Healthcare improvement based on learning from adverse outcomes

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Chapter 3

Barriers and facilitators to learn and improve through morbidity and mortality conferences: a qualitative study

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ABSTRACT

Objective

To explore barriers and facilitators to successful morbidity and mortality conferences (M&M), driving learning and improvement.

Design

This is a qualitative study with semistructured interviews. Inductive, thematic content analysis was used to identify barriers and facilitators, which were structured across a pre-existing framework for change in healthcare.

Setting

Dutch academic surgical department with a long tradition of M&M.

Participants

An interview sample of surgeons, residents and physician assistants (n=12).

Results

A total of 57 barriers and facilitators to successful M&M, covering 17 themes, varying from 'case type' to 'leadership', were perceived by surgical staff. While some factors related to M&M organisation, others concerned individual or social aspects. Eight factors, of which four were at the social level, had simultaneous positive and negative effects (e.g.,'hierarchy' and 'team spirit'). Mediating pathways for M&M success were found to relate to available *information*; staff *motivation*; and *realisation* processes.

Conclusion

This study provides leads for improvement of M&M practice, as well as for further research on key elements of successful M&M. Various factors were perceived to affect M&M success, of which many were individual and social rather than organisational factors, affecting information and realisation processes but also staff motivation. Based on these findings, practical recommendations were formulated to guide efforts towards best practices for M&M.

Key words: morbidity and mortality conferences; quality improvement; patient safety; continuing education; barriers and facilitators; professionals; providers.

INTRODUCTION

The morbidity and mortality conference (M&M) is a deep-rooted tradition in surgery, adopted by many other medical specialties, aiming to serve both educational and quality improvement (QI) purposes.[1,2] M&M additionally provides opportunities to teach principles of patient safety and QI, which are current requirements for residency education.[3–5] Despite similar objectives, significant variation exists in M&M practice.[1,3] Case presentations and discussions may highlight important learning points, but implementation and follow-up often receive less attention at the conference, which is a known challenge for many improvement practices in health care.[5–9]

M&M practice variation is likely related to the fact that key factors for successful M&M, driving learning and improvement, remain largely unclear. Factors that have been reported include organisational aspects, such as a structured approach to review events,[10,11] using moderators,[2,12–14] and participation of all involved staff, [10,15,16] which were corroborated by survey studies.[3,17–20] Except for the importance of a safe, blame-free environment,[2,12] the impact of non-organisational factors, such as team dynamics, has not been considered. While learning and change theories stipulate that these processes occur at different levels, affected by various factors at the individual and team level,[21–24] it remains unknown to what extent these factors effect learning and improving processes at M&M.

We hypothesized that barriers and facilitators to successful M&M, resulting in learning and improvement, also exist at the individual and social level. To obtain a broad and nuanced understanding of the complexity of factors influencing M&M success, a qualitative approach was used. Qualitative studies have rarely been used to study M&M, but can yield rich insights that may not be revealed by quantitative assessments. The purpose of this study was to enhance understanding of the barriers, facilitators and mediating pathways to successful M&M, driving learning and improvement of clinical practice.

METHODS

A total of 12 semi-structured one-hour interviews were conducted to identify barriers and facilitators for successful M&M. This qualitative approach was chosen as it allows exploring perceptions, and encourages participants to share rich descriptions and in-depth information.[25] The number of 12 interviews was selected because of feasibility and anticipated number needed to reach data saturation, defined as three consecutive interviews without additional themes emerging.[26] Purposive sampling was used to invite participants via telephone or email - varying gender, seniority and surgical subspecialty - to obtain a diversity of viewpoints and hence increase the ability to identify all relevant barriers and facilitators. Standards for reporting qualitative research were used to guide reporting of this study.[27]

All invited agreed to participate, including six attending surgeons, five surgical residents and one physician assistant (PA) (four women; mean local work experience: 7.2 years [range 1-18 years]). All worked at the surgical department of a large academic hospital in the Netherlands (882 beds), covering general, endocrine, vascular, gastrointestinal, paediatric, oncologic, trauma and transplant surgery (all represented in the interview sample). All interviewees had prior experience with M&M practice at other, mostly teaching, hospitals. The department has a long tradition of departmental M&M meetings, which gather all faculty, residents, PAs and medical students to discuss a single case during a 1-hour conference every 2 weeks. More details on the local M&M format can be found in prior publications.[28,29] Cases are selected and presented by residents under faculty supervision (i.e., regardless of their involvement). A single case is presented per meeting with the aid of fixed presentation formats, which is followed by a 20-40 minute discussion led by a moderator.[29]

Prior to the interview, participants were informed about the study objectives and design. Identity of interviewees was kept anonymous to both colleagues and department chiefs to protect confidentiality and promote openness. A topic guide was developed to guide the interviews (Appendix 1). First, participants were asked about their overall opinion on M&M practice and what factors may affect M&M success, defined as a conference that results in learning and improvement. This broad definition was intentionally selected to allow interviewees to freely explore what makes a successful M&M. Interviewees were encouraged to discuss experiences with M&M in both the local and other hospitals (e.g., due to hospital rotation during residency), as well as factors that they expected but never experienced. Further questions related to the perceived effect of factors that are most common in the M&M literature, related to the conference's structure (i.e., attendance, culture) and content (i.e., case selection, presentation, moderation, deriving plans).[3,29] Questions about experiences with the local M&M were used to evoke discussion of generic success factors and barriers (e.g., what illustrates that your M&M is [not] free of shame and blame?)

