

# Development of a tool for identifying and addressing prioritised determinants of quality improvement projects led by healthcare professionals: a mixed-methods study

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## Research

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# Abstract

**Background** Several frameworks have been developed to identify essential determinants for healthcare improvement. These frameworks aim to be comprehensive, leading to the creation of long lists of non-prioritised determinants. Furthermore, most existing frameworks do not describe the methods or actions used to identify and address the determinants, limiting their practical value. The aim of this study is to describe the development of a tool to determine the prioritised facilitators and barriers for healthcare improvement projects led by healthcare professionals, supplemented with methods to identify and address each determinant.

**Methods** A mixed-methods study design was used to develop the tool. First, a cross-sectional study was performed, using an online survey to ask healthcare professionals about the determinants they experienced during the performance of their quality improvement project. A priority score was calculated for every named determinant, and those with a priority score  $\geq 20$  were incorporated into the tool. Semi-structured interviews with implementation experts determined: 1) how healthcare professionals can be assisted to use our tool to analyse the determinants in their project and 2) how healthcare professionals can tackle the barriers or use the facilitators identified in their quality improvement project.

**Results** The 25 healthcare professionals in this study experienced 64 facilitators and 66 barriers when performing their improvement projects. Of these, 12 facilitators and nine barriers were incorporated into the tool. Sufficient support from management of the department was identified as the most important facilitator, while having limited time to perform the project was considered the biggest barrier. The interviews with 16 experts in implementation science led to various inputs for better identifying and addressing each determinant. Important themes included maintaining adequate communication with stakeholders, keeping the project at a manageable size, learning by doing and being able to influence determinants.

**Conclusions** This paper describes a tool for performing quality improvement projects in healthcare, with the barriers and facilitators that were considered most important by healthcare professionals. For each of these barriers and facilitators, suggestions on how to analyse and address the determinant are given. More research is needed to validate and develop the tool further.

## Contributions To The Literature

In the existing literature, there are various determinant models to understand the influence of barriers and facilitators on implementation outcomes.

Although the literature agrees to a large extent on which determinants are significant, it is less clear which determinants are considered important by healthcare professionals, who frequently lead quality improvement projects, and how to match determinants with strategies to address them.

This study describes a tool of prioritised facilitators and barriers for healthcare quality improvement, with suggestions of how best to analyse and address them. This tool contributes to the prioritisation of

determinants and links them to implementation strategies.

## Background

The importance of contextual determinants for the success of quality improvement initiatives is widely accepted(1, 2). The increased interest in the context where quality improvement initiatives are implemented has resulted in the publication of several frameworks of determinants in the literature (e.g., Tailored Implementation for Chronic Disease (TICD(2)), Consolidated Framework for Implementation Research (CFIR(3)), Model for Understanding Success in Quality (MUSIQ(4)) and Measurement Instrument for Determinants of Innovations (MIDI(5)). These frameworks describe general classes of determinants, which are independent variables that prevent or enable implementation outcomes, such as changes in healthcare professional behaviours(2, 6). These determinants are also described as barriers and enablers, barriers and facilitators or problems and incentives(2). The aim of these frameworks is to help implementation researchers and people responsible for performing quality improvement projects (QIPs) in healthcare to identify determinants, enabling them to design and execute more effective implementation strategies(6). Implementation strategies in the healthcare sector can be defined as methods or techniques used to enhance the adoption, implementation, and sustainability of a clinical practice or programme(7) .

Most of the existing generic frameworks of determinants of practice aim to be comprehensive and include all important domains and determinants(2). These frameworks are based on the idea that implementation is a multidimensional phenomenon taking place in complex settings with multiple interacting influences within and across different types of determinants(6). The downside is that these frameworks lead to long lists of determinants (e.g., TICD contains 57 determinants, while MIDI has 29 determinants), which can be challenging to use in practice; it would be difficult to analyse and address all of these determinants in an improvement project(8). For healthcare professionals planning to implement an improvement project, a shorter tool of prioritised determinants would be useful; however, to our knowledge, no framework yet exists that prioritises determinants based on the healthcare professionals' experience of them during the implementation of improvement projects.

