http://links.lww.com/JCEHP/A105>).¹⁵

Assessment of Methodological Quality

The Mixed Methods Appraisal Tool (MMAT) was used to evaluate methodological quality.¹⁶ The validity and reliability of the MMAT has been established and is suitable for appraising mixed method studies.¹⁷ Two reviewers assessed quality independently and results were compared. Studies meeting the screening questions of the MMAT on clarity of research questions and appropriateness of collected data were considered appropriate quality for inclusion. All 53 studies met these criteria and were included in the review. The quality assessment is presented in Table 1.

Data Extraction

Two reviewers completed the data extraction independently. A customized data extraction form was developed (see Supplemental File 4, Supplemental Digital Content 4, <http://links.lww.com/JCEHP/A106>). One reviewer compared the data extraction forms and discrepancies were resolved through discussion between reviewers.

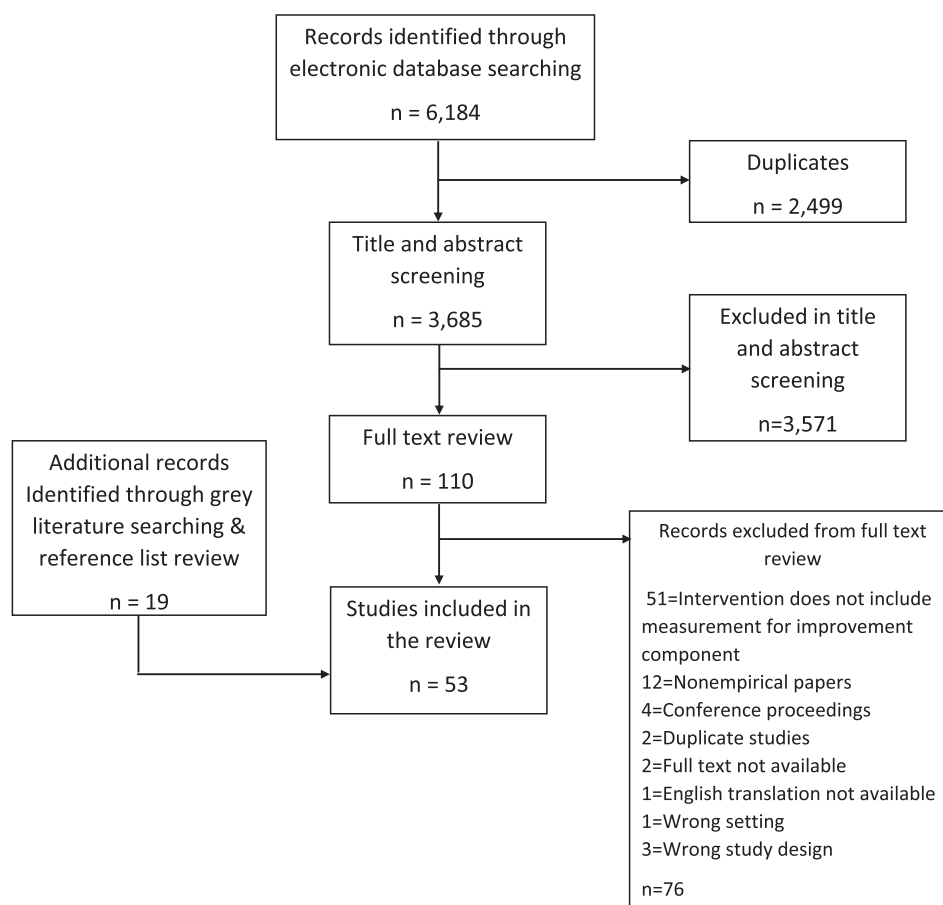


FIGURE 1. PRISMA Statement. An overview of the study selection process. The 6184 records identified through database searching were screened by 2 reviewers. Nineteen records were identified and included from grey literature sources. Exclusion reasons at each stage are shown.

RESULTS

The 53 included studies were published between 2009 and 2019 and set in 11 countries. Most studies (35/53) were based in the United States. Most Study designs were quantitative descriptive (17/53) followed by mixed methods studies (16/53). The population varied widely, ranging from frontline staff, clinical and nonclinical staff, and leaders. A summary of studies is presented in Supplemental File 5, Supplemental Digital Content 5, <http://links.lww.com/JCEHP/A131>.