Each interviewee was interviewed individually in a conference room of a research department in the hospital. Interviews were audiotaped and transcribed in full. Anonymized transcripts were analysed using thematic content analysis with an inductive, data-driven approach, which involved a recursive process of open coding and collocating codes into themes.[30,31] Coding was performed in ATLAS.ti software (GmbH, Berlin, Germany) by the same researcher who individually conducted the interviews (MdV). This researcher has an MD degree and experience in research on M&M,[29,32] but no professional relationship with interviewees as she is currently not involved in clinical work. A second coder, who was a research assistant with qualitative research experience, independently reviewed all coded transcripts for continuity of data interpretation and any miscoded statements, and discussed with the primary coder until consensus was reached. To guide the analysis, emerging themes were structured across six domains of a pre-existing framework for barriers to and incentives for change in healthcare, developed based on various theories and models for implementing

change.[22] Domains included: case (adapted from 'patient'), action (adapted from 'innovation'), individual professional, social context, organisational context, and external context. Frequencies of reported factors were only reported when notably high, low or different between residents and faculty. Factors were assessed for their direction of effect (i.e., facilitator, barrier or both) and their pathways to achieve a successful M&M (i.e., how exactly does this enhance M&M-based learning and improvement?). The mediating pathways for M&M success identified in this study were subsequently assessed for their relation to existing, more general frameworks for improvement in healthcare.[22]

RESULTS

A total of 57 facilitators and barriers for M&M success were reported by interviewed professionals (Table 1). All were reported in at least three interviews, and data saturation was reached at the 10th interview. More facilitators than barriers were reported, with most facilitators at the case level, and most barriers at the organisational level. Many facilitators could also serve as a barrier if absent or insufficient (e.g., motivation), but for eight factors, of which four were at the social level, both positive and negative effects were perceived simultaneously (e.g., hierarchy) (Table 1). Illustrative quotes for all facilitators and barriers are provided in Appendix 2. Facilitators and barriers were grouped into 17 themes, which will be discussed per level of the framework for change in healthcare (Table 1).

Case/action level

The type of case discussed at M&M as well as the type of action items, were reported as influencing factors. Cases and actions dealing with clinically relevant and attractive topics (i.e., high severity/frequency and surgical technical issues) were perceived to increase sense of urgency to bring about change (Table 1).

> "*We like that [surgical technique]. We're all very practical people.*" (#7)

To enhance information transfer, presenters should be skilful, well-prepared and supervised, using fixed presentation formats to cover the case, pertinent literature, surgical skills and involved system-level factors. M&M was also seen as an important opportunity to address soft skills, such as communication or emotional impact. Including local data and trends was perceived to instigate reflection and increase the sense of urgency.

> "*(…) about pneumonia, everyone will be like 'oh no, boring', but if you present a concise plan and numbers and those things, then, I think that'd be very nice, because that concerns everyone.*" (#5)

Table 1. Facilitators and barriers to successful M&M practice, grouped in themes and structured across levels of a framework for achieving change in healthcare.

Theme	*Factor*	*Facilitator* (+)	*Barrier* (–)
I) Case level			
Type of case (1)	Attractive topic	+	
	Clinical relevance	+	
	Value for education/improvement	+	
Information (2)	Include local data	+	
	Literature	+	
	Skills education	+	
	Information from those involved	+	–
	Addressing system factors	+	
	Addressing 'soft skills'	+	
Presentation (3)	Qualified presenter	+	
	Proper preparation	+	
	Proper supervision	+	
	Fixed format	+	
II) Action level			
Type of plan (4)	Attractive topic	+	
	Clinically significant topic	+	
	More disciplines involved		–
	Higher complexity		–
Planning (5)	Explicitly formulated	+	
	Responsibility assigned	+	–
	Time frame determined	+	
	Included in protocols	+	
III) Individual level			
Motivation (6)	Intrinsic motivation	+	
	Interest in specific topic	+	
	Values/beliefs	+	–
	Other priorities/incentives		–
Participation (7)	Personality	+	–
Realisation (8)	Empowerment, control	+	
	Forgetfulness		–
IV) Social level			
Culture (9)	Safe environment	+	
	Team spirit	+	–
	Super specialization		–
Leadership (10)	Reinforcing attendance	+	
	Reinforcing actions	+	
	Hierarchy	+	–
	Exemplary behaviour	+	

Table 1. Facilitators and barriers to successful M&M practice, grouped in themes and structured across levels of a framework for achieving change in healthcare. (continued)

Theme	*Factor*	*Facilitator* (+)	*Barrier* (–)
Participants (11)	Participation of experts	+	
	Interactivity	+	
	Audience composition/size	+	–
	Multidisciplinary participation	+	–
Moderation (12)	Qualified moderator	+	
V) Organisational level			
M&M format (13)	Strong focus on improvement	+	
	M&M in specialist setting	+	
	Communications (before/after)	+	
	Too many cases per meeting		–
	No tracking of actions		–
	No check/feedback on effect		–
Reporting (14)	System for data collection	+	
	Difficult access to data		–
	Lack of feedback from data		–
Staff (15)	Dedicated staff/committee	+	
	Super specialization		–
	Staff turnover		–
	Other/conflicting expectations		–
Time (16)	Overall lack of time		–
	Receiving dedicated time	+	
VI) External level			
Healthcare (17)	Inevitability ('nature')		–
	Benchmarking	+	

Details regarding context and deliberations in cases should be obtained from those involved, but some residents added that (emotional) involvement might also bias judgment and hinder information accuracy.

Overall complexity of proposed actions was perceived as a barrier to implementation and considered to increase with the number of people or disciplines involved. Hence plans should be explicit, including a timeline and person in charge. At the same time, however, top-down task assignment could hinder implementation, referred to as 'mandatory volunteerism'.

> *"If you just send someone off like 'you go do that', that won't work, it has been proven."* (#9)

Individual level

In various ways, professionals perceived 'motivation' as a powerful and important facilitator for M&M, enhancing attendance rates, active participation, and subsequent realisation of actions (Table 1). Motivation was considered to improve when M&M covered topics applicable to one's own practice or field of interest, or when topics were accompanied by a sense of urgency.