In most general determinant frameworks, it is unclear whether the barriers and facilitators are the most relevant determinants within a specific context and for a specific population. A systematic review of 12 available frameworks and taxonomies of determinants of practice revealed that most were based on literature reviews or developed using brainstorming and consensus processes(2). A recent scoping review(9) of determinant frameworks showed that many were developed based on earlier frameworks, which could lead to a narrow approach to exploring and understanding relevant determinants. Although some frameworks are based on the author's own implementation experiences(9), it is unclear to what extent these frameworks are relevant to the determinants encountered by other healthcare professionals responsible for the implementation of healthcare improvements.

The applied use of determinant frameworks is also restricted by the limited guidance available on how to analyse determinants in practice and how to match determinants with implementation strategies(10, 11). Most frameworks of implementation strategies (e.g., Expert Recommendations for Implementing Change (ERIC)(12)) have not linked their implementation strategies to determinants. This can lead to a mismatch between identified determinants and strategies(13), making the effect of these implementation strategies variable(11). A systematic review of 32 studies(14) showed that strategies tailored to determinants were more effective than those that were not; however, the methods used to select implementation strategies were often not well described(14). Enhancing the link between identified determinants and implementation strategies is therefore a priority for implementation science(15).

To our knowledge, there is no relatively short general determinant tool that prioritises determinants based on the actual experiences of healthcare professionals responsible for performing QIPs in their own practice. Such a tool could support these professionals, for example those leading the implementation of a QIP in a hospital setting, to analyse and address important determinants. The aim of this study was therefore to develop a tool of determinants prioritised based on the experience of healthcare professionals leading QIPs in their own workplace. The tool was developed to be practical rather than comprehensive, resulting in a relatively short list of determinants with suggestions on how to analyse and address them. In this article, we describe the development of this tool.

## Methods

### Setting

Healthcare professionals and implementation experts participated in this study. Both groups were involved in a two-year half-time post-initial scientific master's programme (subsequent to an initial master's) on quality improvement in healthcare. The program trains healthcare professionals with an academic background to become leaders in the evidence-based improvement of healthcare quality and safety. Professionals are enrolled in 12 interactive learning modules (see Figure 1, which shows the core elements of the master's programme). The implementation experts are teachers and supervisors in these modules and have different specialties, such as leadership or patient involvement in quality improvement. Professionals work intensively on their personal (leadership) development in quality improvement through portfolios and coaching. Together, these educational interventions support professionals to lead and perform a QIP at their workplace during their master's programme. Because these QIPs are carried out in the context of a teaching programme, they are to some extent standardised (e.g., all professionals receive methodological support, all QIPs are performed in a hospital setting and are led by healthcare professionals, and all theses are evaluated using the Standards for Quality Improvement Reporting Excellence (SQUIRE) guidelines(16)), making them valuable sources for the development of this tool.

## **Year 1: knowledge and skills**

Interactive modules:

- 1–2: Introduction
  - 3: Patient centered care
  - 4: Effective care
  - 5: Implementation of quality improvement
  - 6–7: Safe care
  - 8: Efficient care
  - 9: Scientific research in quality improvement

From a quality improvement project idea to a plan

Personal (leadership) development using portfolios and coaching

## **Year 2: Skills, distance learning, workplace learning and peer coaching**

Interactive modules:

- 10: Transboundary care
- 11–12: Leadership track 1 and 2

Leading a quality improvement project

Free electives based on personal learning goals

Longitudinal learning paths: Interprofessional learning, lifelong learning and patient involvement

Figure 1. Elements of the Dutch two-year post-initial master's on Quality and Safety in Healthcare

## Design

We used a mixed-methods design(17) to develop the tool. First, we performed a cross-sectional study using an online survey among healthcare professionals from the master's programme, in which they were asked about the determinants they experienced during the performance of their QIP. We subsequently performed semi-structured interviews with implementation experts about 1) how healthcare professionals can be assisted to analyse the determinants of our tool within their QIP and 2) how healthcare professionals can tackle the barriers or use the facilitators identified in their improvement project. We used the Strengthening of Reporting of Observational Studies in Epidemiology guidelines (STROBE) and the Consolidated Criteria for Reporting Qualitative Research guidelines (COREQ) when designing our study. For more details, see additional files 1 and 2 [see Additional file 1 and 2].