Training Description

Less than half (14/53) of the studies were based on a collaborative approach. Duration of the collaboratives was variable, ranging from 2 months to 72 months. Half of the studies used a blended learning approach (25/53) combining face-to-face and distance learning modes, whereas 21 studies relied solely on face-to-face learning modes. Four trainings were delivered online, whereas three studies did not state training modality used. Interventions included multiple training methods; the most common (39/53) one being face-to-face learning sessions. Other methods included teleconferencing (12/53), online modules (10/53), workshops (9/53), webinars (6/53), and emails (6/53).

Curriculum Description

The curricula were summarized into categories of basic, intermediate, and advanced data skills based on complexity of data

concepts taught. Figure 2 summarizes the three categories and highlights the data concepts part of the training and curricula in the included studies. Basic data skills include concepts of measurement and QI knowledge, which are important for all health care staff. Intermediate data skills concepts are useful for staff working in improvement teams, whereas advanced data skills concepts are useful for improvement team leads and advisors.

Study Outcomes

Study outcomes are categorized as participant reaction, participant learning, participant behavior, sustainability, spread, and course design elements (see Supplemental File 6, Supplemental Digital Content 6, <http://links.lww.com/JCEHP/A107>). All studies measuring participation reaction to training and improved learning reported positive outcomes regardless of the study design. Studies measuring participant behavior also reported positive results except two quantitative descriptive studies.^{63,65} Two randomized control trial studies^{24,53} and a controlled interrupted time series study⁵⁰ reported not achieving the clinical outcomes being measured. A cohort study also reported not achieving the outcome of developing a culture of QI.⁴² In spread, one quantitative descriptive study⁴⁹ reported no spread of QI methods. For sustainability outcomes, Glasgow et al³⁷ (Interrupted time series), Doyle et al³⁰ (Quantitative descriptive), and Cranley et al²⁶ (Mixed methods) reported a lack of sustainability of QI.