Individual personalities were mentioned as potential facilitators as well as barriers, as for example insecurity may hamper speaking up, while other personality traits could be beneficial in that respect. Similarly, personal values and beliefs could enhance or impede motivation to attend, participate and carry out actions. Feedback on actions from prior conferences was considered essential to demonstrate the value of M&M

> "*Did anything change? (…) Feedback needs to improve greatly, otherwise it's so useless.*" (#10)

A barrier was perceived in that staff may prioritize other activities over M&M, such as clinical work or training duties (mostly mentioned by residents) or subspecialty-related activities (mostly mentioned by faculty).

> "*I'm particularly interested in my own service [i.e., subspecialty], those are my patients and my trainees.*" (#6)

Some noted that it should be prevented that M&M is considered a 'chore' as this decreases motivation, but others considered such 'chores' components of professionalism.

> "*(…) some things are chores, but just need to be done.*" (#4)

Social level

The need for a safe environment to allow for an open discussion was often expressed (Table 1). In this respect, a strong sense of team spirit was considered beneficial (e.g., counting on support from peers), but also a potential barrier as one may withhold comments to avoid offending a colleague, referred to as 'back-stabbing' (Appendix 2). Super specialization in surgery was mentioned by all but one interviewee, and considered to have negatively affected team spirit, decreasing interest and motivation for topics outside one's subspecialty.

> *"If you talk about pseudarthrosis, I'm sure no gastro-intestinal or vascular guy really enjoys it."* (#5)

Some suggested that M&M could therefore cover more general topics or increasingly focus on more general aspects, such as communication skills or teamwork involved, as these are shared among different subspecialties.

Leadership was assigned a critical role in harnessing this desired culture through exemplary behaviour and actively lowering barriers to speaking up.

> *"It helps to see that things at times go wrong even for someone you perhaps admire, some expert."* (#11)

Some believed that faculty attendance may set an example to juniors, but others believed that mandatory attendance should be actively reinforced with staff held accountable for absences. All stressed that leadership should check and reinforce progress of M&M-derived actions, and that hierarchy helps in this respect. At the same time, hierarchy may serve as a barrier to an open discussion.

> *"If you really want to promote free speech, then faculty should emphasize that hierarchy is put aside during such a conference."* (#7)

To steer discussions, promoting a safe atmosphere, the use of moderators was considered helpful.

While high attendance rates may serve as a motivator and increase available information and reach, a smaller audience size may better promote a safe and open environment. Similarly, audience composition (i.e., who is present) can both positively and negatively affect the discussion.

> "*You really think about who is involved and try to predict how that person will respond. In some cases, you'll decide: well, I'm not going to do that here.*" (#3)

Specifically, it was considered important to increase interactivity and involve experts or staff who had been involved in the cases, to enhance discussion quality and participant experience. Multidisciplinary participation was considered to provide essential information, but also to potentially negatively affect openness and level of discussions.

> "*Well then there might be some competence differences. Perhaps for some topics it could work, but not in general I'd say.*" (#9)

Organisational/external level

With regards to the M&M format, a strong focus on improvement, and (preceding) communications were considered beneficial. Handling too many cases was mentioned as a potential

barrier, as it may decrease attention and time for discussing opportunities for improvement (Table 1). With regards to the setting, most faculty (4 of 6) advocated for subspecialty rather than departmental M&M, as it would allow discussions to focus on subspecialist topics, which would increase participants' motivation and ability to change processes at their own ward. Moreover, super specialization may currently limit one's ability to attend M&M.

> *"My weeks are overloaded with duties related to my subspecialty (…) An unstoppable phenomenon. The generic conferences suffer from it."* (#4)

Reporting systems were appreciated for their value to collect local data, but lack of feedback was considered a missed opportunity to increase sense of urgency for topics and encourage reporting behaviour. Residents currently perceived a barrier in that it was too labour-intensive and difficult to access local data, while this could provide essential support for case selection, presentations and follow-up. Many also missed systematic follow-up, evaluation and feedback on prior actions at M&M.

> "*A sort of follow-up makes it all more cohesive, of course, it'll give you the feeling that you're all involved in a sort of improvement cycle rather than scattershot.*" (#8)

Lack of continuity due to typical staff turnover in teaching hospitals was considered to hamper (sustaining) improvements.

> "*With varying doctors and trainees, you simply need to repeat things.(…) another group arrives from another hospital, with a different standard practice, where they were used to do things differently.*" (#9)

It was suggested, mostly by faculty, to assign dedicated staff to monitor outcome data and implement plans for improvement.

> "(*…) in task forces because they'll put it on their agenda and have something to say about that topic, about quality.*" (#11)

General lack of time was mentioned in all but one interview, as an important barrier to preparation, attendance and realisation of actions. Similarly, staff may face too many, sometimes conflicting, expectations.

> "*We expect single individuals to fulfil all these requirements for clinical practice, research, training, leadership ánd management (…) that's thé inhibiting factor! Too many tasks and too many different tasks.*" (#2)

Receiving dedicated time to work on tasks arising from M&M was perceived to facilitate these processes.

> "*We rather do it at night to avoid missing surgeries, clinic or clinical… that's the focus of our training, clinical practice.* (…) *If we decide, and acknowledge [that M&M is of equal importance], then I think that we should organise it in such a way that residents receive half a day to do these things.*" (#7)

Only two external-level factors were reported: the 'nature' of healthcare, balancing risks and benefits (e.g., haemorrhage and thrombosis prevention) was perceived to prevent complete eradication of adverse events, and benchmarking local performance against other centres was often mentioned as an important facilitator, serving as a source of information and motivator.

