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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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3 1 **TITLE**
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6 2 Case-study protocol for an integrated evaluation approach to study training,
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8 3 curricular and contextual factors impacting the success of a Measurement for
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10 4 Improvement training programme.
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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

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Measurement is an important element in quality improvement (QI) efforts and the ability to understand and interpret quantitative and qualitative data are valuable skills for healthcare staff and pivotal to the ability to implement and assess QI programmes. It is important to evaluate the factors that determine success or failure of teaching *measurement for improvement* to staff. The aim of this paper is to present a methodology for an integrated evaluation framework to understand the functioning and relative importance of characteristics of the training programme and contextual factors that inhibit or enable the success of a measurement for improvement training. This study will utilise the experiences of trainees, trainers, programme, and site coordinators to address this aim.

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The research will adopt a qualitative retrospective case-study design based on constructivist-pragmatic philosophy. 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.

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20 21 22 23 24

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 the research study. The coding process will be conducted using Nvivo12 software and Microsoft Excel. The comparison between the two cases will be performed using a meta-matrix.

1 **Ethics and dissemination**

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

5 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

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

19 **INTRODUCTION**

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

1
2
3 1 interest in the QI curricula content, the effectiveness of educational design and its
4
5 2 link with organisational performance (3). However, most QI programme evaluations
6
7 3 focus on the improvement of knowledge, skills and confidence of learners and do not
8
9 4 offer insights into clinical and long-term effects (4).

10
11
12
13 5 Existing models of training programme evaluation have a narrow focus; they are
14
15 6 effective in measuring the outputs but do not provide insights into the process that
16
17 7 leads to training effectiveness (5). The impact of contextual factors such as
18
19 8 environment, management support and leadership, organizational culture and data
20
21 9 infrastructure also remains largely unexplored (6). There is also ambiguity around
22
23 10 the quality and effectiveness of the programmes and how the concepts and methods
24
25 11 are taught (7).

26
27
28
29
30 12 One crucial aspect of improvement work is measurement. Measurement is an
31
32 13 important element in quality improvement efforts as change needs to be measured to
33
34 14 demonstrate improvement and to identify and respond to variation (8). Learning how
35
36 15 to measure quality is an important skill for healthcare staff in general and those
37
38 16 involved in quality improvement in particular.

39
40
41
42 17 A systematic literature review has revealed that there are no programme evaluation
43
44 18 studies focusing on measurement for improvement programmes (Khurshid, Z. A
45
46 19 systematic review and narrative synthesis: Determinants of the effectiveness and
47
48 20 sustainability of measurement focused Quality Improvement trainings). There is a
49
50 21 need to evaluate the effectiveness, sustainability and spread of measurement for
51
52 22 improvement programmes but there is uncertainty around evaluation outcomes and
53
54 23 methods. The overall purpose of this research is to explore training, curricular and
55
56 24 contextual factors that inhibit or enable the success of a measurement for
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3 1 improvement training by evaluating experiences of trainees, trainers, programme,
4
5 2 and site coordinators. This paper presents an integrated evaluation framework
6
7 3 developed to address this research aim. The research is expected to be completed
8
9 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

1
2
3 1 of methods which focus on inductive reasoning and interpretation rather than testing
4
5 2 hypotheses, aligns closely with the objectives of this research (12).
6
7

8 3 This research explores complex contextual and human factors in a real-world
9
10 4 healthcare setting making it suitable for a qualitative inquiry (13). It is a retrospective
11
12 5 longitudinal study and includes data from different points in time from the same
13
14 6 sample that was part of the training. This research question requires a research
15
16 7 design that can capture the complexity of the healthcare system, the factors that
17
18 8 impact programme development, implementation and evaluation and provide
19
20 9 evidence for policy action.
21
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23

24
25 10 A case study design can capture the complexity of individual behaviour in
26
27 11 institutional settings, factors that influence it, interrelationship of actions and
28
29 12 consequences, perceptions about programme goals from the perspective of those
30
31 13 who designed it and those who implemented it to provide an evidence base for
32
33 14 decision-making and explain success or failure (14). Thus, a case study design will
34
35 15 be adopted to capture the information required to adequately address this research
36
37 16 question.
38
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40

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42 17 Case-study methodology is a bridge between research paradigms and offers
43
44 18 flexibility in epistemology, ontology and methodology by providing a well-defined
45
46 19 boundary and structure within which appropriate methods can be applied to answer
47
48 20 this complex research question (15). The aim of the study is to gain an in-depth and
49
50 21 multifaceted understanding of the effectiveness, sustainability and spread of the
51
52 22 measurement for improvement programme in the real-world context (16) which
53
54 23 makes case study research a suitable choice. Figure 1 summarises the research
55
56 24 design choices through an adaptation of Saunders' research onion (11).
57
58
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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

1
2
3 1 variables (23). The popularity of this model is attributed to its simplicity in outlining a
4
5 2 system for training outcome assessment and simplifying the complex evaluation
6
7 3 process; however, it is also criticised for being incomplete (24). The understanding
8
9 4 about factors which impact training effectiveness has grown over the years revealing
10
11 5 that contextual factors, individual characteristics, and training design elements play a
12
13 6 critical role in training success. However, the Kirkpatrick model does not account for
14
15 7 these factors (24).

16
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20 8 The model's underlying assumptions are also a source of criticism as it assumes that
21
22 9 each succeeding level provides more information than the previous one, each level
23
24 10 is causally linked to the other and the correlation between the levels is positive (25).
25
26
27 11 It is independent of the learner's previous experience or learning, individual factors
28
29 12 and other environmental and contextual factors that can impact training success
30
31 13 (23).

32
33
34 14 The Kirkpatrick Model is outcome focused and a drawback of such models is that
35
36 15 although they provide a good understanding of what was achieved, they offer little
37
38 16 evidence about the process through which these outputs were achieved and the
39
40 17 related barriers and enablers. This emphasises the need to go beyond the
41
42 18 outcomes-focused Kirkpatrick model to understand how the programme works (26).

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46 19 Despite the criticism, the Kirkpatrick model has remained a popular choice for
47
48 20 evaluating learner outcomes in training programmes (20) and has been used to
49
50 21 evaluate higher education programmes, methodology workshops, professional
51
52 22 development programmes and short duration courses (27). This research will rely on
53
54 23 the four levels presented by the model but will adapt it to the research question and
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1 account for these criticisms through integrating the Model for Understanding
2 Success in Quality alongside the Kirkpatrick Model in a unified evaluation framework.

3 **Model for Understanding Success in Quality (MUSIQ Model)**

4 Context can be defined as the “why” and “when” of change and includes influential
5 factors from the outer setting and internal setting (28). Factors internal to the
6 organizational can include organizational size, teams, leadership, culture and
7 implementation environment while external factors can include regulatory
8 requirements, funding and professional organizations (29).

9 The systematic literature review conducted in the exploratory phase of the research
10 highlighted that success of developing data skills of healthcare professional for
11 quality improvement is not solely dependent on intervention design but also
12 influenced by context (Khurshid, Z. A systematic review and narrative synthesis:
13 Determinants of the effectiveness and sustainability of measurement focused Quality
14 Improvement trainings). Thus, success of a quality improvement intervention can
15 vary across implementation settings (30). Most studies evaluating quality
16 improvement programmes focus on the evaluation of the intervention and only few
17 incorporate methods to assess impact of contextual factors (31). The constructivist-
18 pragmatist research problem being investigated cannot be fully addressed without
19 incorporating context into the evaluation design.

20 There is an increased interest in understanding the role of context in quality
21 improvement initiatives and a number of frameworks and models have been
22 developed to address this (32). One such model is the Model for Understanding
23 Success in Quality (MUSIQ). The model acknowledges the system as a product of
24 individual parts and interrelationships. It identifies twenty-five contextual factors and

1
2
3 1 their relative influence at various levels of the healthcare system (22). The model
4
5 2 was later revised to expand the number of contextual factors to thirty-six (3). These
6
7 3 new factors include external knowledge (general and project specific), portfolio
8
9 4 management, specialist staff, microsystem capacity and patient engagement. The
10
11 5 factors presented in this model are relevant to the research question and will be
12
13 6 incorporated into the evaluation.
14
15

16
17 7 The MUSIQ model is relatively new as it was published in 2012 and has been only
18
19 8 used by a handful of studies to date. Therefore, there is insufficient evidence to draw
20
21 9 conclusions regarding model usefulness, though studies have confirmed the
22
23 10 observation of all original factors in the QI initiatives being studied (33). One reported
24
25 11 the framework and underlying assumptions useful for interrogating the research
26
27 12 question (34) and another reported that the model was useful in identifying
28
29 13 contextual constraints (35).
30
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34 14 The Kirkpatrick model focuses on different outcome levels while MUSIQ adds
35
36 15 another perspective of context at healthcare system level. The MUSIQ model offers
37
38 16 the missing link to context and relationships in the Kirkpatrick model. The evaluation
39
40 17 framework for this research focuses on integrating the two models to address the
41
42 18 research question.
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44

45 46 47 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
50
51 21 critical decisions in designing a comprehensive evaluation once the purpose of the
52
53 22 evaluation has been established (36). The proposed framework presented in Table 1
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55 23 combines evaluation perspectives from the two models and will be used to guide
56
57 24 data collection through semi-structured qualitative interviews and document analysis.
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- 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

	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 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

1

2 Case Design

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

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

1 research is to apply the integrated framework to evaluate the measurement for
2 improvement curriculum.