TABLE 1.
Assessment of Methodological Quality Using MMAT*

Study	Screening Questions		Quantitative																								
			Qualitative					Randomized Control Trial					Nonrandomized CT					Descriptive					Mixed Methods				
	S1	S2	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Adams et al ¹⁸	Y	Y	Y	C	Y	Y	Y											Y	Y	Y	C	C	Y	Y	Y	Y	Y
Bardfield et al ¹⁹	Y	Y																Y	Y	Y	Y	Y					
Barker et al ²⁰	Y	Y																Y	Y	Y	Y	Y					
Berry ²¹	Y	Y	Y	Y	Y	Y	Y																				
Bidassie et al ²²	Y	Y											Y	Y	Y	C	Y										
Brandrud et al ⁴	Y	Y	Y	Y	Y	Y	Y																				
Bundy et al ²³	Y	Y											Y	Y	Y	Y	Y										
Butler et al ³	Y	Y	Y	Y	Y	Y	Y											Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Chinthammit et al ²⁴	Y	Y						Y	Y	Y	C	Y															
Cosimi et al ²⁵	Y	Y											Y	Y	Y	Y	Y										
Cranley et al ²⁶	Y	Y	Y	Y	C	C	C						Y	Y	Y	Y	Y						Y	C	C	C	C
Davis et al ²⁷	Y	Y	Y	Y	C	C	C											Y	Y	Y	C	C	Y	Y	Y	Y	Y
Davis et al ²⁸	Y	Y	Y	C	C	C	C											Y	Y	Y	Y	Y	Y	C	C	C	C
Devers et al ²⁹	Y	Y	Y	Y	C	C	C																				
Dolins et al ²	Y	Y																Y	Y	Y	C	Y					
Doyle et al ³⁰	Y	Y																Y	Y	Y	C	C					
Dücker et al ³¹	Y	Y	Y	Y	Y	Y	Y											Y	Y	Y	Y	Y	Y	Y	Y	C	Y
Dunbar et al ³²	Y	Y																Y	Y	Y	Y	Y					
Fernald et al ³³	Y	Y	Y	Y	Y	Y	Y																				
Fieldston et al ³⁴	Y	Y																Y	Y	Y	C	C					
Fok et al ³⁵	Y	Y											Y	Y	Y	Y	Y										
Gaetke-Udager et al ³⁶	Y	Y	Y	Y	Y	Y	Y																				
Glasgow et al ³⁷	Y	Y											Y	Y	Y	Y	Y										
Godfrey et al ³⁸	Y	Y	Y	Y	Y	Y	Y											Y	Y	Y	Y	Y					
Godfrey et al ³⁹	Y	Y	Y	Y	Y	Y	Y											Y	Y	Y	Y	Y					
Gustafson et al ⁴⁰	Y	Y						Y	Y	Y	N	Y															
Hajjar-Nejad et al ⁴¹	Y	Y																Y	Y	Y	Y	Y					
Joly et al ⁴²	Y	Y											Y	Y	Y	Y	Y										
Kamal et al ⁴³	Y	Y	Y	Y	C	C	C						Y	Y	Y	C	Y						Y	Y	C	Y	C
Kaminski et al ⁴⁴	Y	Y	Y	C	C	C	C											Y	Y	Y	Y	Y	Y	Y	C	C	C
Laing et al ⁴⁵	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y						Y	Y	Y	C	Y
McLinden et al ⁴⁶	Y	Y	Y	Y	Y	Y	Y											Y	Y	Y	C	C	Y	Y	Y	C	Y
McNamara et al ⁴⁷	Y	Y	Y	C	C	C	C											Y	Y	Y	Y	Y	Y	C	C	C	C
Mold et al ⁴⁸	Y	Y											Y	Y	Y	Y	Y										
Morganti et al ⁴⁹	Y	Y																Y	Y	Y	Y	Y					
New et al ⁵⁰	Y	Y											Y	Y	Y	N	Y										
O'Connor et al ⁵¹	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y						Y	Y	Y	Y	Y
O'Leary ⁵²	Y	Y																Y	Y	Y	Y	Y					
Peden et al ⁵³	Y	Y						Y	Y	Y	Y	Y															
Rask et al ⁵⁴	Y	Y	Y	Y	Y	Y	Y											Y	Y	Y	C	C	Y	Y	Y	C	Y
Riley et al ⁵	Y	Y	Y	Y	Y	Y	Y											Y	Y	Y	Y	Y	Y	Y	Y	C	Y
Rinke et al ⁵⁵	Y	Y																Y	Y	Y	Y	Y					
Robert et al ⁵⁶	Y	Y																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rogers et al ⁵⁷	Y	Y	Y	Y	C	C	C											Y	Y	Y	C	C	Y	Y	Y	C	Y
Sarin et al ⁵⁸	Y	Y																Y	Y	Y	Y	Y					
Scott et al ⁵⁹	Y	Y																Y	Y	Y	Y	Y					
Sellers et al ⁶⁰	Y	Y																Y	Y	Y	Y	Y					
Sepulveda et al ⁶¹	Y	Y																Y	Y	Y	Y	Y					
Shaw et al ⁶²	Y	Y											Y	Y	Y	Y	Y										
Tudiver et al ⁶³	Y	Y																Y	Y	Y	Y	Y					
Vaughn et al ⁶⁴	Y	Y																Y	Y	Y	Y	Y					
White et al ¹	Y	Y											Y	Y	Y	Y	Y										
Wong et al ⁶⁵	Y	Y																Y	Y	Y	Y	Y					

*Y, yes; N, No; C, Cannot tell.

Basic Data skills			
Concepts	n	Tools	n
Improvement methodology & applications	37	PDSA	32
Data collection principles	20	Process mapping	5
Measuring changes	13	Flowcharts	3
Lean principles	7	Cause and effect analysis	2
Types of quality measures	6	Driver diagrams	2
Developing and selecting measures	6	Fishbones	2
Quality measurement principles	5	Root cause analysis	2
Data driven Quality Improvement methods	3	Value stream mapping	2
Performance measurement	2	Gap analysis	1
Measurement tools	2		
Real time measurement	1		
Intermediate Data Skills			
Concepts	n	Tools	n
Data analysis	14	Run charts	7
Understanding and addressing variation	6	Control charts	5
Data interpretation	3	Chart auditing	2
Sharing Data	2	Histograms	1
Data evaluation	2	Pareto charts	1
Data abstraction	1	Radar Charts	1
Follow-up measurement	1	Trend graphs	1
Data visualization	1		
Data validity	1		
Data utilization	1		
Data reporting	1		
Advanced Data skills			
Concepts	n	Tools	n
Creating measurement systems	2	Statistical process control charts	2
Selecting a control chart	1	Shewhart Control Charts	1
Survey design & implementation	1	Patient satisfaction scores	1
Interviewing	1	Advanced Control Charts	1
		Conjoint Analysis	1

FIGURE 2. Measurement for Improvement Concepts. Summary of basic, intermediate, and advanced measurement and data skills taught in the QI programs.