Pathways to M&M success

The reported facilitators and barriers appeared to enhance or impede whether professionals are:

1) adequately *informed* to identify targets and plans for improvement;
2) *motivated* to participate in, and support, M&M practice and the ensuing actions;
3) willing and able to *realise* plans of action and bring about change.

Hence, 'information', 'motivation', and 'realisation' seemed to serve as potential mediating pathways by which M&M drives learning and improvement (Table 2). These pathways could also affect each other as, for example, information can motivate by increasing sense of urgency, which may ultimately enhance realisation efforts.

DISCUSSION

This qualitative study identified 57 different barriers and facilitators to successful M&M practice perceived by healthcare professionals, together covering 17 themes. Many factors concerned organisational aspects, but others related to the individual or team level, such as personal motivation or group dynamics. All factors affected whether participants are (1) *motivated* to participate and take action; (2) well-*informed* to identify targets and plans for improvement; and (3) willing and able to *realise* plans; representing the mediating pathways to M&M-based learning and improvement.

An important strength of this study lies in the qualitative approach, yielding nuanced insights that quantitative assessments cannot reveal. To illustrate, qualitative analyses revealed the complexity of various factors, such as hierarchy or team spirit, which appeared to have both positive and negative effects at the same time. Moreover, data saturation was achieved and

Table 2. Mediating pathways to M&M-based learning and improvmeent that are affected by reported facilitators and barriers.

	**INFORMATION** *(to know)* i.e., complete/clear/accessible information, presentations, data/trends, communications, feedback, input/discussion, dissemination.
	**MOTIVATION** *(to want)* i.e., participant attendance, participation, experience, engagement, support, sense of urgency.
	**REALISATION** *(to can/do)* i.e., ensure a clear objective and extensive plan, feasibility, empowerment for change, follow-up/tracking, (re)evaluation, sustaining.

many factors and pathways described in the study appeared to closely relate to more general frameworks and theories of learning and change. An important limitation is the single centre design of this study. The findings may particularly be representative of teaching hospitals as interviewees worked at an academic hospital and their prior M&M experience was mostly at other teaching hospitals. However, qualitative research does not pursue generalizability, but rather aims to explore and develop a deeper understanding of a phenomenon of interest. As interviewees worked in surgery these findings may not be fully representative of all medical specialties that practise M&M. Additional qualitative research is required to reveal whether the same facilitators and barriers apply to other specialties. This is likely the case, as the generic mechanisms by which clinicians learn and improve through these conferences will be more similar. Research on M&M in other settings, such as paediatrics and psychiatry, highlight similar success factors, including resources (i.e., time and staff),[33,34] leadership buy-in and presence,[34,35] input from all staff levels,[33-36] and loop closure.[33,35] Furthermore, in a previous study, we found that departments with great variation in M&M practice shared the same expectations and challenges for M&M.[29] Moreover, the study findings appeared to fit well within the more general frameworks for learning and improvement in healthcare (Appendix 3).

Comparison with existing literature

While M&M practice has often been subject of study, this is, to our knowledge, the first qualitative study of M&M success factors. The present study adds novel insights into the roles of various individual- and social-level factors, perceived as barriers, facilitators or both simultaneously (Table 1) an example being 'team spirit', which was perceived as a potential facilitator

as well as barrier to openly voicing one's opinions or concerns at M&M. Thus far, individual or team-level factors have received scant attention in the M&M literature, with the exception of the importance of 'a blame-free culture'.[2,5,12,20,37] This study confirms the importance of a safe environment, but also provides leads about what the desired culture or 'mindset' for M&M encompasses. It seems that M&M should *elicit* input from all participants,[10,15,16] and truly *value* such input from all corners. In other words, attention needs to be given to both the *sender* and *receiver* end to harness a truly open mindset at the conference. The value of input from other disciplines was appreciated by interviewed professionals, but multidisciplinarity was also perceived as a potential threat to the open environment that is so important for M&M. This finding adds nuance to previous studies advocating for multidisciplinary M&M, expecting only positive effects.[10,37-39] This study revealed three mediating pathways by which M&M may successfully drive learning and improvement, which were related to information, motivation and realisation (Table 1). While the role of motivation has received little attention in prior M&M research, more general publications about organisational learning or improvement have stressed the important role of individual and team factors, such as motivation.[21–24] After all, leadership can create strategies and improvement plans, but this will be insufficient without commitment and support of front-line staff-"culture eats strategy for breakfast".[24,40,41] Pathways to M&M success described in this study appeared to closely relate to more general frameworks for improvement and implementation in healthcare (Appendix 3). We attempted to translate the findings of this qualitative study to actionable recommendations, enlisted in Table 3, targeting one or more of the described pathways to M&M success. Some of these recommendations have been reported in prior M&M studies, such as using local data[42,43] and extensive planning,[10] but others more closely relate to learning behaviour literature, such as sense of urgency, motivation and being receptive to new ideas.[21,23,24,41]

Implications for M&M practice

The recommendations formulated based on the study findings, address some aspects of M&M organisation, but also aim to target challenges at the level of the (individual) professionals (Table 3). Various complexities embedded in healthcare culture may complicate M&M practice, one of which is working with colleagues with different hierarchical or expertise levels. These professional boundaries might be overcome by promoting the desired mindset for M&M. As with the 'culture of shame and blame', which used to be infamous for its presence at M&M, these issues could be targeted with, for example, moderators and local leadership, guided by principles of Just Culture.[44,45] As mentioned in the interviews, seniors or leaders can model desired behaviour and attitudes at M&M, by openly discussing personal errors and addressing the emotional impact. This is confirmed by the, to our knowledge, only other qualitative study of M&M, conducted in internal medicine, which described this type of role-modelling at the conference.[46] For example, the conference could start with framing the purpose as collegial and non-blaming, as used in recently developed novel formats for M&M.[33-35]

Table 3. Recommendations for successful M&M practice based on identified facilitators and barriers, and mediating pathways for M&M-based learning and improvement.