3 **Case selection**

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

17 **Researcher Reflexivity Statement**

18 The leader researcher immersed herself in the work of the National Quality
19 Improvement Team of the Health Service Executive (HSE) Ireland to develop a
20 deeper understanding of their work, understand the context for measurement for
21 improvement and the aims and objectives of the training programmes. This
22 immersion and observation provided invaluable opportunity to the researcher to
23 observe and work on various other projects of the Evidence for Improvement team.

24

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

1
2
3 1 research aims to recruit all trainers, both leads of the two collaboratives in the HSE,
4
5 2 and 10 participants from each collaborative.
6
7

8 3 **Data Processing**

10
11 4 The interviews will be audio recorded and transcribed verbatim. A field journal will be
12
13 5 maintained by the researcher while interviewing which will be used to make a note of
14
15 6 researcher's assumptions, feelings and biases and reflections on the interviews.
16
17 7 After each interview, the recording will be analysed to improve the researcher's
18
19 8 performance as an interviewer. A case database will be maintained to store all
20
21 9 collected data.
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25

26 10 **Data Analysis**

27
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29 11 The data analysis of case studies involves a detailed description of the setting or
30
31 12 individuals and analysis of the data for themes or issues (40). A detailed description
32
33 13 of the training programme, sites and participants will be followed by a thematic
34
35 14 analysis of the qualitative interview data and the documents collected. The coding
36
37 15 and analysis framework is presented in Figure 2 (41). Coding process will be
38
39 16 completed using Nvivo12 (42) software. Causation coding to capture the mental
40
41 17 models of participants will be conducted in Microsoft Excel.
42
43
44

45
46 18 This qualitative analysis will rely on the same theoretical and analytical strategy to
47
48 19 study both cases and then the patterns found in each case will be compared (16).

49
50 20 The comparison between the two cases will be performed using a meta-matrix. Meta
51
52 21 matrices will help assemble the descriptive data of both cases in a standard format.

53
54 22 The next step will be to partition the data in the matrix in new ways, explore
55
56 23 relationships and the cluster the data so contrasts, and similarities emerge (43).
57
58
59
60

1 **Ensuring Rigour**

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

17 **DISCUSSION**

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

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2
3 1 The purpose of research should be to expand the empirical and theoretical
4
5 2 understanding of the research area. Empirically, this research will deepen the
6
7 3 understanding of contextual factors that impact programme success at various levels
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9 4 of the healthcare system as referred to in the MUSIQ model as type 1, 2 and 3
10
11 5 contexts (33). The longitudinal study will also evaluate the programme impact in
12
13 6 terms of long-term factors, referred to in level 3 and 4 in the Kirkpatrick model (21).
14
15 7 The research also incorporates and compares perspectives from different
16
17 8 stakeholders which will expand the knowledge base by identifying characteristics of
18
19 9 individuals, teams and organizations which make them more receptive to
20
21 10 measurement and QI programmes. Another key output of the research will be policy
22
23 11 recommendations for programme development, implementation, and evaluation for
24
25 12 future efforts.

26
27 13 Theoretically, it will contribute towards the current understanding of the two models.
28
29 14 It will add to the evidence base of MUSIQ model and confirm the existence or non-
30
31 15 existence of the contextual factors and relationships presented in the model. The
32
33 16 study uses MUSIQ model in a qualitative design while majority of the previous
34
35 17 studies have relied on quantitative approaches. It will study all four levels proposed
36
37 18 in the Kirkpatrick model which is less common in previous studies. The integrated
38
39 19 framework is a theoretical contribution to the field and the analysis will also reflect on
40
41 20 the useful and effectiveness of the approach.

42
43 21 There is a need for further research in the evaluation of quality improvement
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45 22 programmes in terms of their immediate and long-term impacts. Measurement for
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47 23 improvement is an important but less explored topic in programme evaluations and
48
49 24 there is need to expand the understanding of what to teach, how to teach and how to
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51 25 evaluate programmes that aim to train healthcare staff in quantitative and qualitative

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3 1 data skills. Programme evaluation should be viewed as a driving force for future
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5 2 programme design and policy. Instead of focusing on using standardised models,
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7 3 this study takes a customised evaluation approach, appropriate to answer the
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9 4 research question which is a theoretical contribution to the field. The study will
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11 5 deepen the understanding of the training, curricular and contextual factors that
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13 6 impact effectiveness, spread and sustainability of measurement for improvement
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15 7 programmes.
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20 8 **ETHICS AND DISSEMINATION**

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24 9 The study has received exemption from full ethical review from the Human research
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26 10 ethics committee of our institution (LS-E-19-108). The results of the study will be
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28 11 disseminated in peer reviewed Journals.
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ZK developed the methodology and prepared the initial draft in consultation with ADB and EM. ADB and EM provided substantive feedback on the draft which was revised by ZK. All authors have read and approved the final manuscript.

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The authors have no competing interests to declare.

FIGURE TITLES AND LEGENDS

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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

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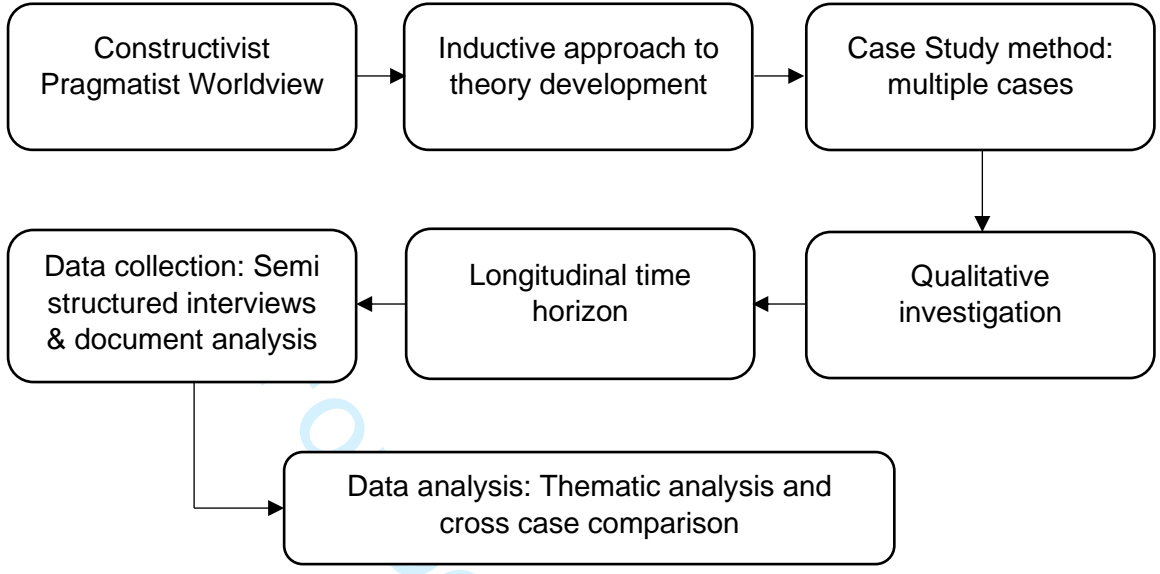
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FIGURE 2

7 **Title:** Coding and Analysis Framework

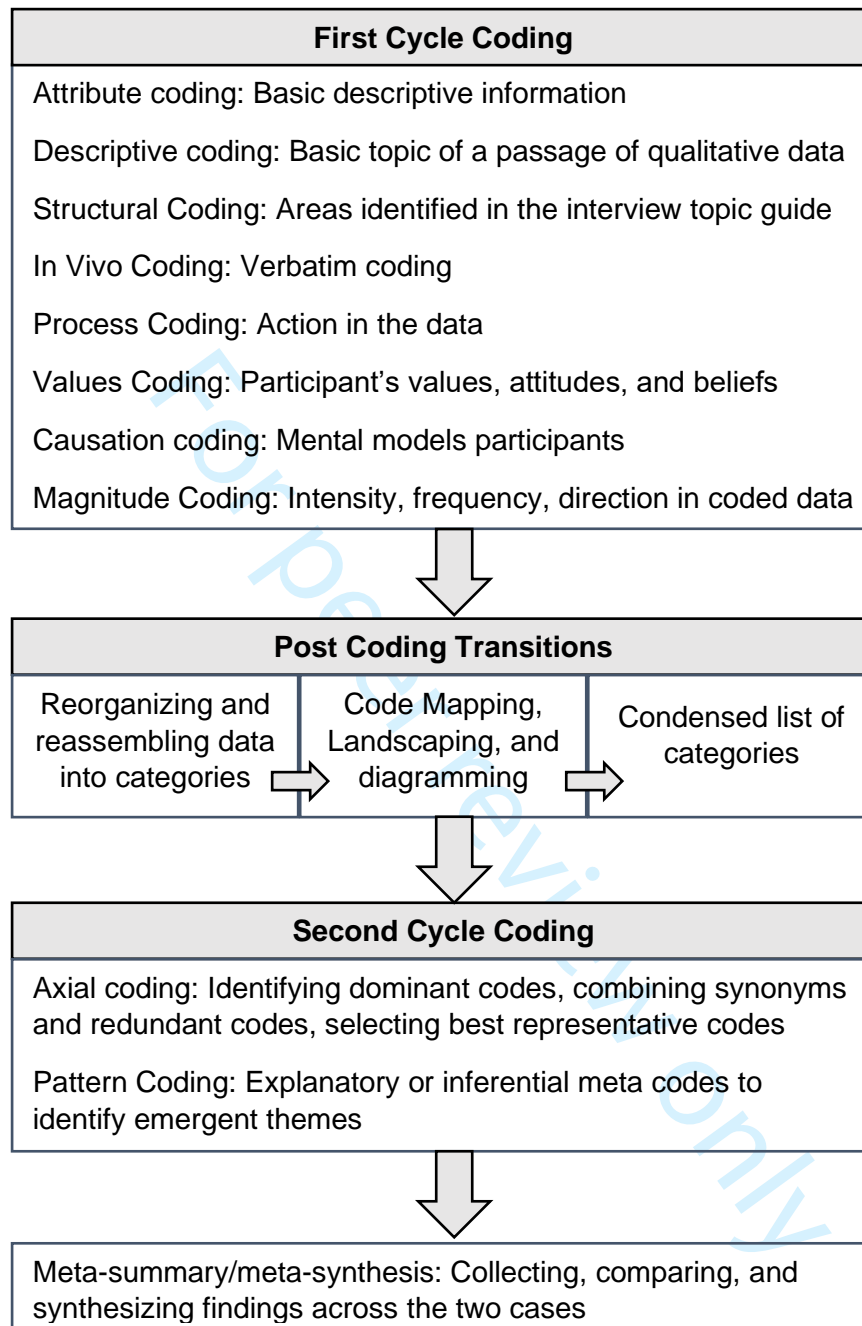
8 **Legend:** Description of coding and analysis steps adapted from Johnny Saldana's
9 coding methodology