The Role of Measurement

The included studies reported on the role of measurement in QI for tracking progress toward goals and offering a systematic way to test changes to close performance gaps.^{20,61} Measurement was identified as a key competency for clinical QI²¹ to understand variation and improve the design health care.⁴ Measurement was used to view data over time and draw conclusions regarding variations.⁵⁴ Measurement also played a role in implementation of QI methods¹⁹ and contributed to the success of QI.⁴⁹

Knowledge about statistics and statistical process control⁴ and additional support for measurement skills was reported by studies as critical.^{2,33,39} Defining clear aims and measuring progress toward them was described as essential for QI.⁶² Measurement was used to demonstrate patient outcomes to the

host organizations³⁰ and provide guidance to decision makers.⁴⁹ Continuous measurement followed the processes through the project period into daily operations.⁴ One study labelled measurement as one of the crucial elements of strategy for QI spread and sustainability.³¹ Timely data and measurement are important for assessing progress and evaluation.³⁰

Challenges in identifying, collecting, and displaying appropriate measures of care impact QI program success.^{4,18,63} Studies cited measurement challenges such as difficulty in obtaining measurable data^{34,64} and presenting data in run/control chart formats.³⁵ Many participating hospitals were not equipped for systematic data collection.³¹ Data collection and measurement was valued,²⁹ but perceived to be time consuming by participants.^{52,53}

Defining Effectiveness and Sustainability

The purpose of the review is to define effectiveness and sustainability and identify the barriers and enablers to success, in the context of QI programs with a focus on data and measurement for improvement. There is variability in how effectiveness and sustainability is defined in the studies. Another related concept that emerged was that of spread. It is therefore important to distinguish between effectiveness, spread, and sustainability. Effectiveness and sustainability definitions were extracted as part of the data extraction tool and summarized in Supplemental Digital Content 7 (see Supplemental file 7, <http://links.lww.com/JCEHP/A108>). The aspects addressed by these extracted definitions were then used to synthesize definitions. This was completed via consultation between three reviewers.

Effectiveness definitions focused on the short-term impact of the QI programs and were measured using participant reaction to the program, improved knowledge and skill application of participants, program participation and completion of QI projects by participants, and improvement in clinical outcomes at the end of the intervention period. Sustainability on the other hand, is defined not only as long-term outcomes beyond the intervention period, but also as a continuous process. Spread definitions focused on the diffusion of QI methods, processes, and skills from the intervention setting to nonintervention settings. We synthesized the following definitions of effectiveness, sustainability, and spread for measurement for improvement programs:

Effectiveness

Demonstrating improvement in key process, outcome, or quality measures being tracked, accompanied with an improvement in measurement knowledge, skills, and behaviors of learners during the intervention period.

Sustainability

Ongoing measurement, and development of processes and policies to maintain and improve the achieved gains in outcomes and participant skills and integration of measurement practices into routine after the intervention period, without further support from the trainers.

Spread

Active and passive diffusion of measurement skills and practices to areas and staff within and outside the organization that were not exposed to the training intervention.

Barriers and Enablers

A six-phased thematic analysis methodology (familiarization with data, initial coding, identifying themes, reviewing themes, naming themes, and reporting) was used to identify the barriers and enablers of sustainability⁶⁶ (see Supplemental file 8, Supplemental Digital Content 8, <http://links.lww.com/JCEHP/A109>). The definitions of effectiveness and sustainability synthesized were used as reference. The coding process was done manually by one reviewer and final themes were discussed and agreed with two other reviewers.

Effectiveness

The four themes that emerged in enablers to effectiveness were intervention design, staff engagement, supportive leadership, and organizational support. Intervention design was the most

important factor in the effectiveness of the program. Customizing training allows teaching of skills relevant to participant's role.^{3,31} Considering the implementation context^{3,39,52,53} and the challenges and opportunities of the setting^{33,43,62} leads to targeted skill building.¹⁹ A good starting point is to assess the prior knowledge and experience of participants²¹ to determine training needs³¹ and design a suitable range of resources^{57,65} corresponding to diversity of experiences and knowledge levels.⁶⁴ Offering online modules⁴⁴ and online resources³³ also helps bridge this gap.