## Part 1: Survey

### *Development*

Two cohorts of healthcare professionals following the master's programme (N = 41) were asked to fill in an online survey about the determinants they experienced during the performance of their QIP. They were retrospectively asked to express the five most important experienced facilitators and five most important experienced barriers. See additional file 3 for the complete survey (in Dutch) [see Additional file 3].

We developed a pre-specified list of facilitators and barriers from which healthcare professionals could choose their determinants for their top five facilitators and top five barriers.

This list was based on two existing models of determinants: MUSIQ(4) and the TICD model(2). To the best of our knowledge, MUSIQ is the only model that includes determinants relevant to team-level quality improvement in our context, while the TICD model is based on a systematic review of other determinant frameworks, not including MUSIQ. We therefore assume that the combination of both models provides an overview of all unique determinants.

First, the researcher (AvT) combined the two models to gain an insight into the unique and overlapping determinants. For the MUSIQ model, we used the questionnaire that was developed to measure contextual determinants(18). For the TICD model, we used the TICD tool that was developed to facilitate the use of the model(2). The researcher (AvT) and one member of the research team (HW) scored all determinants (57 TICD determinants, 39 MUSIQ determinants) by three criteria: relevance (the determinant should be of relevance for performing an improvement project in healthcare), applicability

(the determinant should be applicable across various relevant settings and types of improvement project) and recognition (the determinant must be easily understood by healthcare professionals)(2). Of the selected determinants, 32 came from the MUSIQ questionnaire, 22 from the TICD tool and five were identified in both tools. Two determinants were formulated by discussion with the research group based on their relevance to our context. We formulated all the included determinants as both facilitators and barriers, resulting in two lists of 61 determinants each. A flowchart of the selection process can be found in Figure 2.

Figure 2. Flow diagram of selection process of determinants in the pre-specified list used in the survey

The translation and adaptation of the determinants for the questionnaire was completed by researcher AvT. The list was extensively discussed with the entire research group. The determinants were organised according to the MUSIQ model levels: those of the external environment, organisation, microsystem and QI team. We also added two levels from the TICD model: the level of the patient and of the QIP.

### *Procedure*

In 2014–2018, a total of 46 healthcare professionals with backgrounds in various medical and nursing specialties participated in the first two cohorts of the master's programme. We included all healthcare professionals who started performing a QIP during their master's. Professionals who dropped out of the programme and did not begin a QIP and those who explicitly stated that they did not want to participate were not recruited. In total, 41 healthcare professionals were recruited by e-mail to participate. A reminder was sent two weeks after the first invitation. Participation in this survey was voluntary. Informed consent was implied by the overt action of completing the online questionnaire after reading the information letter.

In the survey, professionals were retrospectively asked to name the five facilitators and five barriers they experienced as most important in their QIP. Professionals could select determinants in two ways; choosing from the pre-specified list of facilitators and barriers and/or naming self-experienced determinants that were not included in this list. The questionnaire could be completed in approximately 10 minutes.

### *Analyses*

For the analyses, the participants' self-experienced determinants were carefully evaluated by the researcher (AvT) to assess whether they could be merged with determinants in the pre-specified list or with determinants reported by other participants. Self-experienced determinants with the same meaning

as a prespecified determinant were accommodated within this determinant. Self-experienced determinants with the same meaning as another self-experienced determinant were combined, sometimes leading to a reformulation of the self-experienced determinant. The combined determinants were discussed with another member of the research team until consensus was reached (HW and/or HC).

A priority score was calculated for each of the top-five determinants named by the respondents. This score consisted of the sum of the ranking in the top five (i.e., a determinant ranked in first place scored five points, a determinant ranked fifth place scored one point), multiplied by the number of times a determinant was placed in a top five by professionals. Determinants with a priority score  $\geq 20$  were included in our tool.