Figure 1



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Figure 2



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?

- PROBES
- Support from senior and frontline managers
- Data Infrastructure within organization
- Resource availability
- External and Internal motivating factors
- 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?
 - PROBES
 - Role of leaders
 - Supportive culture of the organization
 - Availability of resources

COVID-19

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

<p>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</p>	<p>Page 1</p>
<p>Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions</p>	<p>Page 3</p>

Introduction

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

Methods

<p>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**</p>	<p>Page 6</p>
<p>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</p>	<p>Page 16</p>
<p>Context - Setting/site and salient contextual factors; rationale**</p>	<p>Page 15</p>
<p>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**</p>	<p>Page 17</p>
<p>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</p>	<p>Page 21</p>
<p>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**</p>	<p>Page 17</p>

1 2 3 4 5	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
6 7 8	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
9 10 11 12	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
13 14 15 16	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
17 18 19 20	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

23 24 25 26	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
27 28 29	Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	NA

Discussion

32 33 34 35 36 37	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
38 39	Limitations - Trustworthiness and limitations of findings	Page 4

Other

42 43 44	Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	Page 27
45 46	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
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For peer review only

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:	<i>BMJ Open</i>
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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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6 2 Protocol for an integrated evaluation framework to study training, curricular and contextual
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8 3 factors impacting the success of a Measurement for Improvement training programme for
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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.

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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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2
3 1 definitions of QI. One simple way to define QI is considering it an approach for improving
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5 2 health service systems and processes through the routine use of health and programme
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7 3 data to meet patient and programme needs (5). These definitions of quality and QI reveal the
8
9 4 central role of measurement for improvement in the improvement process. Measurement for
10
11 5 improvement refers to the process of collecting, analysing, and presenting quantitative and
12
13 6 qualitative data to demonstrate whether a change has resulted in an improvement (6).

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16 7 Despite its importance, measurement for improvement is a less explored topic in QI research
17
18 8 and there is a need for further research in the area. With the growing importance of QI
19
20 9 knowledge in healthcare, there is a developing research interest in the QI curricula content,
21
22 10 the effectiveness of educational design and its link with organisational performance (7).

23
24 11 However, most QI programme evaluations focus on the improvement of knowledge, skills
25
26 12 and confidence of learners and do not offer insights into clinical and long-term effects (8).

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28 13 Additionally, the measurement for improvement component is rarely evaluated.

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31 14 Existing models of training programme evaluation often have a narrow focus; they are
32
33 15 effective in measuring the outputs (what works) but do not provide insights into the process
34
35 16 that leads to training effectiveness (how it works) (9, 10). This highlights the need for
36
37 17 evaluation approaches that explore the processes that led to improvements. The impact of
38
39 18 contextual factors such as environment, management support and leadership, organisational
40
41 19 culture and data infrastructure also remains largely unexplored (11). There is also ambiguity
42
43 20 around the quality and effectiveness of the programmes and how the concepts and methods
44
45 21 are taught (12). One crucial aspect of improvement work is measurement. Measurement is
46
47 22 an important element in QI efforts as change needs to be measured to demonstrate
48
49 23 improvement and to identify and respond to variation (13). Learning how to measure quality
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51 24 is an important skill for healthcare staff in general and those involved in QI in particular.

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55 25 A systematic literature review revealed that there are no QI programme evaluation studies
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57 26 focusing on evaluating the factors that influence development and use of measurement for
58
59 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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3 1 in a certain situation and why and then use this knowledge to develop solutions, linking the
4
5 2 research outcomes to recommended actions which is a characteristic of the pragmatist
6
7 3 worldview. The pragmatist worldview believes in the presence of multiple forms of reality and
8
9 4 that theories are extracted from actions and then applied back in practice through an
10
11 5 iterative process (18). This research thus contains elements from pragmatist and
12
13 6 constructivist viewpoints.

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15
16 7 This is an exploratory study that uses an inductive approach to explore the research problem
17
18 8 to understanding of measurement for improvement programme effectiveness, sustainability
19
20 9 spread and evaluation methods (19). Out of the various approaches to do case study
21
22 10 research, a pragmatic constructivist approach which asserts that reality is constructed
23
24 11 socially and experientially and propagates the use of methods which focus on inductive
25
26 12 reasoning and interpretation rather than testing hypotheses, aligns closely with this research
27
28 13 (20). This research explores complex contextual and human factors in a real-world
29
30 14 healthcare setting making it suitable for a qualitative inquiry (21). This research aim requires
31
32 15 a research design that can capture the complexity of the healthcare system, the factors that
33
34 16 impact programme development, implementation and evaluation and provide evidence for
35
36 17 policy action. A case study design can capture the complexity of individual behaviour in
37
38 18 institutional settings, factors that influence these, interrelationship of actions and
39
40 19 consequences, perceptions about programme goals from the perspective of those who
41
42 20 designed it and those who implemented it to provide an evidence base for decision-making
43
44 21 and explain success or failure (22). Thus, a case study design will be adopted to capture the
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46 22 information required to adequately address this research question.

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51 23 Case-study methodology is a bridge between research paradigms and offers flexibility in
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53 24 epistemology, ontology, and methodology by providing a well-defined boundary and
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55 25 structure within which appropriate methods can be applied (23). The aim of this study is to
56
57 26 gain an in-depth understanding of the factors that influence measurement for improvement
58
59 27 skill development and use in the real-world context which makes case study research a
60

1 suitable choice (24). Figure 1 summarises the research design choices in this research
2 through an adaptation of Saunders' research onion (19).

3 **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.

21 **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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2
3 1 however, it is also criticised for being incomplete (32). The understanding about factors
4
5 2 which impact training effectiveness has grown over the years revealing that contextual
6
7 3 factors, individual characteristics, and training design elements play a critical role in training
8
9 4 success. However, the Kirkpatrick model does not account for these factors (32).

11
12 5 The model's underlying assumptions are also a source of criticism as it assumes that each
13
14 6 succeeding level provides more information than the previous one, each level is causally
15
16 7 linked to the other and the correlation between the levels is positive (33). It is independent of
17
18 8 the learner's previous experience or learning, individual factors and other environmental and
19
20 9 contextual factors that can impact training success (31). The Kirkpatrick Model is outcome
21
22 10 focused and a drawback of such models is that although they provide a good understanding
23
24 11 of what was achieved, they offer little evidence about the process through which these
25
26 12 outputs were achieved and the related barriers and enablers. This emphasises the need to
27
28 13 go beyond the outcomes-focused Kirkpatrick model to understand how the programme
29
30 14 works (34). Some areas of improvement identified by previous studies in the Kirkpatrick
31
32 15 Model include paying more attention to the teaching and learning methods (31) and utilising
33
34 16 all four levels of the model over a longer period, and mechanisms for exploring possible
35
36 17 causal links among the four levels (35).

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40 18 Despite the criticism, the Kirkpatrick model has remained a popular choice for evaluating
41
42 19 learner outcomes in training programmes (28) and has been used to evaluate higher
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44 20 education programmes, methodology workshops, professional development programmes
45
46 21 and short duration courses (36). This research will rely on the four levels presented by the
47
48 22 model but will adapt it to purpose of this research and account for these criticisms through
49
50 23 integrating the MUSIQ alongside the Kirkpatrick Model in a unified evaluation framework.