Intervention effectiveness can be enhanced using multiple learning strategies²¹ and evidence-based curricula.²⁸ An effective intervention is responsive to participant learning styles⁶⁵ and improves the training based on feedback.^{28,64} The best way to learn is by doing²¹ and incorporating experiential learning principles²³ through demonstration projects²⁹ and case studies⁶⁵ builds capability. Another aspect of customized content is developing an interdisciplinary and team-based course^{46,60,65} as working in teams prevents participants from becoming overburdened with measurement.⁶⁴ Having a participatory, data-driven approach contributes to effectiveness.^{19,53} Focusing on real-time data increases²⁰ the program's value as participants can identify gaps in current processes.^{23,55} Teaching practical data gathering,²¹ statistical control charts,⁴ data analysis, and comparison contribute to effectiveness. Feedback from fellow participants allows them to learn from each other and adds to effectiveness.^{36,64} Similarly, informing participants about other team's progress creates healthy competition and prevents redundancy of efforts.⁶⁴

Effective coaching also plays an important role. Customized coaching experience through just-in-time coaching²⁸ and direct onsite, in-person support³³ improves effectiveness. Coaching is more effective when trainers can respond directly to participant concerns.⁴⁰ The ability of coaches to provide measurement support²² in creating data collection processes²⁷ and data quality troubleshooting³³ adds to effectiveness. Practice facilitation³³ is also an enabler because providing private coaching between learning sessions,⁴⁴ ongoing mentorship²¹ and tools and resources³⁹ are valued by participants. Coaches can provide customized feedback and assistance.²⁹ When participants perceive the training organization to be credible and have a sense of affiliation with it, they consider the training to be more effective.²³

Guiding participants in indicator selection by focusing on establishing clear, realistic, mutually agreed,^{18,22} and clinically meaningful goals^{43,47,50} is a successful strategy. Encouraging participants to focus on simple solutions^{18,25} and making small changes^{26,62} leads to effectiveness. In-person workshops²¹ are an effective mode of training as face-to-face contact³³ is preferred by participants. Using technology for designing easy to access, self-paced and self-initiated interventions⁵⁷ improves effectiveness.

Successfully engaging health care staff is another important theme in effectiveness. Clinical staff feel empowered when they can identify and address gaps²⁵ and select relevant QI topics.^{41,52} Providing dedicated time to participants to attend training sessions^{34,41,42,45,53} also adds to effectiveness. Demonstrating the value of competency in QI skills⁶⁴ and offering maintenance of certification credit⁵⁹ also helps in creating enthusiasm among staff. Supportive policies of the organization such as assuring time release recognizes the training as a valued

activity.²¹ Leadership support is an important factor in the success of such programs.²¹

There are four themes in barriers to effectiveness: incompatible intervention design, lack of staff engagement, lack of organizational support, and lack of strategic approach. Fast pace of collaboratives¹⁸ and didactic instruction³⁰ which did not correspond to learning needs of all participants, especially those in support roles³ were perceived as barriers. The number of concepts covered in the training made it difficult for participants to keep up and the terminology used was sometimes difficult to understand.²⁹ A single day of classroom training was an insufficient dose⁵⁰ and scheduling a full day training workshop is tiring for participants.⁶³ When training programs that did not incorporate advice on implementation⁵³ and leading change,³⁶ it proved to be a barrier to effectiveness.

Lack of organizational support was visible in cases where participants were not provided protected time and struggled to attend the sessions.^{3,64} Poor data infrastructure impeded data collection³¹ and obtaining baseline measures.^{34,44} Lack of staff engagement and a negative perception about QI work and training because of previous negative experiences^{18,45} dampened effectiveness. Some programs failed to incorporate appropriate reward systems to motivate behavior³⁶ and the lack of interest among participants resulted in low attendance^{35,50} and in some cases, staff disliked new tools and processes that required learning new methods.³⁹ Staff struggled with learning measurement skills such as presenting data as run charts/control charts^{35,36} which decreased collaborative effectiveness. Some did not see any value in investing time in such collaboratives⁶³ and believed the burdens outweighed the benefits.^{29,36} Another barrier was the lack of a strategic approach and the participants selected projects that were incompatible with the goals of their institutions.^{36,51}

Sustainability

The themes observed in enablers to sustainability were taking a strategic approach, accountability, communication, learning networks, staff engagement, organizational support, intervention design, and supportive leadership. Taking a strategic approach requires connecting the program to organizational and national priorities,²¹ strategic goals,^{2,27} and teaming up with other departments⁶⁴ and organizations⁵³ with similar agendas.²⁹ As organizations prioritize and implement QI,⁵⁷ they move from sporadic efforts toward performance management systems,⁵ which sustains learning. Incorporating strategies to address psychology²⁰ of change improves sustainability. Using a standard approach to QI ensures a common and clear improvement language.⁴⁴