## **Part 2: Interviews**

### *Questions*

We received further information about determinants with a priority score  $\geq 20$  from the implementation experts using semi-structured interviews. The interview guideline consisted of open-ended questions about how healthcare professionals could be assisted to analyse determinants, use facilitators and confront barriers when performing a QIP. We also asked for general comments on the tool. The interview guide was pilot-tested with a member of the research team (HC) and adapted where necessary.

### *Procedure*

We recruited 29 implementation experts from eight Dutch universities. They all had a teaching role in the master's programme and possessed different expertise regarding the implementation of QIPs. We used purposive sampling to select implementation experts with varied expertise in implementing QIPs. All 29 implementation experts were approached by e-mail to participate, and were provided with information about the goal of the study. After a week, a reminder was sent. Those implementation experts who agreed to participate were contacted by the primary researcher (AvT) to schedule a date for the interview. Oral consent was recorded. The primary researcher interviewed all implementation experts. All interviews were audio-taped and field notes were made.

During the interview, implementation experts were asked to choose two facilitators and two barriers from the list of determinants with a priority score  $\geq 20$ , on which they wanted to provide input. Input was based on the implementation experts' theoretical knowledge and practical experiences with QIPs. As an increasing number of interviews were held, it became clear that some determinants had received more



input than others. Therefore, as we conducted more interviews, we asked implementation experts if they could also advise on the determinants which had previously received less input.

### *Analyses*

All interviews were transcribed verbatim by the primary researcher (AvT), and from each transcript an extensive summary was made to facilitate the analyses. The transcript summaries were analysed in pairs using principles from thematic analyses(19). The primary researcher (AvT) analysed all summaries and two researchers (HW and HC) with implementation expertise also analysed half of the summaries each. This involved carefully reading the summaries before discussing the meaning of the input to identify and develop themes, which were reformulated into suggestions for analysing and addressing the determinants in the tool.

## **Results**

### **Survey**

Of the 41 professionals who received the survey, 25 responded (68% participation rate). Most participants had a professional background as a physician (50%), followed by a background as a nurse (36%).

We found 130 unique determinants named by respondents, consisting of 64 facilitators (53%) and 66 barriers (47%). Facilitators related to the quality improvement team were most commonly reported, while the most commonly reported barriers were related to healthcare organisations. Of the 64 facilitators, 32 (50%) were self-reported by the professionals and thus outside our pre-specified list of determinants. Of the 66 barriers, 34 (52%) were self-reported. Additional file 4 provides all determinants that were ranked in the professionals' top five lists [see Additional file 4].

Twelve facilitators were found to have a priority score  $\geq 20$  (min. 24, max. 288). Most facilitators were related to the level of the department. The availability of management support was identified as the most important facilitator. We found nine barriers with a priority score  $\geq 20$  (min. 20, max. 767). Most barriers were experienced at the organisation level. Healthcare professionals feeling they had insufficient time to perform the QIP was identified as the most important barrier. Table 1 provides a list of the 12 facilitators and nine barriers with their priority scores.

Table 1  
Facilitators and barriers with a priority score  $\geq 20$ , grouped by category

Facilitators	Priority score <sup>a</sup>
External environment	
Incentives or pressure (financial, legal or politica)	64
Organisation	
Sufficient support of expertise in the field of quality improvement	95
Culture of improvement	60
Sense of urgency <sup>b</sup>	42
Sufficient available time	90
Department	
Sufficient support of management	288
Employee support <sup>b</sup>	203
Bottom-up project approach <sup>b</sup>	96
Enthusiastic and supportive department head <sup>b</sup>	76
Workforce is motivated about the improvement project	33
Quality improvement team	
Sufficient participation in the decision-making process by team members	24
Intervention of the project	
Intervention fits in with current workflow	120
Barriers	
Organisation	
Insufficient available time	767
Data infrastructure	120
Insufficient support of the Executive Board for the project	110
Opponents of the project	30
Other organisational changes (reorganisation, merger)	27
Insufficient integration of quality improvement	27

<sup>a</sup> The priority score consists of 1) the sum of the ranking in the top five (i.e., a determinant ranked first place in the top five got five points, while a determinant ranked fifth place in the top five received one point) multiplied by 2) the number of times a determinant was placed in the top five by professionals.