Recommendation	*Further details (related themes in Table 1)*
1. URGENCY **Select topics relevant to the audience and demonstrate a sense of urgency.**	Ensure topics are applicable to one's own practice, clinically significant and accompanied by a sense of urgency, e.g., by supporting presentations with (local) data on incidences and harm (1,4,13).
2. INFORMATION **Maximize informativeness and attractiveness of presentations.**	Use well-prepared presenters, engagement of those involved in cases, and fixed presentation formats including case details, literature, local/benchmark data as well as system-level and soft/human factors (2,3,6).
3. PLANNING **Be explicit in terms of action items and follow-up.**	Determine who will do what, when, and how, with a plan for follow-up and re-evaluation (5,10,13).
4. MOTIVATION **Motivate participants through interactivity and feedback.**	Ensure that participants are motivated, e.g., by using moderators to promote interactivity and 'close the loop' on prior actions through evaluation and feedback (6,10-14).
5. ANTICIPATION **Consider feasibility of actions, and anticipate and counter problems.**	Anticipate and plan how to counter problems with realisation and sustaining of actions, e.g., due to complexity, lack of empowerment or engagement of all staff involved, or staff turnover (4,7,10).
6. INPUT **Draw upon collective expertise of participants.**	Ensure presence and input from all involved in care processes, e.g., by actively inviting comments from experts, juniors or other disciplines (7,9-11).
7. RECEPTIVITY **Cultivate an open mindset, receptive to all input and opportunities.**	Emphasize that input of all involved in care is essential and valued as such, and underline the need to be sensitive to 'weak signals' that may signal opportunities for improvement (7,9-13).
8. SETTING **Consider M&M meetings in specialist settings**.	In meetings on the subspecialty or multidisciplinary level ('integrated care'), participants may be more informed and in control as topics are more closely related to their daily practice (8,9,13,15).
9. RESOURCES **Dedicate time and staff to M&M practice and ensuing plans for improvement.**	Consider blocking time for attendance but also preparation and realisation of actions, and consider use of a dedicated committee or staff to implement plans that ensue from M&M (6,10,15).
10. DATA **Use local/benchmark data for information and (timely) feedback**	Ensure that data collection and monitoring systems are accessible to allow assessment of local performance, benchmarking against others and re-evaluation of prior plans for improvement (14,17).

There is no hierarchical order in this list. How recommendations relate to earlier published frameworks for improvement in healthcare and to mediating pathways, is depicted in Appendix 3.

An important question for future research appears to be how to motivate and engage all participants to receive the necessary input and support to actually improve clinical practice. Interviews reflected the paradoxical nature of hierarchy in this respect, as this can both help and hurt staff's motivation and support. Another solution may be to organise M&M in smaller, focused settings, such as subspecialties[15] or integrated care. Interviewees also perceived motivational effects of reviewing local or benchmark data and follow-up of actions from prior conferences, which could be incorporated into M&M practices to motivate participants and demonstrate the value of M&M.[5,20] More time for feedback and assessment of prior initiatives

would mean that fewer topics can be discussed at M&M or that extra time needs to be made available, but this would both be worthwhile considering the expected positive effects on achieving sustainable improvements.

CONCLUSIONS

This study enhanced understanding of the factors influencing M&M-based learning and improvement, and the pathways by which this occurs. Many factors were related to the individual or team rather than how M&M is organised. These insights may be used to improve M&M practices, and provide a framework for further study on determinants of M&M success. Future research is warranted to investigate success factors for M&M, and specifically the extent to which these are transferable to other settings, in order to design a universally applicable best practice for M&M.

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APPENDIX

Appendix 1. Topic list for semi-structured interviews with attending surgeons and residents.

Introduction

- Background and objectives
- Information about interview (anonymity, safe)
- Information about participant: years of work experience at the department.

Morbidity and Mortality conference (M&M)

- How do you feel about M&M practice? What do you value? What do you miss/would you like to change?
- Do you consider M&M part of your profession (i.e., core business)?
- What affects whether learning occurs through M&M?
- What affects whether improvement occurs through M&M?
- What is the role of adverse event reporting in this?

Other topics:

Case selection

Prompts:

- What criteria should be used to select cases for M&M and why?
- Could a case of another surgical subspecialty be of educational value (to you)?

Presentation

Prompts:

- Who could best present the case and why? (senior or junior staff; involved in case or not)
- Would a fixed presentation format be beneficial or limiting?
- What information is essential to a successful M&M (e.g., local data)?

Attendance

Prompts:

- To what extent do logistic factors, e.g., OR schedules, influence M&M attendance rates?
- Would attendance rates benefit from mandatory attendance, e.g., with sign-in sheets, or from exemplary behaviour of staff?
- How would personal beliefs or motivation influence attendance rates?

Moderator

Prompts:

- Who could best moderate and how?
- To what extent does the moderator influence success of M&M (e.g., environment)?

Culture

Prompts:

- Is there an open environment, free of shame and blame? What illustrates or influences that?
- If you're at another department, how could you assess whether there is a blame-free culture?

- Example: a postoperative haemorrhage case is presented at M&M, you've also been present in the operating room and you now remember that you had doubts about haemostasis, would you mention that? What (potential) consequences could such a comment have?

Plans for improvement

Prompts:

- What affects whether formulated plans of action are successfully implemented?
- Are lessons explicitly formulated and documented? How would this affect implementation?
- How are plans tracked for implementation? Who should be responsible for this?

Appendix 2. Facilitators and barriers for successful M&M at different levels for achieving change in healthcare with quotes.