Another aspect of sustainability is to recruit the right people in the project team.^{4,22} A purposeful participant selection strategy⁴⁶ ensures inclusion of individuals who are interested in improvement work. Scale-up plans¹⁸ with a goal of institution-wide diffusion³¹ add to sustainability. It is important to integrate QI into programs and services^{42,53} through updated job descriptions,³³ building QI responsibility into operational responsibilities⁴⁷ and continually reinforcing skills.⁴⁹ Engaging all stakeholders from an early stage^{2,18,19,21,53} is also an enabler. In addition, while planning evaluations, it is important to assess learner involvement and QI project outcomes beyond completion of the programme.⁵² A strategic approach requires taking a system-level view^{20,21} of improvements with a blameless culture

focusing on systems rather than individuals,^{24,53} which considers challenges as system issues rather than staff issues.²⁸

Supportive organizational practices encourage QI by removing barriers,²⁶ investing in workforce capacity and culture change²⁸ and providing a conducive environment for teamwork.^{38,45} It also commits resources^{3,33,46,56} and provides opportunities to practice the skills learned.^{19,22,27} Accountability is an important enabler for sustainability. A clear definition of responsibilities,³⁴ tasks³⁹ and individual roles⁶² is key. Establishing time-bound targets²⁰ and regular meetings to follow through on action⁶² ensures accountability. It is also beneficial to establish measurement guidelines to follow the process through the project period into daily operations.⁴ This continuous sharing of numbers leads⁵³ to motivation and boosts sustainability.⁴ The training organization can also provide external accountability³³ and ensure participants see projects to completion.⁴¹

Focus on capacity building also improves sustainability. This includes training staff for specialized QI roles such as QI champion,²⁸ process coach,³¹ and QI advisor.³³ A mentorship framework to support those interested in developing QI skills and encouraging permanent staff to develop coaching skills improves sustainability.⁴⁷ Effective communication contributes to sustainability. Recognizing the efforts of QI teams^{26,34} by showcasing success stories²⁸ through ongoing promotional activities⁵⁶ is a rewarding strategy. Senior leader communication through board letters³¹ also supports sustainability. Formal and informal dissemination are vital to communication and sustainability. Formal dissemination can include internal dissemination,³¹ dissemination to local, national, and international audiences² and toolkits.⁵⁵ Informal dissemination can include enthusiastic employees⁵³ and other informal contacts.³¹ Similarly, visual display of data and progress helps in disseminating the message of improvement.⁵⁹

Learning networks are an important enabler.⁵³ Learning from peers by sharing ideas^{18,21} and building relationships creates a strong learning community for idea exchange.³³ These learning platforms serve as venues for knowledge transfer⁵⁷ and repositories for QI.²⁷ Development of collaborations between organizations leads to networking⁵⁶ and solution sharing.³³ Another area in staff engagement is generating awareness about QI¹⁸ beyond the project team^{2,26,42} and its impact on career.²² Extended support from coaches for implementation sequencing⁴⁸ improves sustainability.

Support from leaders is crucial to sustainability.⁵³ This involves improving leaders' QI skills so they can develop infrastructure for QI in their organizations²⁸ such as establishing QI teams.⁵³ Senior leadership support²² including board executives and chief of the medical staff provide legitimacy to QI.³¹ A strong leadership structure championing QI on a daily basis³⁴ sends a message for sustainability. Leadership support allows staff to try new ideas in a safe environment that does not punish risk-taking.⁵⁶ Organizational support plays a role through various strategies such as incentivizing diffusion⁴⁸ and providing resources and autonomy to innovate.³

Themes in barriers to sustainability include lack of accountability, poor communication, lack of leadership support, lack of staff engagement, lack of organizational support, absence of learning networks, and not having a strategic approach. When timelines, roles, and responsibilities are not

established, the plan of actions can evaporate leading to slip-page in agreed timeframes and a loss of momentum.⁵⁰ Because of poor institutional communication, staff lack a shared perception of problems⁵¹ and often lack institutional knowledge to approach the relevant individuals for QI work.⁶⁰ Lack of leadership support manifests in the form of a lack of interest from top management⁴ and variations in the readiness of senior leaders to engage in QI.⁴⁶

Learning networks play a vital role in sustainability; however, they are challenging to establish because few practices reach out to others to learn from them⁶² and may also face difficulty in learning from practices with dissimilar QI capacity and patients.²⁹ Lack of organizational support is a major barrier to sustainability⁵³ because it represents a culture that is not conducive to making or sustaining change.³³ Presence of administrative red tape^{3,64} can inhibit innovation and indicate that QI is not a priority for the organization.⁵⁵