<sup>b</sup> Self-experienced determinant listed by professionals (not included in the pre-specified list of determinants used in the survey).

Facilitators	Priority score <sup>a</sup>
Intervention	
Lack of evidence in literature of the effects of intervention	24
Department	
Insufficient motivation among the workforce	21
Experiencing one's competencies needed for the intervention as insufficient	20
<sup>a</sup> The priority score consists of 1) the sum of the ranking in the top five (i.e., a determinant ranked first place in the top five got five points, while a determinant ranked fifth place in the top five received one point) multiplied by 2) the number of times a determinant was placed in the top five by professionals.	
<sup>b</sup> Self-experienced determinant listed by professionals (not included in the pre-specified list of determinants used in the survey).	

(Insert Table 1)

## Interviews

We interviewed 16 implementation experts (response rate = 55%). The reasons for non-participation were needing to meet other deadlines and overlapping expertise. Five interviews were conducted face to face at the professional's workplace, while the remainder were held over the telephone. The interviews took on average 34 minutes (range 20–57 minutes). Table 2 shows the areas of expertise of the implementation experts.

Table 2  
Area of expertise implementation experts participating in interviews

Area of expertise	N implementation experts <sup>a</sup>
Qualitative research	1
Governance of quality and safety in healthcare	2
Patient safety and teamwork	2
Quality and safety advisor	4
Quality improvement in patient care and education	1
Evidence based healthcare	2
Implementation improvement projects in patient care	2
Implementation as learning	2
Implementation in the field of perioperative patient safety	3
Evaluation of quality improvement	1
Patient involvement	3
<sup>a</sup> Some experts were interviewed from different areas of expertise	

(Insert Table 2)

For each determinant with a priority score  $\geq 20$ , we identified several practical suggestions on 1) how to assist healthcare professionals in analysing the determinant and 2) how to use a facilitator or tackle a barrier. The suggestions are included in the tool under the headings 'analyse determinant' and 'address determinant'; for example, Table 3 shows the suggestions included in the tool for analysing and addressing a facilitator and a barrier.

Table 3

Example for analysing and addressing a facilitator and barrier, based on input from implementation experts

Determinant	Analysis	Approaches
Facilitator		Ways to use facilitator when performing QIPs
Sufficient support of management	<ul style="list-style-type: none"> <li>- Conduct a stakeholder analysis</li> <li>- Does management meet its agreements? Are you involved in matters relating to the project? Do you receive information about the project?</li> <li>- Are a member of the Executive Board and a department head the project sponsor? Do they actively support it and provide resources?</li> </ul>	<ul style="list-style-type: none"> <li>- Seek support from management before the start of the project.</li> <li>- At least once every 9 months, according to an agreement with the management, provide periodic information about the progress of the project. This is part of a detailed communication plan.</li> <li>- Explicitly ask the department head and a member of the Executive Board to sign the project plan.</li> </ul>
Barrier		Ways to tackle barrier when performing QIPs
Insufficient support of the Executive Board for the project	<ul style="list-style-type: none"> <li>- Conduct a stakeholder analysis</li> <li>- Has the project plan been signed by a member of the Executive Board?</li> </ul>	<ul style="list-style-type: none"> <li>- Make sure your project fits the mission or the strategic principles of the Executive Board and show this explicitly in the title of your project.</li> <li>- Take someone else from your project team to a meeting with the Executive Board so that you can complement each other.</li> </ul>

(Insert Table 3)

In addition to providing input on how to analyse and address the determinants in our tool, experts frequently made general comments about performing QIPs. These comments led to the identification of four themes: communication, keep it small, influence and concern, and learning by doing. Box 1.1 provides a description of each theme.

