Taking Morbidity and Mortality Conferences to a Next Level: The Resilience Engineering Concept

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The Resilience Engineering Concept

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Objective: To explore possibilities to improve morbidity and mortality conferences using advancing insights in safety science.

Summary background data: Mortality and Morbidity conferences (M&M) are the golden practice for case-based learning. While learning from complications is useful, M&M does not meet expectations for system-wide improvement. Resilience engineering principles may be used to improve M&M.

Methods: After a review of the shortcomings of traditional M&M, resilience engineering principles are explored as a new way to evaluate performance. This led to the development of a new M&M format that also reviews successful outcomes, rather than only complications. This ''quality assessment meeting'' (QAM) is presented and the first experiences are evaluated using local observations and a survey.

Results: During the QAM teams evaluate all discharged patients, addressing team resilience in terms of surgeons' ability to respond to irregularities and to monitor and learn from experiences. The meeting was feasible to implement and well received by the surgical team. Observations reveal that reflection on both complicated and uncomplicated cases strengthened team morale but also triggered reflection on the entire clinical course. The QAM serves as a tool to identify how adapting behavior led to success despite challenging conditions, so that this resilient performance can be supported.

Conclusions: The resilience engineering concept can be used to adjust M&M, in which learning is focused not only on complications but also on how successful outcomes were achieved despite ever-present challenges. This reveals the actual ratio between successful and unsuccessful outcomes, allowing to learn from both to reinforce safety-enhancing behavior.

Keywords: morbidity and mortality conferences, patient safety, quality improvement, resilience engineering, team reflection

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Originated in the early 20th century, Morbidity and Mortality conferences (M&M) have been a longstanding tradition in surgical care to improve quality through case-based learning of adverse events and incidents.[1] Also known as the ''golden hour of surgical education,'' the conference has been a platform for a department-wide discussion of cases with suboptimal outcomes. Despite being appreciated for its value for education, studies have shown that M&M do not meet expectations for continuous learning and system-wide quality improvement.[2–4]

Recent developments in safety science are moving away from a sole focus on adverse events to a strategy directed towards enhancement of team capacity and resilience.[5] Resilience (or resilient performance) is defined as ''*the ability of an organization to adapt behavior prior to, during or following changes and disturbances, in order to sustain operations under both expected and unexpected conditions*.''[5,6] Although not studied before, these rapidly evolving principles in safety management might have potential for the enhancement of resilient performance of surgical teams, and thereby the overall quality of surgical care.

This article reflects upon M&M practice, by discussing the history and available evidence for M&M, and developments in safety science and their opportunities for future improvement of how we reflect on delivered surgical care and promote safe and reliable surgical care.

THE (NON)SENSE OF MORBIDITY AND MORTALITY CONFERENCES

Based on the principle of learning from error, M&M aims to fulfil both a quality improvement and an educational purpose. However, as a result of the absence of a ''golden standard,'' a wide variety in M&M-practice is apparent,[2,7,8] and it remains unclear how to structure the conference to have good impact on quality improvement. Some surgical groups merely discuss selected interesting cases, whereas others make great effort to register complications and use the data from registries to reflect on the delivered care. Commonly, higher severity grades of Clavien-Dindo classified complications form the basis for the selection of cases to be discussed.[9,10] The comprehensive complication index[11] is used in some centers to select cases for discussion at M&M. For example, cases with comprehensive complication index values above the benchmark values of respective procedures at discharge, or better at 3 months, must be presented at M&M.[12]

Previous studies have suggested that M&M is too focused on individual performance rather than the wider system in which these individuals provide care.[7,13–17] That is, a general M&M tends to address unique or severe complications, with individual and technical issues, rather than systemic issues, emphasized as a root-cause in the analysis. Although individual skills and responsibility are very important, a specific focus on individual performance hampers efforts to achieve long-term improvements. There are strong arguments in the literature that improvement frequently requires addressing system-level factors,[18,19] as also incorporated in Accreditation Council for Graduate Medical Education (ACGME) core competencies for residents in the United States.[3,8] The ACGME mandates that a set of 6 competencies, among others ''system-based practice,'' should be acquired by every graduating resident,[20–22] underlining the importance of a system-wide approach for patient safety.