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

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56 25 Context can be defined as the "why" and "when" of change and includes influential factors
57
58 26 from the outer setting and internal setting (37). Factors internal to the organisation can
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2
3 1 include organisational size, teams, leadership, culture, and implementation environment
4
5 2 while external factors can include regulatory requirements, funding, and professional
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7 3 organisations (38).
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10 4 The systematic literature review conducted in the exploratory phase of this research
11
12 5 highlighted that success of developing data skills of healthcare professional for QI is not
13
14 6 solely dependent on intervention design but also influenced by context (14). Thus, success
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16 7 of a QI intervention can vary across implementation settings (39). Most studies evaluating QI
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18 8 programmes focus on the evaluation of the intervention and only few incorporate methods to
19
20 9 assess impact of contextual factors (40). The constructivist-pragmatist research problem
21
22 10 being investigated cannot be fully addressed without incorporating context into the
23
24 11 evaluation design.
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27 12 There is an increased interest in understanding the role of context in QI initiatives and
28
29 13 several frameworks and models have been developed to address this (41). One such model
30
31 14 is the MUSIQ model. The model acknowledges the system as a product of individual parts
32
33 15 and interrelationships. It identifies twenty-five contextual factors and their relative influence
34
35 16 at various levels of the healthcare system (30). The model was later revised to expand the
36
37 17 number of contextual factors to thirty-six. These new factors include external knowledge
38
39 18 (general and project specific), portfolio management, specialist staff, microsystem capacity
40
41 19 and patient engagement (30). The factors presented in this model are relevant to this
42
43 20 research question and will be incorporated into this evaluation.
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47 21 The MUSIQ model is relatively new as it was published in 2012 and has been only used by a
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49 22 handful of studies to date. Therefore, there is insufficient evidence to draw conclusions
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51 23 regarding model usefulness, though studies have confirmed the observation of all original
52
53 24 factors in the QI initiatives being studied (42). One reported the framework and underlying
54
55 25 assumptions useful for interrogating the research question (43) and another reported that the
56
57 26 model was useful in identifying contextual constraints (44). The Kirkpatrick model focuses on
58
59 27 different outcome levels while MUSIQ adds another perspective of context at healthcare
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3 1 system level. The MUSIQ model offers the missing link to context and relationships in the
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5 2 Kirkpatrick model. The evaluation framework for this research focuses on integrating the two
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7 3 models to address the aim of this research.
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10 4 **Integrated evaluation framework**

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13 5 Knowing what information to collect, whom to collect it from and when to collect are critical
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15 6 decisions in designing a comprehensive evaluation once the purpose of the evaluation has
16
17 7 been established (45). The proposed framework presented in Table 1 combines evaluation
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19 8 perspectives from the two models and will be used to guide data collection through semi-
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21 9 structured qualitative interviews and document analysis. A draft interview guide for
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23 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

1 **Case design**

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

13 **Case selection**

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

26

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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3 1 purposive sampling strategy by including participants who shared the common experience of
4
5 2 the training and had participated in the two collaboratives (48). This is purposely kept broad
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7 3 as both collaboratives were completed more than two years ago as the researchers
8
9 4 anticipate challenges in recruiting participants. Participation in the study will be on a
10
11 5 voluntary basis and the researcher will describe the nature of the study in detail to the
12
13 6 participants and answer all questions prior to any data collection. The National QI Team will
14
15 7 serve as a gatekeeper for participant recruitment for trainees and send a letter to introduce
16
17 8 the researcher to participants The recruitment letter is available in Supplemental File 2.
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19 9 Those willing to participate would then contact the researcher and written informed consent
20
21 10 will be obtained. The study consent form is available in Supplemental File 3.
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25 11 The data collection will be conducted via semi-structured interviews and document analysis.
26
27 12 The semi-structured interviews will be conducted by the lead author. The interview method
28
29 13 will allow the researcher to capture the words, thoughts, feelings, perceptions, and
30
31 14 experiences of the participants to answer the research question (49). The first two interviews
32
33 15 will be used as a pilot to review the interview guide and make changes if required. The
34
35 16 collected documents will be used to inform participant reaction and learning (Kirkpatrick
36
37 17 levels 1 and 2). These documents will include (depending on the availability) the end of
38
39 18 collaborative reports and any feedback forms used during the collaboratives. Level 3 and 4
40
41 19 data along with contextual factors (from MUSIQ framework) will be collected through
42
43 20 interviews. This research aims to recruit all trainers, both leads of the two collaboratives in
44
45 21 the HSE, and 10 participants from each collaborative.
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49 **Data processing**

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51 23 The interviews will be audio recorded and transcribed and anonymised. Site pseudonyms
52
53 24 will be used. A field journal will be maintained by the researcher while interviewing which will
54
55 25 be used to make a note of researcher's assumptions, feelings and biases and reflections on
56
57 26 the interviews. After each interview, the recording will be analysed to improve the
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3 1 researcher's performance as an interviewer. A case database will be maintained to store all
4
5 2 collected data.
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8 3 **Data analysis**

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10 4 The data analysis of case studies involves a detailed description of the setting or individuals
11
12 5 and analysis of the data for themes or issues (50). A detailed description of the training
13
14 6 programme, sites and participants will be followed by a thematic analysis of the qualitative
15
16 7 interview data and the documents collected. The coding and analysis framework is
17
18 8 presented in Figure 2 (51). Coding process will be aided by the NVivo12 software which
19
20 9 provides a platform for data management, querying and visualisation (52).
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23

24 10 This qualitative analysis will rely on the same theoretical and analytical strategy to study both
25
26 11 cases and then the patterns found in each case will be compared (24). The comparison
27
28 12 between the two cases will be performed. The involves analysing the data in new ways,
29
30 13 explore relationships and the cluster the data so contrasts, and similarities emerge (53).
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33 14 **Ensuring rigour**

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36 15 Rigour will be ensured by triangulating through multiple sources of data by including
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38 16 perspectives of multiple stakeholders and multiple data collection methods. Data collection
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40 17 and analysis methods and researcher reflexivity will be clearly documented to ensure
41
42 18 transparency. At the analysis stage, two other researchers will review codes collectively in
43
44 19 regular meetings (54). The researchers aim to perform member checking by contacting 10%
45
46 20 of the participants and sharing a summary of results. The researchers also aim to perform
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48 21 member checking with a broader audience through an interactive webinar. The HSE
49
50 22 regularly conducts QI webinars, and this platform would be useful for reaching healthcare
51
52 23 professionals interested in QI and enable the researchers to obtain and incorporate
53
54 24 feedback from a wider audience into the results. The other method of dissemination would
55
56 25 be through peer-reviewed journal articles which would also strengthen the study. To
57
58 26 incorporate the impact of the COVID-19 pandemic on this research process and the work
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3 1 practices of healthcare staff, questions to explore the role of QI education and measurement
4
5 2 for improvement in adapting to new ways of working are included in the interview topic
6
7 3 guide.
8
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10 4 **DISCUSSION**

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12
13 5 Data and measurement can be used to monitor and support improvement and to enhance
14
15 6 the quality of care, making measurement for improvement an essential skill for the
16
17 7 healthcare staff (55). This research aims to explore training, curricular and contextual factors
18
19 8 that can help in the development and use of measurement for improvement skills in
20
21 9 healthcare staff. To our knowledge, no previous studies have evaluated measurement for
22
23 10 improvement programmes. Additionally, many QI programmes are not appropriately
24
25 11 evaluated, peer-reviewed or published (56) therefore it is difficult to access any work on
26
27 12 measurement for improvement skills that may have been conducted before.
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30
31 13 Theoretically, this research will contribute towards the current understanding of the two
32
33 14 models. It will add to the evidence base of MUSIQ model and confirm the existence or non-
34
35 15 existence of the contextual factors and relationships presented in the model. The study uses
36
37 16 MUSIQ model in a qualitative design while majority of the previous studies have relied on
38
39 17 quantitative approaches. It will study all four levels proposed in the Kirkpatrick model which
40
41 18 is less common in previous studies. The integrated framework is a theoretical contribution to
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43 19 the field and the analysis will also reflect on the useful and effectiveness of the approach.
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46 20 Although qualitative research may not be generalisable, this research will be one of the few
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48 21 studies focusing on measurement for improvement and will reveal a multitude of avenues for
49
50 22 future research. The results will not only be of importance for QI/measurement training
51
52 23 design, but also for evaluation purposes and for healthcare organisations and systems.
53

54 24 There is a need for further research in the evaluation of QI programmes in terms of their
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56 25 immediate and long-term impacts. Measurement for improvement is an important but less
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58 26 explored topic in programme evaluations and there is need to expand the understanding of
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2
3 1 what to teach, how to teach and how to evaluate programmes that aim to train healthcare
4
5 2 staff in quantitative and qualitative data skills. Programme evaluation should be viewed as a
6
7 3 driving force for future programme design and policy. Instead of focusing on using
8
9 4 standardised models, this study takes a customised evaluation approach, appropriate to
10
11 5 answer this research question which is a theoretical contribution to the field. This approach
12
13 6 is expected to expand the empirical and theoretical understanding of factors that influence
14
15 7 the development and use of measurement for improvement skills in healthcare staff. Another
16
17 8 expected impact of this research will be to deepen the understanding of contextual factors
18
19 9 that impacted programme success at various levels of the healthcare system.
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23 10 **ETHICS AND DISSEMINATION**

24
25 11 The study has received exemption from full ethical review from the Human research ethics
26
27 12 committee of our institution (LS-E-19-108). The results of the study will be disseminated in
28
29 13 peer reviewed Journals.
30
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32 14 **AUTHORS' CONTRIBUTIONS**

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35 15 ZK developed the methodology and prepared the initial draft in consultation with ADB and
36
37 16 EM. ADB and EM provided substantive feedback on the draft which was revised by ZK. All
38
39 17 authors have read and approved the final manuscript.
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42 18 **COMPETING INTERESTS**