All facilitators and barriers with a priority score > 20, together with practical suggestions for analysing and addressing the determinants, were combined in a practical tool. Based on the major themes that emerged from interviews with implementation experts, a distinction is made between determinants that can be influenced by healthcare professionals (proximal) and determinants that cannot or are less easily influenced by professionals (distal). The full tool can be found in additional file 5 [see Additional file 5].

## Discussion

In this study, we developed a tool of 12 prioritised facilitators and nine prioritised barriers for performing QIPs led by healthcare professionals, with practical suggestions on how to analyse and address these determinants within a QIP. This tool can be used before, during and after the implementation of a QIP and may guide reflection on the process of implementation to explore which factors are most important. The tool therefore helps healthcare professionals to learn from failures, to avoid repeating mistakes, and to learn from successes, which can be used in future projects. Most facilitators in our tool are at the level of

the department, while most barriers are at the organisational level. We identified support from the departmental management staff as the most important facilitator for performing a QIP, while lacking the proper time to perform a project was the most important barrier. Methods for analysing and addressing each determinant are provided, based on interviews with implementation experts. Although not every determinant can be directly influenced by professionals, good communication with stakeholders, keeping the project small and learning from implementation are important overall guidelines for performing a QIP.

## **Differences with other determinant models**

In contrast to most determinant models in the literature, our tool makes an explicit distinction between barriers and facilitators. We assume that the presence of a determinant during the implementation of a project does not necessarily have to be equally as helpful as its absence would be prohibitive, and vice versa. By analysing the professionals' top five most important experienced facilitators and barriers, we conclude that this assumption is valid because we found that determinants that are experienced as most important facilitators were different than determinants that are experienced as most important barriers. Our tool therefore contains separate lists of prioritised facilitators and barriers. We hope that this distinction supports professionals in making more informed choices on which facilitators to use and which barriers to address during the implementation of their project.

Because identifying determinants is just the first step to challenge or use determinants, we decided not to only include a list of prioritised facilitators and barriers but also to provide practical suggestions of how to analyse determinants, use facilitators and address barriers. Current determinant models and models of implementation strategies often fail to provide a link between determinants and the strategies to address them(11, 14, 15). A recent study of which implementation strategies in the ERIC model would best address contextual barriers from the CFIR found that respondents had varying opinions regarding which implementation strategies best addressed each contextual barrier(10). This result can be explained by the fact that most implementation strategies are limited in their specification, poorly described and 'package' approaches consisting of multiple poorly understood elements(20). The practical suggestions in our tool are different to those of other implementation strategies in that they are concrete and focus on one specific determinant. Although we recognise that these suggestions, just as the implementation strategies, should be selected upon a complete understanding of the context(15), we hope that the practical use of the tool will support healthcare professionals in addressing the determinants they face. More research is needed to enhance the evidence for these suggestions, including, but not limited to, research into the assumed mechanisms and pathways through which these suggestions address the determinants.

## **Reflection on the barriers and facilitators in the tool**

We identified receiving sufficient support from management as the most important facilitator to perform a QIP. Support from management helps to formally confirm a project, for example by integrating the project in the policy statements of the department(21) or by providing resources(18). In an exploratory analysis of the MUSIQ model, researchers found that microsystem determinants (e.g., department-level

factors) have direct effects on the success of QIPs(18). Microsystem leadership (similar to our determinant 'management support of department') was not found have a direct influence on QIP success; however, this determinant was found to be directly influenced by quality improvement team leadership, which in turn had one of the strongest direct effects on measures of QIP success. Our tool is based on the experiences of quality improvement team leaders, who, it could be argued, are highly influenced by their departmental management team. Analyses of the MUSIQ model also found that most determinants related to the quality improvement team had a direct effect on success because this team is responsible for guiding implementation. Our results also show that facilitators at the level of the quality improvement team were most often reported but were not included in our tool due to their priority score (< 20).