The combination of a focus on negative outcomes and a focus on individual performance, has another serious drawback namely that it increases the risk of ''shame and blame,''[23–26] which forms an important barrier to learning, as addressed in landmark publications such as Bosk's research on surgical training,[27] Wachter's book on medical error[28] and the reports of the Institute of Medicine.[29] In the

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aftermath of an (serious) adverse event most clinicians experience feelings of incompetence or guilt. These feelings hamper subsequent surgical activities of the involved professional and can have serious consequences even to an extent that surgical practice can no longer be performed. This phenomenon is often referred to as ''second victim.''[30] Discussing morbidity and mortality with a focus on individual performance might emphasize these feelings and can undermine morale for the whole surgical team.[31]

LEARNING FROM SUCCESS

Whereas the vast majority of outcomes in surgical practice are actually successful despite irregular circumstances and limited resources, these cases rarely get any attention. An imaginable argument for this is that when nothing goes wrong, there might be nothing to learn and therefore no time should be spent on discussing these cases. Safety scientists would argue, however, that it is exactly in these cases that professionals carry out a wealth of activities (some trained, others improvised) to ensure that nothing goes wrong. This ''resilient performance'' allows to achieve success in most cases despite the varying circumstances and limited resources (limited time, manpower, and accurate information) that could easily lead to failure.[32] Patient safety relies on dedicated clinicians, who need to adapt to the varying circumstances and the specific characteristics of the individual patient. Teams need to compensate for problems and cope with uncertainty and complexity of every day practice. This presents challenges to professionals to fulfil their tasks despite constant pressure on staff and budgets. Because the traditional format of M&M has a sole focus on learning from error, M&M disregards all situations where the resilience of professionals and the way their team adapts has led to desired outcomes. As a result, little to nothing is learned from these valuable situations, which hampers our efforts to learn from the past to further improve the care we deliver to future patients.

RESILIENCE ENGINEERING

Concepts from safety science can be used to redesign M&M in an attempt to overcome its current shortcomings for learning and improvement. A theory that is gaining ground in the field of quality and safety management, originated in safety science and specifically in the field of resilience engineering, is directed to enhancing resilient performance. This resilient performance entails the potential for perform under varying circumstances, by adjusting one's work before, during or after expected and unexpected circumstances.[6,33] Resilience engineering principles serve as a different view on safety in high-risk industries by looking at both successes and failures. Consequently, rather than defining safety as the absence of harm, safety is regarded as the ability to achieve safety by making adjustments and trade-offs in response to challenges.[34]

Applying resilience principles to practices for learning in the high-risk environment of surgical care, would shift the focus from sole attention for negative outcomes, such as complications, to focus on daily practice as a source to reflect on and learn from. The original thinking behind M&M reasons that adverse events happen because something has gone wrong, and that finding the cause allows to eliminate it and thereby prevent future recurrence of the adverse event.[35] Yet, in the analysis of the adverse event it is rarely acknowledged that most outcomes from similar procedures are successful, thereby leaving the factors that contributed to these successful outcomes undiscussed. Cases in which everything goes according to plan and those with an unplanned adverse course share a similar basis, which consists of skilled professionals working in teams and using various technical resources. In all cases, teams make a great effort to adjust their work to match the situation. In hindsight, these adjustments may prove to have contributed to a successful outcome or not. When viewed as the result of a collective effort to create safety in the complex reality of everyday practice, it is only sensible to try to learn from these efforts that lead to successful and unsuccessful endings.[36,37]

As opposed to using M&M for studying adverse events, it can serve as a platform for recognizing that surgical practice results in a wide spectrum of outcomes (eg, expected good, unexpected bad or unexpected very good). This can give rise to the assessment of *why* an outcome was ''good'' and how one can facilitate the behavior that led to achieving the desired outcome. When able to identify what adjustments were necessary to overcome problems, which eventually helped to ''get the job done,'' this safety-enhancing behavior can be supported.

To enhance a team's resilience, attention should be directed to the *ability to respond* to irregularities and disturbances; the *ability to monitor* components that could have affected performance; the *ability to learn* from experiences; and the *ability to anticipate* potential disruptions and constraints. These cornerstones are explicitly mentioned in the resilience engineering principles.[6,33] Responding means knowing what to do, rather than being surprised by it. Systematic monitoring helps to identify factors that can affect the team's performance, either positively or negatively. Learning adds to future resilience by extracting the right lessons from experiences, both the successful and unsuccessful. Lastly, anticipation assures that a team is aware of future developments, such as novel difficulties, potential disturbances, or rising opportunities.[38] Resilience eventually makes healthcare teams able to recover quickly from an unsuccessful outcome, foresee possible risks and know how to turn a thing for the better, to achieve success rather than a ''failure to rescue.''[39]

Resilience principles are gaining ground in other fields, such as aviation,[40] air traffic management[41] and other high-risk industries.[42] Recent research from NASA Langley Research Centre recommends to shift from investigating only large scale incidents in commercial aviation, to assessments of routine successful flights, because a flight crew makes sensible adjustments in response to something happening (eg, changing weather or aircraft malfunction).[40] The researchers state that safety management is often largely based on a small sample of nonrepresentative data, whereas data on behaviors that contribute to regular safe flights are lacking; to enhance safety, it is essential to create a system that takes safety-producing behavior into account.