43
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45 19 The authors have no competing interests to declare.
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47

48 20 **FUNDING STATEMENT**

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56
57 24 analyses, interpretation of the data, or decision to publish results.
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3 **FIGURE TITLES AND LEGENDS**
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6 **FIGURE 1**
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8 **Title:** Research design choices through an adaptation of Saunders' research onion
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11 **Legend:** Flow chart of Research design choices for the study through an adaptation of
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14 Saunders' research onion
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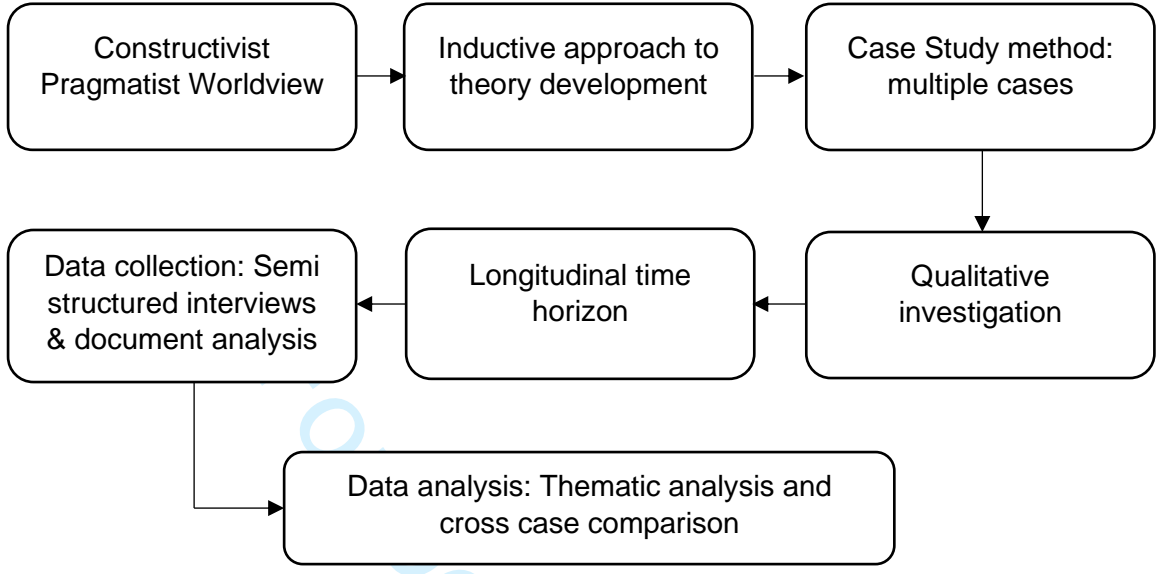
16 **FIGURE 2**
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19 **Title:** Coding and Analysis Framework
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22 **Legend:** Description of coding and analysis steps adapted from Johnny Saldana's coding
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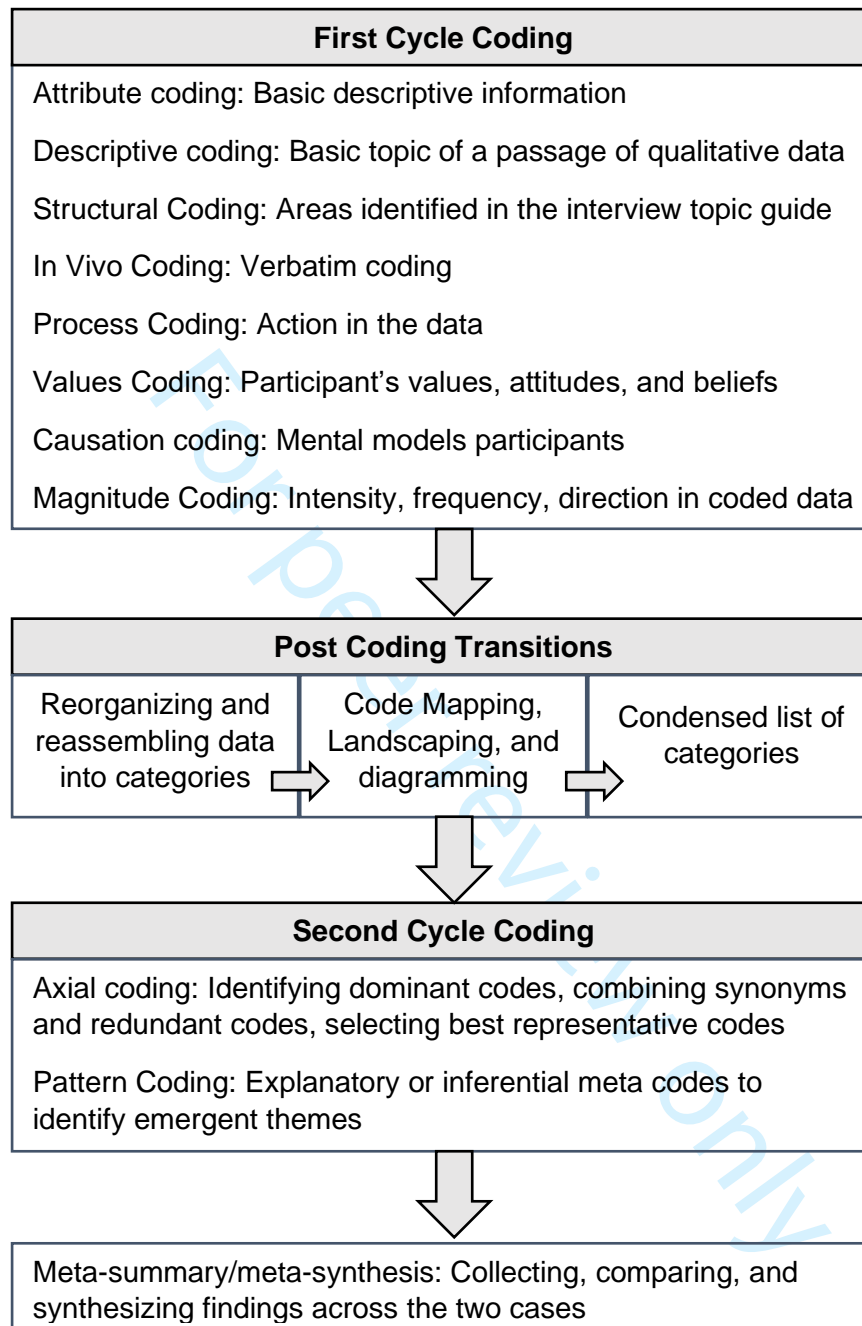
For peer review only

Figure 1



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Figure 2



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?

- PROBES
- Support from senior and frontline managers
- Data Infrastructure within organization
- Resource availability
- External and Internal motivating factors
- 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?
 - PROBES
 - Role of leaders
 - Supportive culture of the organization
 - Availability of resources

COVID-19

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

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3 **Supplemental File 3: Consent forms**
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UCD School of Nursing, Midwifery and Health Systems
UCD College of Health and Agricultural Sciences

10 **PARTICIPANT CONSENT FORM**

11 **Project:** Evaluating the impact of Measurement for
12 Improvement training

13 **Participant Number:**

14 **Principal Investigator:** Prof Eilish McAuliffe¹

15
16
17 **Researchers:** Ms. Zuneera Khurshid¹, Dr Aoife De Brun¹, Dr. Jennifer Martin, Dr. Philip
18 Crowley²

19
20 **Please tick each**

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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.	<input type="checkbox"/>
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.	<input type="checkbox"/>
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.	<input type="checkbox"/>
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	<input type="checkbox"/>
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.	<input type="checkbox"/>
My queries have been addressed to my satisfaction by the research team and I consent to take part in this study.	<input type="checkbox"/>

41
42
43 _____
44 **Name of participant**

Signature

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48 **Name of person taking consent**

Signature

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|---|
| 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.

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-047639.R2
Article Type:	Protocol
Date Submitted by the Author:	19-Jan-2022
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

SCHOLARONE™
Manuscripts

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3 1 **TITLE**
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6 2 Protocol for an integrated evaluation framework to study training, curricular and contextual
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8 3 factors impacting the success of a Measurement for Improvement training programme for
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10 4 healthcare staff in Ireland.
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12
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31 35 **KEYWORDS**
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34 36 Quality improvement, QI, programme evaluation, measurement for improvement, qualitative
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36 37 research
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39 38 **WORD COUNT**
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46 **ABSTRACT**

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

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

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

71 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

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3 72 • The proposed evaluation framework focuses on the long-term sustainability of
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5 73 measurement for improvement skills in healthcare staff.
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7 74 • The proposed framework is based on the current evidence and models used by
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9 75 various QI studies and accounts for the contextual realities of the healthcare system.
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11 76 • The study addresses current gaps in the methods and application of evaluation
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13 77 frameworks and models in QI evaluation.
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15 78 • The study design is responsive to the current situation and explores the role of
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17 79 Quality Improvement (QI) education and measurement for improvement in adapting
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19 80 to new ways of working during COVID-19.
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23 81 The major limitation of this study is recall bias as the training programmes being evaluated
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25 82 were completed more than 2 years ago.
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28 83 **INTRODUCTION**