Theme	Facilitator (F) and/or barrier (B)	Illustrative quote
I) Case level		
Type of case	Attractive topic (F)	*'Surgery (…) something technical, you can visualize, (…) makes it easier to remember and to disseminate it to others(…) It might be more, well, fun, to learn about something 'operative'.'(#8)*
	Clinical relevance (F)	'*While some topics may be less interesting (…) pressure ulcers or hospital acquired pneumonia for example, these are still of clinical relevance.'(#1)*
	Value for education/ improvement(F)	*'A preference to discuss recent cases makes that you select a severe haemorrhage case while that actually went very well all year. It's key to identify and select real targets for improvement.'(#5)*
Information	Include local data (F)	*'Especially if you review your own numbers, that would provide valuable insights.'(#3)* *'(…) pneumonia, everyone will be like 'oh no, boring', but if you present a concise plan and numbers and those things, then, I think that'd be very nice, because that concerns everyone.'(#5)*
	Literature (F)	'*Why do I have to see 6000 graphs? (…) Just use the conclusions of the best papers (#1)'* '*Just a few relevant papers, somewhat related to your own patient population.'(#8)* '*Everyone thinks 'Well, how's our performance? Where are we compared to the literature?'(#9)* *'Nationally, globally, are we above or below the line?'(#11)*
	Skills education (F)	*'The presentation needs to include the very technical things, regarding surgical techniques.'(#6)* *'You just want to prevent those errors and that's purely technical I think.'(#10)*
	Information from those involved (F+B)	*F: 'If you've been involved, it's nice to present that case and the content benefits from it too.'(#9)* *B: 'The disadvantage of being emotionally involved is that you're sort of biased. [And can that bias impede learning?] Well yes, I think, cause it's only part of the story, from someone who's emotionally involved (…) difficult to keep it factual when the message is already 'coloured' .'(#7)*
	Addressing system factors (F)	'*I think, if the focus of the conference would shift towards system-level improvement, one would be more inclined to offer their opinion (…) it would yield more input.' (#5)*
	Addressing 'soft skills' (F)	'*That's where this conference should be about (…) because then you don't learn from each other about content knowledge, but behavioural aspects – something 'the department' still shares (#2)'* *'we are humans (…)let's go back to the moment it happened: What did you forget? What were you doing? Were you busy? (#7)*

Appendix 2. Facilitators and barriers for successful M&M at different levels for achieving change in healthcare with quotes. (continued)

Theme	Facilitator (F) and/or barrier (B)	Illustrative quote
Presentation	Qualified presenter (F)	'*It requires a skilful presenter otherwise, the pitfall is that it becomes a dry enumeration of things, while it should be lively, it's particularly all about the discussion.' (#11)*
	Proper preparation (F)	*[What makes that it does result in concrete targets?] 'The level of preparation by all means.' (#1)*
	Proper supervision (F)	*'As long as there's proper supervision. No, it's not about the presentation of course, it's about the well-thought construction of your story, all things sorted out and whether these are correct.'(#3)*
	Fixed format (F)	*'Yes I think that has benefits [a fixed format], it makes it easier to make, for residents, less time, and you don't provide them the space to stray off topic, that it'll get to lengthy.'(#4)*
II) Action level		
Type of plan	Attractive topic (F)	'*If it's about a thread that resorbs faster, we're all extremely eager to say: 'we should use thát!'(…) while if it's about antibiotics 1 day more or less, it really doesn't interest anyone.'(#1)*
	Clinically significant topic (F)	*'Patients might die (…) is life threatening, so then you've got an incentive to do something.'(#3)*
	More disciplines involved (B)	*'How many people in the organization are involved? Lessons [i.e., to improve future care] that involve thousands of stakeholders are more difficult than those you can realize on your own.' (#4)*
	Higher complexity (B)	*'Some things are technical, you can visualize them (…) a clear intervention, because you either do it or you don't – while others more greatly depend on multiple factors.' (#8)*
Planning	Explicitly formulated (F)	*'I think because, it is most interesting when you head home thinking 'Darn. I'll do that differently tomorrow'. (…) and preferably within 15 minutes. Short and concise'(#11)*
	Responsibility assigned (F+B)	*F: 'It shouldn't be non-committal, you should really earmark people.'(#11)* *B: 'If you just send someone off like 'you go do that', that won't work, it has been proven.' (#9)*
	Time frame determined (F)	*'Give it a month and then: 'Well a month ago we've discussed this, what has been done?' Then you really trigger someone.'(#5)* *'We'll discuss this in 3 months and then we'll assess progress, did anything change?' - that way it's not so vague. It will be remembered and will definitely have a follow-up attached to it. (#9)"*
	Included in protocols (F)	*'It's challenging to translate lessons learned into changes in protocols or policies, but once you've connected those, well yes, then you're really going to improve your quality. (#9)*

Appendix 2. Facilitators and barriers for successful M&M at different levels for achieving change in healthcare with quotes. (continued)