Poor data infrastructure,^{4,33,53} data quality, and access to data⁴ decrease sustainability. Repeated data collection can be cumbersome and labor intensive in the long run.⁵² Lack of resource availability^{3,26,46} for QI projects is another barrier. Programs that lack ongoing organizational support are likely to be unsuccessful.⁶⁵ Health care staff have competing demands on their time,^{46,62,63,63} which interferes with team’s ability to meet and work.³ Because QI teams are a disparate group of staff,⁵⁰ a lack of dedicated time for QI work⁵⁷ can be a barrier. Failing to engage staff, and leadership effectively and not focusing on motivation and behavior change can be a barrier to

sustainability.⁵³ It is also important to account for the high levels of stress and emotional demands experienced by front-line staff.¹

DISCUSSION

The purpose of the systematic review is to define effectiveness and sustainability of QI programs with a significant data skills component and to identify the relevant barriers and enablers. Fifty-three studies were included in the review. There was heterogeneity in the content, teaching methods, and program design in the included studies and variability in the way effectiveness, sustainability, and spread were defined and measured in the context of QI programs. The review also highlighted variation in the ability of the programs to achieve desired outcomes. These inconsistencies in program success were attributed to various barriers and enablers to effectiveness and sustainability.

The lack of staff engagement, lack of a strategic approach, and lack of organizational support are barriers common between effectiveness and sustainability, which implies that these factors have implications for the short-term and long-term success of the programs. Poor intervention design affects the effectiveness of the program while poor communication, lack of accountability, and lack of leadership support can plague the ability to sustain the skills and results in the long-term. In enablers, intervention design, supportive leadership, engaged staff, and organizational support can affect positively on both effectiveness and sustainability of programs. Enablers that are