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30 84 Quality in healthcare is a subjective, complex, and multi-dimensional concept which makes it
31
32 85 difficult to define and measure (1). The common defining attributes of healthcare quality in
33
34 86 research include the delivery of effective and safe care to attain desired outcomes and a
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36 87 culture of excellence (2). In his pioneering work on healthcare quality, Donabedian described
37
38 88 high quality healthcare as the type of care which maximises patient welfare while accounting
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40 89 for the expected gains and losses using legitimate means (3). Since then, the understanding
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42 90 of quality has greatly evolved. The Health Foundation defines healthcare quality as the
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44 91 ability of healthcare services to deliver the desired health outcomes consistent with recent
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46 92 professional knowledge, to individuals and populations (4). Similarly, there are various
47
48 93 definitions of QI. One simple way to define QI is considering it an approach for improving
49
50 94 health service systems and processes through the routine use of health and programme
51
52 95 data to meet patient and programme needs (5). These definitions of quality and QI reveal the
53
54 96 central role of measurement for improvement in the improvement process. Measurement for
55
56 97 improvement refers to the process of collecting, analysing, and presenting quantitative and
57
58 98 qualitative data to demonstrate whether a change has resulted in an improvement (6).
59
60

1
2
3 99 Despite its importance, measurement for improvement is a less explored topic in QI research
4
5 100 and there is a need for further research in the area. With the growing importance of QI
6
7 101 knowledge in healthcare, there is a developing research interest in the QI curricula content,
8
9 102 the effectiveness of educational design and its link with organisational performance (7).
10
11 103 However, most QI programme evaluations focus on the improvement of knowledge, skills
12
13 104 and confidence of learners and do not offer insights into clinical and long-term effects (8).
14
15 105 Additionally, the measurement for improvement component is rarely evaluated.
16
17
18 106 Existing models of training programme evaluation often have a narrow focus; they are
19
20 107 effective in measuring the outputs (what works) but do not provide insights into the process
21
22 108 that leads to training effectiveness (how it works) (9, 10). This highlights the need for
23
24 109 evaluation approaches that explore the processes that led to improvements. The impact of
25
26 110 contextual factors such as environment, management support and leadership, organisational
27
28 111 culture and data infrastructure also remains largely unexplored (11). There is also ambiguity
29
30 112 around the quality and effectiveness of the programmes and how the concepts and methods
31
32 113 are taught (12). One crucial aspect of improvement work is measurement. Measurement is
33
34 114 an important element in QI efforts as change needs to be measured to demonstrate
35
36 115 improvement and to identify and respond to variation (13). Learning how to measure quality
37
38 116 is an important skill for healthcare staff in general and those involved in QI in particular.
39
40
41
42 117 A systematic literature review revealed that there are no QI programme evaluation studies
43
44 118 focusing on evaluating the factors that influence development and use of measurement for
45
46 119 improvement skills of healthcare staff (14). There is a need to evaluate the effectiveness,
47
48 120 sustainability and spread of measurement for improvement programmes but there is
49
50 121 uncertainty around evaluation outcomes and methods. Measurement often gets
51
52 122 overshadowed by the overall focus on understanding QI and on outcomes, resulting in a
53
54 123 dearth of measurement for improvement research. Quality measurement is frequently
55
56 124 treated as an ancillary matter in healthcare systems' approach to QI (15). Research to
57
58 125 explore factors that will enable healthcare staff to embrace measurement for improvement
59
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1
2
3 126 and appreciate its value in demonstrating outcomes is needed. In addition to this, many QI
4
5 127 teams are failing to fully implement measurement tools and techniques (16). Despite this
6
7 128 identified gap in measurement skills, there is little to no research exploring ways to develop
8
9 129 measurement for improvement skills in staff or to better understand the factors that influence
10
11 130 the development of these skills.

12
13
14 131 The overall aim of this research is to understand the training, curricular and contextual
15
16 132 factors that inhibit or enable the success of measurement for improvement training by
17
18 133 utilising the experiences of trainees, trainers, programme, and site coordinators. The
19
20 134 research will be conducted in the Irish health system using two QI collaboratives (Pressure
21
22 135 Ulcers to Zero and Clinical Microsystems) which included dedicated training on
23
24 136 measurement for improvement. This paper presents an integrated evaluation framework
25
26 137 developed to address this research aim. This research started in August 2020 and is
27
28 138 expected to be completed by December 2021.

31 32 139 **METHODS**

33 34 35 140 **Theoretical underpinning**

36
37 141 The underlying assumption of this research is that the views of stakeholders about the
38
39 142 training programme and the context are required to make sense of this problem. This aligns
40
41 143 with the constructivist worldview. The constructivist worldview asserts that humans construct
42
43 144 meaning when they interact with the world and are influenced by historical and social
44
45 145 perspectives and context (17). Another objective of this research is to investigate what works
46
47 146 in a certain situation and why and then use this knowledge to develop solutions, linking the
48
49 147 research outcomes to recommended actions which is a characteristic of the pragmatist
50
51 148 worldview. The pragmatist worldview believes in the presence of multiple forms of reality and
52
53 149 that theories are extracted from actions and then applied back in practice through an
54
55 150 iterative process (18). This research thus contains elements from pragmatist and
56
57 151 constructivist viewpoints.
58
59
60

1
2
3 152 This exploratory study uses an inductive approach to understand the research problem of
4
5 153 measurement for improvement programme effectiveness, sustainability, spread and
6
7 154 evaluation methods (19). The pragmatic constructivist approach asserts that reality is
8
9 155 constructed socially and experientially and propagates the use of inductive reasoning which
10
11 156 aligns most closely with this research (20). This research explores complex contextual and
12
13 157 human factors in a real-world healthcare setting making it suitable for a qualitative inquiry
14
15 158 (21). This research aim requires a design that can capture the complexity of the healthcare
16
17 159 system, the factors that impact programme development, implementation and evaluation and
18
19 160 provide evidence for policy action. A case study design can capture the complexity of
20
21 161 individual behaviour in institutional settings, factors that influence these, interrelationship of
22
23 162 actions and consequences, perceptions about programme goals from the perspective of
24
25 163 those who designed it and those who implemented it to provide an evidence base for
26
27 164 decision-making and explain success or failure (22). Thus, a case study design will be
28
29 165 adopted to capture the information required to adequately address this research question.
30
31

32
33 166 Case-study methodology is a bridge between research paradigms and offers flexibility in
34
35 167 epistemology, ontology, and methodology by providing a well-defined boundary and
36
37 168 structure within which appropriate methods can be applied (23). The aim of this study is to
38
39 169 gain an in-depth understanding of the factors that influence measurement for improvement
40
41 170 skill development and use in the real-world context which makes case study research a
42
43 171 suitable choice (24). Figure 1 summarises the research design choices in this research
44
45 172 through an adaptation of Saunders' research onion (19).
46
47

48 173 **Framework development process**

49
50
51 174 Programme evaluation should not be considered just a set of techniques but utilised as an
52
53 175 integrated approach which is intricately linked with needs assessment, course design,
54
55 176 course presentation, and transfer of training (25). It may be argued that considering these
56
57 177 programme evaluation elements may add to strength of a study. Additionally, programme
58
59 178 evaluation often gets neglected, with attention being narrowly focused on programme
60

1
2
3 179 development and implementation (26). This protocol aims to avoid these common pitfalls
4
5 180 and limitations and presents an evaluation framework which integrates these elements.
6
7
8 181 Research suggests that instead of focusing on the development of a standardised appraisal
9
10 182 tool for quality measurement, evaluation should be guided by the purpose (27). This
11
12 183 research aims to retrospectively understand which curricular, training, and contextual factors
13
14 184 inhibit or enable the effectiveness, sustainability and spread of the measurement for
15
16 185 improvement training using a customised framework. Medical educators can select from
17
18 186 various individual programme evaluation models or use a combination to develop a
19
20 187 framework appropriate to answer their evaluation questions (28). This research draws on
21
22 188 two evaluation models to develop a tool suitable for this case study: The Kirkpatrick
23
24 189 Evaluation Model (29) and MUSIQ (30). The following sections describe the selected
25
26 190 evaluation models and provide justification for their use.
27
28
29
30 191

192 **Kirkpatrick evaluation model**

31
32
33
34
35 193 Kirkpatrick's model measures the impact of training at four levels; reaction of participants,
36
37 194 participant learning, change in behaviour and impact on the organisational results (29). The
38
39 195 model employs straightforward evaluation criteria and requires measurement of a limited
40
41 196 number of variables (31). The popularity of this model is attributed to its simplicity in outlining
42
43 197 a system for training outcome assessment and simplifying the complex evaluation process;
44
45 198 however, it is also criticised for being incomplete (32). The understanding about factors
46
47 199 which impact training effectiveness has grown over the years revealing that contextual
48
49 200 factors, individual characteristics, and training design elements play a critical role in training
50
51 201 success. However, the Kirkpatrick model does not account for these factors (32).
52
53
54
55 202 The model's underlying assumptions are also a source of criticism as it assumes that each
56
57 203 succeeding level provides more information than the previous one, each level is causally
58
59 204 linked to the other and the correlation between the levels is positive (33). It is independent of
60

1
2
3 205 the learner's previous experience or learning, individual factors and other environmental and
4
5 206 contextual factors that can impact training success (31). The Kirkpatrick Model is outcome
6
7 207 focused and a drawback of such models is that although they provide a good understanding
8
9 208 of what was achieved, they offer little evidence about the process through which these
10
11 209 outputs were achieved and the related barriers and enablers. This emphasises the need to
12
13 210 go beyond the outcomes-focused Kirkpatrick model to understand how the programme
14
15 211 works (34). Some areas of improvement identified by previous studies in the Kirkpatrick
16
17 212 Model include paying more attention to the teaching and learning methods (31) and utilising
18
19 213 all four levels of the model over a longer period, and mechanisms for exploring possible
20
21 214 causal links among the four levels (35).