Experiencing insufficient time to perform the project was reported as the most important barrier by healthcare professionals, which is in line with previous study results. A study of barriers to healthcare providers' adherence to guidelines, diffusion of innovation and implementation of evidence into practice found time to be the most common resources-related barrier(22). Furthermore, a systematic review on the barriers to evidence-based medicine identified a lack of time as one of the most common barriers(23). Based on our interviews with implementation experts, lack of time seems to be a determinant with no ready-made solution. Although the workload of healthcare professionals is a probable reason for this determinant being so highly prioritised(23), this feeling may also be grounded in other causes. As we also formulate in our tool, we suggest that professionals first analyse what causes the lack of time and then find an appropriate solution.

Our tool includes four facilitators that were self-experienced by the professionals (i.e., outside our pre-specified list of determinants). These facilitators include: urgency to improve, bottom-up approach, an enthusiastic and supportive head of department and workforce commitment. A bottom-up approach to implementation was one of the most highly prioritised facilitators. This shows the value of developing a determinant model based on the experiences of those who are responsible for implementing QIPs, as these determinants are not found in models based on literature reviews or expert knowledge. Some of these 'new' determinants are not new in other disciplines; for example, a bottom-up approach is a frequently mentioned theme in literature about policy implementation(24, 25). More research on these 'new' determinants is needed to determine how they influence the implementation of healthcare QIPs.

During interviews, several experts highlighted the need to see QIPs as a learning process in itself. Although in healthcare implementation science this view on quality improvement is relatively new, the fields of human resource management and behavioural science acknowledge this need(26). When a project has difficulties that are changed into breakthroughs, critical learning occurs(27). It is important to understand what kind of learning process takes place during the implementation of an innovation to support the innovation, but this can be challenging because this learning often takes place implicitly(28). Research shows, however, that there are some important principles that support these learning processes(26). It is notable that some of the most important principles are also included in our tool; for instance, the principle 'working from individual motivation' is in line with our determinant relating to the motivation of the workforce. This principle stresses the importance of motivation in order for

breakthroughs in the process to occur. Motivation can lead to ownership and entrepreneurship and is linked to individual curiosity. The principle 'creating something together' is in line with our facilitator of a 'bottom-up approach' and helps to create a common practice. Finally, the principle 'organising creative turmoil' is similar to our facilitator 'sense of urgency'(26). The similarities between the determinants we found to be most important in the implementation of QIPs and the principles that support learning from the process support our suggestion to place more emphasis explicitly on seeing implementation as a learning process. Process evaluations of interventions currently focus on how the intervention was delivered in a specific context to interpret and explain outcomes(29). It would be a valuable addition to these evaluations to assess what healthcare professionals, and all other stakeholders involved in implementation, have learnt from the implementation, especially from overcoming barriers and what they (implicitly) organise to stimulate learning.

## How to use this tool

By providing a tool of prioritised facilitators and barriers with practical suggestions for how to analyse and address determinants, we intend to help healthcare professionals reflect systematically on aspects that are important for the design, performance and evaluation of their QIP. Using the tool prior to the implementation can help to identify potential barriers and facilitators to implementation, to refine the implementation strategy, adapt the innovation before implementation and consider how learning from the project can be supported. These efforts will increase the likelihood of successful implementation and, in a later phase, the spread and sustainability of the project. During implementation, our tool can serve to monitor the implementation and to identify and address determinants. After implementation, the tool can help to reflect upon which determinants influenced the implementation. As with most determinant models, the idea is that analysing and addressing determinants facilitates the success of QIPs, because these determinants are believed to influence implementation outcomes(6). Unfortunately, how to conceptualise success remains an incompletely resolved question in implementation science(30). Future research on whether there is a link between the use of our tool and meaningful implementation outcomes would be valuable to understand which determinants influence outcomes and under what conditions.