Theme	Facilitator (F) and/or barrier (B)	Illustrative quote
III) Individual level		
Motivation	Intrinsic motivation for QI (F)	*'In part it's about your motivation for that, that you just want to, just want to improve. If you're like 'it will all work out', yes, well, then nothing will happen.'(#1)*
	Interest in specific topic (F) (applicable, interest, urgency)	*'(…) when it's personal, when it's applicable to your own work, then you learn from it (…) also when it involves your own surgical service then it suddenly becomes top priority.'(#11)*
	Values/beliefs (F+B)	*F: '(…) experienced as a chore, which in itself isn't bad (…) some things are chores, but just need to be done' (#4)* *B:'If you consider your job to be solely about operating, then you're not interested (…)'(#11)*
	Other priorities/ incentives (B)	*'[residents] don't do it [free up time for actions], because we rather do it in the evening to avoid missing surgeries, clinic or clinical.. that's the focus of our training, clinical practice'(#7)*
Participation	Personality (F+B)	*F:'It has to do with the type you hire. If it's the timid, anxious – yes, well then little will be said. But if you hire people with a big mouth, you will hear a lot of talking but not a lot of content (…) I think, you should tell the juniors: listen, if you don't dare, then you shouldn't be here.'(#2)* *B: 'I think that [fear of speaking up] is in part related to personality, I want to avoid offending others, so that's something that has to do with me personally rather than the environment.'(#7)*
Realization	Empowerment, control (F)	*'If it's about knot X instead of Y, that's something we can execute, we understand that, we are in control for that, and thus we will do it. (…) Surgeons are particularly in control in the OR.' (#7)* *'No matter how hard I'd try if they [anaesthesia] won't do something then they don't want and I can't influence that; while if a certain thread has better outcomes, I can change that myself.'(#9)*
	Forgetfulness (B)	*'But we haven't done that [actions] yet. Just because other things receive priority and because you simply forget about it.' (#8)*
IV) Social level		
Culture	Safe environment (F)	*'There needs to be an open environment, non-judgmental, I think that is the crux of the matter, because otherwise you won't learn anything, people will put their foot down and get angry.' (#9)*
	Team spirit (F+B)	*F: 'They [subspecialty]know what I'm worth and I know their capacities, which creates a safe environment [for speaking up].' (#1)* *B: 'It's considered 'not done' - to not support each other [in discussions] – it's disloyal.' (#7)* *'Backstabbing undermines team spirit and most people in surgery are team players (…) so you'll always behave in the interest of the team.' (#8)*
	Super specialization (B)	*'It's not 'us surgeons' anymore, it's a totally different organization.'(#2)*

Appendix 2. Facilitators and barriers for successful M&M at different levels for achieving change in healthcare with quotes. (continued)

Theme	Facilitator (F) and/or barrier (B)	Illustrative quote
Leadership	Reinforcing attendance (F)	*'It sounds bland, but it works, someone who says angrily: 'You have to attend, I'm the boss.'(#4)*
	Reinforcing actions (F)	*'It works to promote action (…) that you'll fulfil your commitments (…) when you fear that if you won't do it you will get a roasting.'(#7)*
	Hierarchy (F+B)	*F: 'It's [attendance behaviour] more due to hierarchy, e.g., if attending X is always there, you'd need a good reason to be absent when X is there. He's got more important stuff to do than you, so it's probably important then. I definitely think that works.'(#3)* *B:'If you really want to promote free speech, then faculty should emphasize that hierarchy is put aside during such a meeting.'* (#7)
	Exemplary behaviour (F)	*'I think if you're a resident on a rotation and a faculty member will also be absent, they you'd think, well why would I go? Yes, it's a sort of exemplary role.' (#1)*
Participants	Participation of experts (F)	*'Input from someone with experience, more 'master level' in addition to trainees. (…) Yes, [someone involved in the case] with enough 'flight hours' to be able to evaluate it.' (#1)* *'It's about content experts. (…) Half of our faculty members don't even know how to prescribe medications with the hospital software, so they shouldn't say anything about that.'(#2)*
	Interactivity (F)	*'[moderators]can evoke discussion by asking stimulating questions giving people in the audience the opportunity to respond.' (#12)*
	Audience composition/ size (F+B)	*F: 'Some people are more receptive to critique than others.' (#4)* *'The conference benefits from high attendance rates.' (#8)* *B: 'Well that [courage to speak up] depends on who's present, their interests and whether you could damage people.(...) It's by all means safer to discuss things in a smaller group.' (#1)* *'I think in a smaller setting (…) less [plans] will 'get lost'. It's a disadvantage that you reach fewer people, but the advantage is that less is lost.' (#3)*
	Multidisciplinary participation (F+B)	*F: 'If a nurse was involved then she needs to be present too. (…) We could discuss interesting cases with other specialists (…) we can really learn a lot together.'(#6)* *B: 'For some, if, say, nurses and other people are present, you would perhaps be less inclined to tell your boss that something went not so well.'* (#5)
Moderation	Qualified moderator (F)	*'The role of the moderator, who has an important role in lowering the barrier [to speaking up] and be inviting, to create an environment that allows that. (#1)*

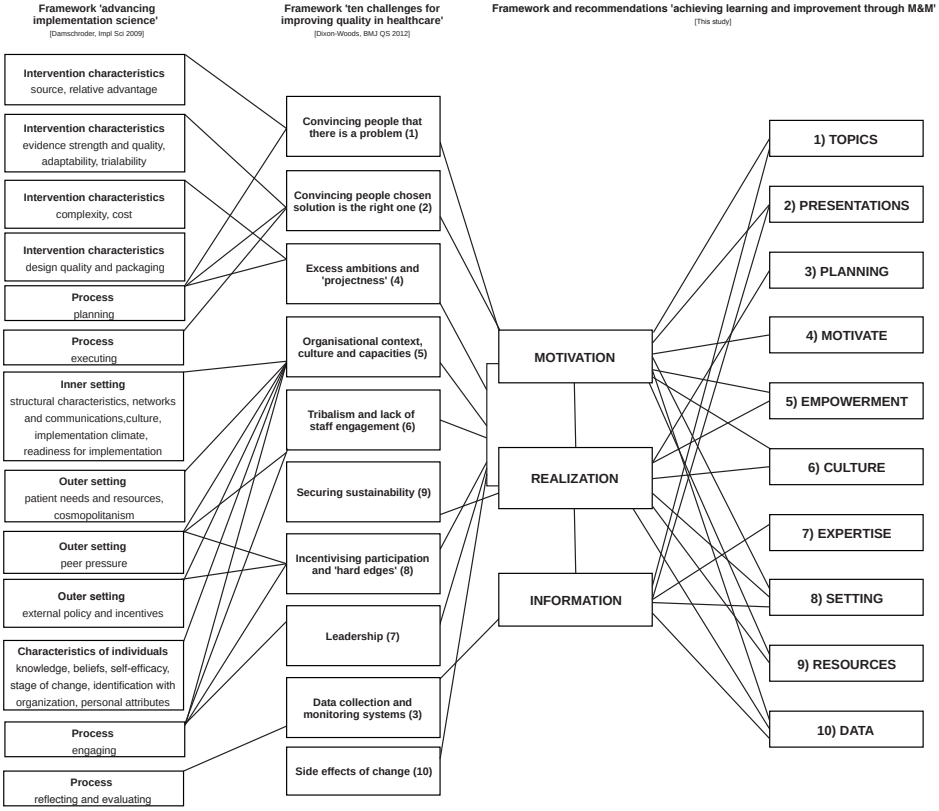
Appendix 2. Facilitators and barriers for successful M&M at different levels for achieving change in healthcare with quotes. (continued)