22
23
24
25 215 Despite the criticism, the Kirkpatrick model has remained a popular choice for evaluating
26
27 216 learner outcomes in training programmes (28) and has been used to evaluate higher
28
29 217 education programmes, methodology workshops, professional development programmes
30
31 218 and short duration courses (36). This research will rely on the four levels presented by the
32
33 219 model but will adapt it to purpose of this research and account for these criticisms through
34
35 220 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

1
2
3 231 programmes focus on the evaluation of the intervention and only few incorporate methods to
4
5 232 assess impact of contextual factors (40). The constructivist-pragmatist research problem
6
7 233 being investigated cannot be fully addressed without incorporating context into the
8
9 234 evaluation design.

11
12 235 There is an increased interest in understanding the role of context in QI initiatives and
13
14 236 several frameworks and models have been developed to address this (41). One such model
15
16 237 is the MUSIQ model. The model acknowledges the system as a product of individual parts
17
18 238 and interrelationships. It identifies twenty-five contextual factors and their relative influence
19
20 239 at various levels of the healthcare system (30). The model was later revised to expand the
21
22 240 number of contextual factors to thirty-six. These new factors include external knowledge
23
24 241 (general and project specific), portfolio management, specialist staff, microsystem capacity,
25
26 242 and patient engagement (30). The factors presented in this model are relevant to this
27
28 243 research question and will be incorporated into this evaluation.

29
30
31
32 244 The MUSIQ model is relatively new as it was published in 2012 and has been only used by a
33
34 245 handful of studies to date. Therefore, there is insufficient evidence to draw conclusions
35
36 246 regarding model usefulness, though studies have confirmed the observation of all original
37
38 247 factors in the QI initiatives being studied (42). One reported the framework and underlying
39
40 248 assumptions useful for interrogating the research question (43) and another reported that the
41
42 249 model was useful in identifying contextual constraints (44). The Kirkpatrick model focuses on
43
44 250 different outcome levels while MUSIQ adds another perspective of context at healthcare
45
46 251 system level. The MUSIQ model offers the missing link to context and relationships in the
47
48 252 Kirkpatrick model. The evaluation framework for this research focuses on integrating the two
49
50 253 models to address the aim of this research.

51 52 53 254 **Integrated evaluation framework**

54
55
56 255 Knowing what information to collect, whom to collect it from and when to collect are critical
57
58 256 decisions in designing a comprehensive evaluation once the purpose of the evaluation has
59
60

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

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/pro cess & 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

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

264

265 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.

277 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

1
2
3 286 in 2017 and its aim was to improve the quality of patient care and work life of the emergency
4
5 287 departments' staff participating in the collaborative (47). Both collaboratives consisted of 3
6
7 288 training days and activity periods in between, with measurement for improvement being an
8
9 289 important component of the training content.
10

11
12 290

15 291 **Researcher reflexivity statement**

16
17
18 292 The lead researcher immersed herself in the work of the National QI Team of the Health
19
20 293 Service Executive (HSE) Ireland to develop a deeper understanding of their work,
21
22 294 understand the context for measurement for improvement and the aims and objectives of the
23
24 295 training programmes. This immersion and ethnographic observation provided invaluable
25
26 296 opportunity to the researcher to observe and work on various other projects of the National
27
28 297 QI Team. The researcher, therefore, developed an insider perspective about the operations
29
30 298 and culture of the health system, something which facilitated a better understanding when
31
32 299 participants described aspects of the system such as bureaucracy. However, one possible
33
34 300 drawback of this could be a preference for 'trainer' views due to the researcher's familiarity
35
36 301 with these individuals. To counter this, the researcher will structure the analysis into trainer
37
38 302 and trainee perspectives so that both perspectives are included in a balanced analysis. As
39
40 303 an additional quality step, the emerging findings will be presented to the research team to
41
42 304 challenge assumptions and increase trustworthiness.
43
44

46 305 **Patient and public involvement statement**

47
48 306 There was no patient or public involvement in the study. The study collected data from
49
50 307 healthcare staff about their experiences of participating in a QI training programme and did
51
52 308 not require any data from patients or the public.
53
54

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1
2
3 311 **Data collection**
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5

6 312 Data collection will be conducted using multiple sources of evidence through semi-structured
7
8 313 interviews with training participants, trainers and site coordinators and document analysis. A
9
10 314 case study database in the form of electronic files will be maintained for this case study
11
12 315 research. The database will have two main sections; the evidence or data collected and
13
14 316 reports of the investigators (24).
15
16

17 317 The study population will include healthcare staff who were trained, those who delivered
18
19 318 training, site coordinators of participating sites, leads of the two collaboratives in the HSE.
20

21 319 The trainee population ranges from senior-level staff such as Assistant Directors of Nursing
22
23 320 to frontline staff such as healthcare assistants and nurses. This research will use a
24
25 321 purposive sampling strategy by including participants who shared the common experience of
26
27 322 the training and had participated in the two collaboratives (48). This is purposely kept broad
28
29 323 as both collaboratives were completed more than two years ago as the researchers
30
31 324 anticipate challenges in recruiting participants. Participation in the study will be on a
32
33 325 voluntary basis and the researcher will describe the nature of the study in detail to the
34
35 326 participants and answer all questions prior to any data collection. The National QI Team will
36
37 327 serve as a gatekeeper for participant recruitment for trainees and send a letter to introduce
38
39 328 the researcher to participants The recruitment letter is available in Supplemental File 2.
40
41 329 Those willing to participate would then contact the researcher and written informed consent
42
43 330 will be obtained. The study consent form is available in Supplemental File 3.
44
45
46

47 331 The data collection will be conducted via semi-structured interviews and document analysis.
48

49 332 The semi-structured interviews will be conducted by the lead author. The interview method
50
51 333 will allow the researcher to capture the words, thoughts, feelings, perceptions, and
52
53 334 experiences of the participants to answer the research question (49). The first two interviews
54
55 335 will be used as a pilot to review the interview guide and make changes if required. The
56
57 336 collected documents will be used to inform participant reaction and learning (Kirkpatrick
58
59 337 levels 1 and 2). These documents will include (depending on the availability) the end of
60

1
2
3 338 collaborative reports and any feedback forms used during the collaboratives. Level 3 and 4
4
5 339 data along with contextual factors (from MUSIQ framework) will be collected through
6
7 340 interviews. This research aims to recruit all trainers, both leads of the two collaboratives in
8
9 341 the HSE, and 10 participants from each collaborative.

12 342 **Data processing**

15 343 The interviews will be audio recorded and transcribed and anonymised. Site pseudonyms
16
17 344 will be used. A field journal will be maintained by the researcher while interviewing which will
18
19 345 be used to make a note of researcher's assumptions, feelings and biases and reflections on
20
21 346 the interviews. After each interview, the recording will be analysed to improve the
22
23 347 researcher's performance as an interviewer. A case database will be maintained to store all
24
25 348 collected data.

28 349 **Data analysis**

31 350 The data analysis of case studies involves a detailed description of the setting or individuals
32
33 351 and analysis of the data for themes or issues (50). A detailed description of the training
34
35 352 programme, sites and participants will be followed by a thematic analysis of the qualitative
36
37 353 interview data and the documents collected. The coding and analysis framework is
38
39 354 presented in Figure 2 (51). Coding process will be aided by the NVivo12 software which
40
41 355 provides a platform for data management, querying and visualisation (52).

44 356 This qualitative analysis will rely on the same theoretical and analytical strategy to study both
45
46 357 cases and then the patterns found in each case will be compared (24). The comparison
47
48 358 between the two cases will be performed. The involves analysing the data in new ways,
49
50 359 explore relationships and the cluster the data so contrasts, and similarities emerge (53).

53 360 **Ensuring rigour**

56 361 Rigour will be ensured by triangulating through multiple sources of data by including
57
58 362 perspectives of multiple stakeholders and multiple data collection methods. Data collection
59
60

1
2
3 363 and analysis methods and researcher reflexivity will be clearly documented to ensure
4
5 364 transparency. At the analysis stage, two other researchers will review codes collectively in
6
7 365 regular meetings (54). The researchers aim to perform member checking by contacting 10%
8
9 366 of the participants and sharing a summary of results. The researchers also aim to perform
10
11 367 member checking with a broader audience through an interactive webinar. The HSE
12
13 368 regularly conducts QI webinars, and this platform would be useful for reaching healthcare
14
15 369 professionals interested in QI and enable the researchers to obtain and incorporate
16
17 370 feedback from a wider audience into the results. The other method of dissemination would
18
19 371 be through peer-reviewed journal articles which would strengthen the awareness about this
20
21 372 study. To incorporate the impact of the COVID-19 pandemic on this research process and
22
23 373 the work practices of healthcare staff, questions to explore the role of QI education and
24
25 374 measurement for improvement in adapting to new ways of working are included in the
26
27 375 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

1
2
3 390 is less common in previous studies. The integrated framework is a theoretical contribution to
4
5 391 the field and the analysis will also reflect on the useful and effectiveness of the approach.
6
7

8 392 Although qualitative research may not be generalisable, this research will be one of the few
9
10 393 studies focusing on measurement for improvement and will reveal a multitude of avenues for
11
12 394 future research. The results will not only be of importance for QI/measurement training
13
14 395 design, but also for evaluation purposes and for healthcare organisations and systems.