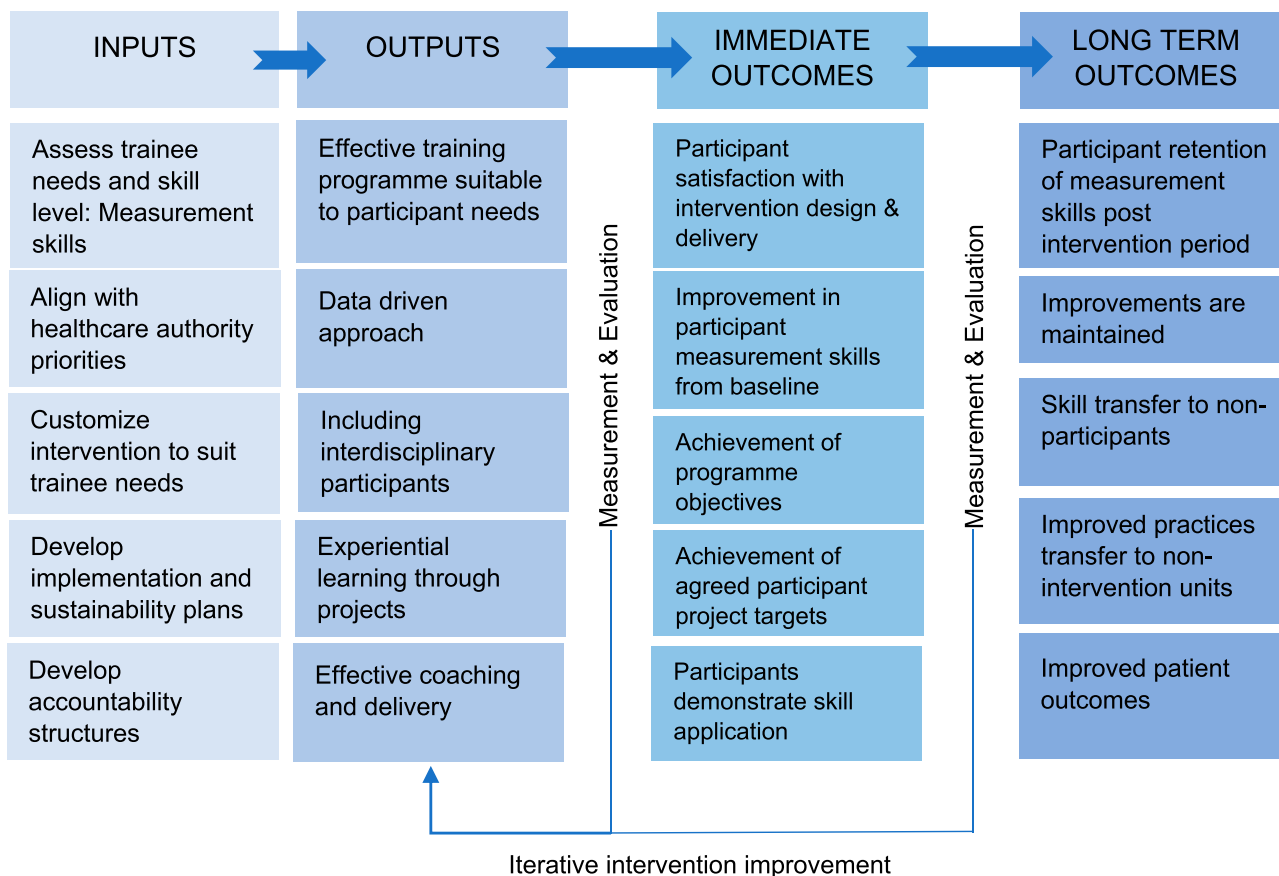


FIGURE 3. Intervention success factors. Summary of QI program inputs contributing to achievement of short-term and long-term outcomes.

relevant to sustainability are learning networks, communication, accountability, and a strategic approach to QI. The barriers and enablers highlight the importance of organizational,³⁹ learner, teacher, curricular,³⁵ and contextual factors³ in the success of QI programs.

The definitions derived for effectiveness and sustainability highlight the importance of measurement. Studies reported measurement as a key competency for clinical QI.²¹ Continuous measuring and remeasuring play an important role in maintaining⁶² and operationalizing improvements in the long run. Selecting appropriate measures,^{18,22} data collection³⁴ and using charts to display data³⁵ are essential to show effective change.⁶⁴ QI programs therefore need to focus on training staff in QI methods and how to measure care and use data to drive change.⁶² There is an increasing expectation from health care professionals to measure, report, and continually improve the quality of care.⁶² This indicates the need for a cultural shift from traditional academic-focused programs toward programs focusing on measurement and results to develop the capability of health professionals in leading improvement.⁴⁴

The findings of this systematic review also advocate for program evaluation to consider impact on participant behavior, patient outcomes, and supporting downstream learning beyond the direct participants of the programme.⁴³ Instead of solely relying on measuring quantitative outcomes, evaluators should also use qualitative data to assess whether program outcomes are achieved.²⁹

Measurement emerged as a critical element of QI training programs, which enables health care professionals and organizations to demonstrate effectiveness of improvement efforts and sustain improvements in the long run. Training health care professionals in data skills can have implications for improving health systems. However, health care systems are complex and various actors such as the health care authorities, training organizations, trainers, trainees, and trainee's organization have a collaborative role to play in ensuring effectiveness and sustainability of QI programs. Outputs of the thematic analysis in the form of effectiveness and sustainability barriers and enablers were broken down into inputs, outputs, and short- and long-term outcomes, which were then mapped onto a logic model. This was completed via consultation between three reviewers and presented in Figure 3.

Limitations

A limitation of this review is that there were no stand-alone measurement for improvement training studies. The reviewers overcame this by establishing the presence of measurement component in the QI programs as an inclusion criterion. Because no search strategy is perfect, there is a risk of missing relevant studies; however, we mitigated this risk using a search strategy focused on sensitivity and iteratively testing the search strategy in selected databases.

CONCLUSION

The review highlighted that measuring the improvement in outcomes and participant knowledge establishes effectiveness while remeasuring continuously helps in sustaining outcomes in the long-term for QI programs with a significant measurement skills component. The review identified staff engagement, strategic approach to QI, organizational support, intervention

design, communication, accountability, leadership support, and learning networks as factors that affect effectiveness and sustainability. The review expands current knowledge about the importance of measurement in QI training programs. Ensuring effectiveness and sustainability of measurement for improvement programs requires a collective effort from trainers, trainees, the organizations in which the interventions are implemented and policy makers.

Lessons for Practice

- Measurement has a central role in demonstrating improvements and maintaining desired improvement outcomes of QI programs in the short- and long-term.
- Staff engagement, strategic approach to QI, organizational support, intervention design, communication, accountability, leadership support, and learning networks influence effectiveness and sustainability of QI programs.
- Effectiveness, sustainability, and spread of QI programs with a measurement component requires a collective effort from trainers, trainees, the organizations in which the interventions are implemented, and policy makers.

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