Our determinants are prioritised based on the experiences of determinants by healthcare professionals who were leading a QIP. It is assumed that the higher the priority score, the more important this determinant is in the implementation of the project. However, as every project is unique and every context is different, the priority score should not be seen as definite and prescriptive but as an orientation. It is therefore important to analyse which potential determinants within and outside of our tool seem to be of relevance to an individual project. Although the science of measuring determinants is immature(1), the column 'analyse' in the tool will be helpful for this task. Knowing which determinants could potentially influence the project does not mean that the determinant can be influenced using the practical suggestions in our tool or other implementation strategies however; interviews with implementation experts showed that some determinants lie beyond the sphere of influence of healthcare professionals. An organisational culture supportive of quality improvement is an example of a facilitator, but is difficult to influence directly and in the short term by healthcare professionals. We therefore suggest maintaining



a primary focus on addressing determinants that lie within healthcare professionals' sphere of influence. Because our tool is the first of its kind to include the sphere of influence, we recommend more research on which determinants can be influenced by whom and under which circumstances.

## Limitations

Our study has several limitations. First, the QIPs at the basis of this study were performed within the context of an educational programme, making the results susceptible to selection bias. It is possible that healthcare professionals performing a QIP outside the context of an educational programme will experience different determinants. Although this possibility, our projects are performed using the principles from experiential learning which means that real-life experiences in the context relevant to learners own future career are used, making the difference with projects performed outside the educational context relatively small(31, 32). Another limitation is that our tool is based on a small number of QIPs (N = 25), which may further limit its generalisability. The QIPs were performed in a wide range of hospitals across the Netherlands however, including all academic hospitals in the country. Third, the merging of the self-experienced determinants was based on the researchers' knowledge and experiences with determinants and therefore not fully objective. We did not perform interviews with participants to determine precisely what was meant by their determinants, and therefore the merging of determinants was based solely on our interpretations. However, every merged determinant was discussed with a second researcher with implementation expertise. Finally, our tool has not been prospectively validated. Further evaluation and modification is needed, including feedback from a broad range of healthcare professionals about their experiences with the tool. This tool is not a finished product and will benefit from further adjustments and developments.

## Conclusion

To our knowledge, this is the first tool of prioritised determinants based on the practical experiences of healthcare professionals. The tool consists of nine barriers and 12 facilitators for the performance of healthcare improvement projects based on the experiences of healthcare professionals leading these projects. For each of these barriers and facilitators, suggestions on how to analyse and address the specific determinant are given based on input from implementation experts. This tool will facilitate healthcare professionals in the systematic reflection and analysis of determinants for QIPs; however, additional research is needed to further adjust, develop and validate our tool.

## Abbreviations

QIPs

Quality improvement projects

TICD

Tailored Implementation for Chronic Disease

CFIR

Consolidated Framework for Implementation Research  
MUSIQ  
Model for Understanding Success in Quality  
MIDI  
Measurement Instrument for Determinants of Innovations  
ERIC  
Expert Recommendations for Implementing Change  
SQUIRE  
Standards for Quality Improvement Reporting Excellence

## Declarations

### Ethics declarations

#### *Ethics approval and consent to participate*

Research ethics approval was sent to the Research Ethics Committee of the Radboud university medical centre. The committee judged that ethical approval was not required under Dutch national law (2018-4918). Participation in this study was fully voluntary and anonymity was guaranteed by the use of non-identifiable data. For the survey, informed consent was implied by the overt action of completing the online questionnaire after reading the information letter. Oral consent was recorded from the participants of the interviews.

#### *Consent for publication*

Not applicable

#### *Availability of data and materials*

The datasets that support the findings of this study are not publicly available due to information that could compromise research participant consent and privacy but can be made available from the corresponding author (AvT) with appropriate precautions and upon reasonable request.

#### *Competing interests*

HW, HC and PG have roles in the master's programme on which the participants for this study are employed; HW was the former director of the master's, HC is co-ordinator of the programme and PG is current director of the master's. The master's programme is partly financed by the Dutch Federation of University Medical Centers, which is the same organisation that partly financed this study. To ensure confidentiality of participants, identifying data about the individuals were only available to the main researcher AvT, who has no role in the master's programme nor any association with the Dutch Federation of University Medical Centers.

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### *Authors contributions*

AvT collected the data, analysed the data and drafted the manuscript. HW analysed the data and contributed to early drafting. HC also analysed the data. All researchers participated in the design of the study and made important contributions to the theoretical approach and interpreting insights. All authors read, revised and approved the final manuscript.

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