Theme	Facilitator (F) and/or barrier (B)	Illustrative quote
IV) Social level		
M&M format	Strong focus on improvement (F)	*'We should attribute more time to exploring how we're going to improve (…) this conference is meant to achieve improvement rather than to present the most exciting case of the month.'(#5)*
	M&M in specialist setting (F)	*'For subspecialist themes, I think the output will be much better if you'd discuss those in a smaller group within the surgical service, there will be a much safer environment too.'(#1)* *'Like love. I'm in love with my service and I'd do everything to ensure things run smoothly'(#6)* *'If it concerns your division, then you're really motivated to get those [complication] numbers down, then it suddenly becomes top priority.'(#11).*
	Communications (before/after) (F)	*'(…) to send out some sneak previews, that will motivate people to attend.' (#8)* *'If something derives from it, it'll be nice to know, but you'd have to keep the email short.'(#5)*
	Too many cases per meeting (B)	*'You won't make it [to discuss many cases] and it takes up so much energy and time, that you might miss lessons to be learned from cases.'(#8)*
	No tracking of actions (B)	*'And then what? It [action] ends up in a folder or email or something, that's not working.'(#3)* *'You'd have to check whether it was actually done. [Is it now?] No.' (#12)*
	No check/feedback on effect (B)	*'Did anything change? (…) Feedback needs to improve greatly, otherwise it's so useless.' (#10)* *'According to improvement cycles you need a check (...) also to see if it had the right effect.'(#12)*
Reporting	System for routine AE reporting (F)	*'You'd have to register otherwise you don't know what you're doing. It's a terrible task; I'm really bad at it. But yes, you have to, because you want to learn from your performance.'(#5)*
	Difficult access to data (B)	*'[Omitted because] it's a lot of work to retrieve data or we don't really know it that well.'(#12)*
	Lack of feedback from data (B)	*'The feedback is lacking. If you (…) only infrequently hear about an adverse event, you don't apply it to yourself. (…) It's all about feedback! Register, feedback, show the real world.'(#11)*

Appendix 2. Facilitators and barriers for successful M&M at different levels for achieving change in healthcare with quotes. (continued)

Theme	Facilitator (F) and/or barrier (B)	Illustrative quote
Staff	Dedicated quality committee/group (F)	'(…) *requires leadership to evoke actions at the right moments by saying 'OK now we have to do this and now that.' That requires a group within the department that stands for that.*' (#2). *'By embedding that [actions]in task forces because they'll put it on their agenda and have something to say about that topic, about quality.' (#11)*
	Super specialization (B)	*'It's difficult to find time to meet, because we all do different things. (…) We share the surgical department, but we don't share anything in terms of topics or daily practice.'(#2)*
	Staff turnover (B)	*'A hospital like this is run by temporarily staff, residents who rotate. You can't count on the collective memory, cause it disappears.' (#3)* *'Try to maintain such a thing! In the sense that, new people arrive constantly' (#4)*
	Other/conflicting expectations of staff (B)	'*As long as we expect single individuals to fulfil all these requirements for clinical practice, research, training, leadership ánd management - we'll miss important moments. (…) that is thé inhibiting factor! Too many tasks and too many different tasks.'(#2)* *'I find the work load on employees bizarre in certain cases. (…) It's just too much.'(#3)*
Time	Overall lack of time (B)	*'All conferences.. apparently everyone is a lot busier than 10 years ago. There's no time.'(#4)* *'To do a good job [as presenter], takes a lot of time. I think that's thé biggest bottleneck. I really think so, cause during working hours you just can't find the time for that.'(#12)*
	Receiving dedicated time for QI (F)	*'That [block OR time for M&M] provides you the space. (…) Apparently it's what we need.'(#9)* *'If we decide, and acknowledge [the importance], then give half a day.. I think that we should organize it in such a way, that residents receive half a day to do these things. We'd have to'.(#7)*
V) External level		
'Nature'	Inevitability of AEs (B)	*'Well.. whether you'd always learn from it.. in the sense that a year later they [AEs] will occur less often, I don't know. I think there's a certain lower limit you can't overcome.' (#4)*
Other hospitals	Benchmarking (F)	*'It's nice to benchmark to the rest of the world. How often does this happen here and somewhere else.. what are renowned centres, what're there numbers (…) can make it very urgent.'(#11)* *'If we exceed the global or European incidence rates, then you'd have a need to assess that trend.' (#6)*

Appendix 3. Relation of published frameworks for improvement in healthcare to this study's model of mediating pathways and practical recommendations.



From left to right: 'Consolidated Framework For Implementation Research' (CFIR)[1;] framework from 'Ten challenges for improving quality in healthcare'[2], and this study's pathways and recommendations for M&M.The relation between the first and second framework is depicted as described in the paper by Dixon-Woods et al.[2]

References:

1. Damschroder LJ, et al. *Implement Sci.* 2009;4:50.
2. Dixon-Woods M, et al. *BMJ Qual Saf* 2012;21:877-84.