15
16 396 There is a need for further research in the evaluation of QI programmes in terms of their
17
18 397 immediate and long-term impacts. Measurement for improvement is an important but less
19
20 398 explored topic in programme evaluations and there is need to expand the understanding of
21
22 399 what to teach, how to teach and how to evaluate programmes that aim to train healthcare
23
24 400 staff in quantitative and qualitative data skills. Programme evaluation should be viewed as a
25
26 401 driving force for future programme design and policy. Instead of focusing on using
27
28 402 standardised models, this study takes a customised evaluation approach, appropriate to
29
30 403 answer this research question which is a theoretical contribution to the field. This approach
31
32 404 is expected to expand the empirical and theoretical understanding of factors that influence
33
34 405 the development and use of measurement for improvement skills in healthcare staff. Another
35
36 406 expected impact of this research will be to deepen the understanding of contextual factors
37
38 407 that impacted programme success at various levels of the healthcare system.
39
40

41 42 408 **ETHICS AND DISSEMINATION**

43
44
45 409 The study has received exemption from full ethical review from the Human research ethics
46
47 410 committee of University College Dublin, Ireland (LS-E-19-108). The results of the study will
48
49 411 be disseminated in peer reviewed journals.
50

51 52 412 **AUTHORS' CONTRIBUTIONS**

53
54
55 413 ZK developed the methodology and prepared the initial draft in consultation with ADB and
56
57 414 EM. ADB and EM provided substantive feedback on the draft which was revised by ZK. All
58
59 415 authors have read and approved the final manuscript.
60

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2
3 416 **COMPETING INTERESTS**
4

5
6 417 The authors have no competing interests to declare.
7

8
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10

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14
15 421 analyses, interpretation of the data, or decision to publish results.
16
17 422
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3 558 **FIGURE TITLES AND LEGENDS**
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6 559 **FIGURE 1**
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9 560 **Title:** Research design choices through an adaptation of Saunders' research onion

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11 561 **Legend:** Flow chart of Research design choices for the study through an adaptation of
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13 Saunders' research onion
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16 563 **FIGURE 2**
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19 564 **Title:** Coding and Analysis Framework

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22 565 **Legend:** Description of coding and analysis steps adapted from Johnny Saldana's coding
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Figure 1

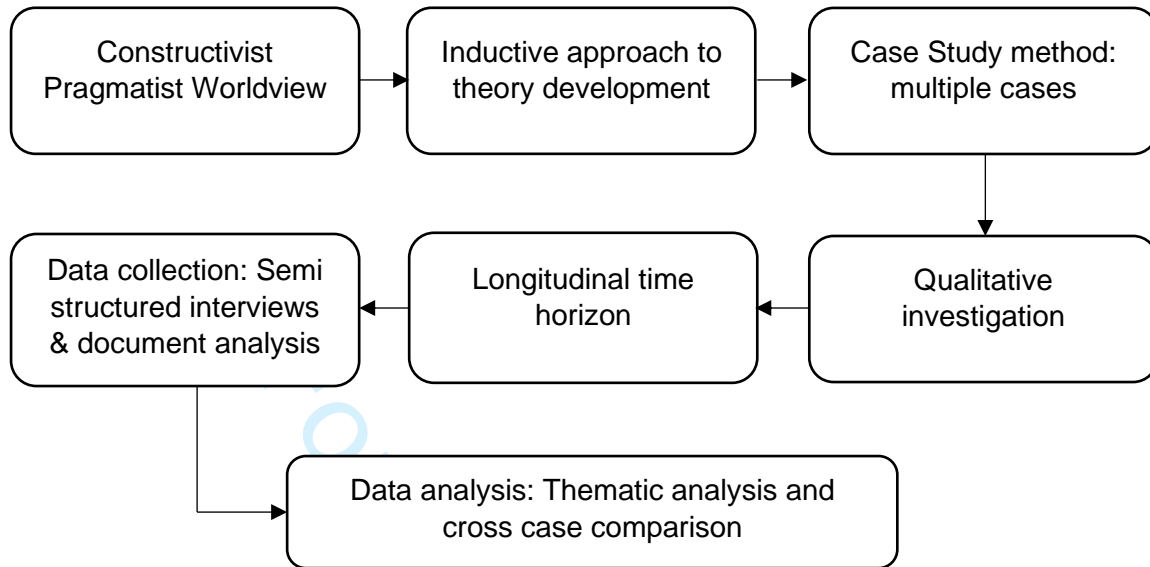
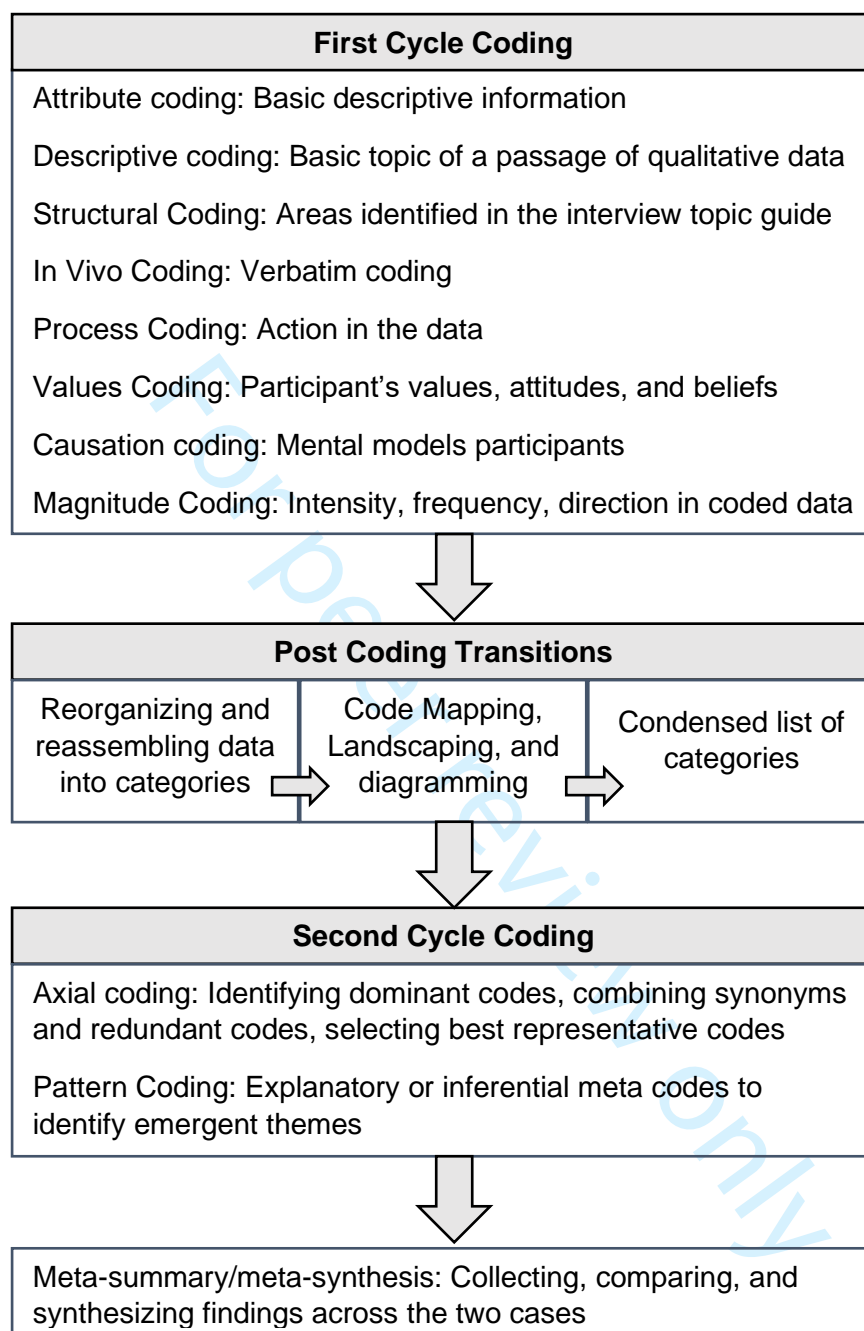


Figure 2



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?

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- PROBES
 - Support from senior and frontline managers
 - Data Infrastructure within organization
 - Resource availability
 - External and Internal motivating factors
 - 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?
 - PROBES
 - Role of leaders
 - Supportive culture of the organization
 - Availability of resources

COVID-19

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

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 McAuliffe¹

Researchers: Ms. Zuneera Khurshid¹, Dr Aoife De Brun¹, Dr. Jennifer Martin², Dr. Philip Crowley²

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.	<input type="checkbox"/>
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.	<input type="checkbox"/>
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.	<input type="checkbox"/>
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.	<input type="checkbox"/>
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.	<input type="checkbox"/>
My queries have been addressed to my satisfaction by the research team and I consent to take part in this study.	<input type="checkbox"/>

Name of participant

Date

Signature

Name of person taking consent

Date

Signature

- | |
|--|
| <p>1. School of Nursing, Midwifery & Health Systems, University College Dublin</p> <p>2. National Quality Improvement Team, Health Service Executive</p> |
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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.

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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