There are, to the best of our knowledge, no studies assessing the use of resilience engineering principles to improve resilience of surgical teams. Nevertheless, various activities already indicate that resilience gets implicit attention. A clinical handover that happens every morning and afternoon, serves as a mean of a formal moment to discuss, evaluate and indirectly learn from a diverging range of cases. Moreover, one frequently monitors and anticipates during these discussions. Also, Team Simulation Training on the basis of Crew Resource Management is commonly used to explore how teams operate in different scenarios, and moreover to teach how to improve team performance.[43,44] Apart from Crew Resource Management acknowledging human factors as the underlying cause for errors, both methods are based on the principles of learning to monitor incipient events and anticipate on situations, but foremost to reflect on performance. This shows that the surgical community has recognized the importance of developing and enhancing teamwork, which has contributed to the present level of resilience. Yet, a platform to reflect as a team on system-wide care may help to enhance resilient performance in a more ongoing and transparent manner.

DEVELOPMENT OF A NEW TYPE OF MEETING

Enhancing resilience in teams demands frequent lowkey consultation between team members on how the team is performing, where a team can adapt or improve, and what risks can be foreseen in

the future. An essential part of resilience engineering concerns a regular, systematic and well-scheduled evaluation of the work performed.[33] This implicates that a meeting should be developed to reflect on the delivered care, by discussing both desired outcomes and less or not successful care.

A new form M&M conference should meet the aforementioned need to look from a wider perspective at surgical performance. It should be a frequent, once a week meeting with the relevant team, which in surgery means the specific surgical service, nurses, and paramedical staff. For this team meeting we propose the term "'quality assessment meeting (QAM)." The decentralized design per surgical service brings reflections on delivered care closer to the involved teams. Lessons learned in the team can be shared on larger extent with the whole surgical department in a ''Department Quality of Care Meeting'' with lower frequency (once a month).

The QAM, that needs to be prepared in advance, consists of a discussion of (all or selected) discharged patients of the specific surgical service, including both the desired and undesired outcomes (Fig. 1). Patients that experienced a brief hospitalization without any specific remarks can be evaluated briefly, whereas more complex cases may need more discussion. In addition, the next planned surgeries should be reviewed in anticipation of their inpatient admission the following week, to identify possible irregularities. For specific adverse events literature is reviewed and discussed by means of a monthly literature review.

Such meetings were implemented in the subspecialty subsections of the Surgical Department of the Leiden University Medical Centre. In addition to the above format, several administrative aspects are checked and finalized. The adverse events are systematically documented in the patient's electronic health record during hospitalization, and are to be affirmed in the meeting. This includes checking on the medical term and severity score based on the Clavien-Dindo classification.[45] Cases with $\geq$3 adverse events during 1 admission or with adverse events with severity grade >II, are automatically selected for a more extensive discussion on the preventability and implications for a similar next scenario. A summary of the discussion is subsequently marked in the patient's health record and a lesson to be learned is documented.

EVALUATION OF THE NOVEL M&M FORMAT

A local evaluation of the novel meeting type was performed through a combination of prospective observations and an electronic survey among participants, 1 year after implementation of the QAM at the vascular, transplantation, gastro-intestinal/oncological, and trauma surgery service.

A total of 35 meetings were observed by a single observer that was not involved in clinical decision making (MJV). A regular QAM was attended by a mean of 4 attending surgeons and 3 residents and/or PA's (a mean of 75% of a surgical service). The mean duration of the meeting was 60 minutes for each of the 4 surgical services, to discuss a mean of 10 discharged patients from the previous week. The number of scheduled surgeries ranged from 5 to 7 per surgical service per week.

Observations revealed that reviewing recently discharged patients generally led to an extended, frank, and constructive discussion among attendees. In these discussions, current literature was cited, or expert opinions were shared to offer clarification of the case. Reviewing a surgical technique for instance, stirred up motivation and a deep-rooted professional interest in participants. Discussing all patient cases, including those with a desired and those with an undesired course of events, seemed to lead to a rather novel type of discussions, leading to novel insights listed in Box 1. For example, successful outcomes and even cases with unexpected success were now reflected upon, whereas this used to be uncommon in previous M&M. This moreover seemed to have a positive effect on team morale. The fact that the meetings' approach was to discuss all discharged patient cases rather than selected surgical complications, seemed to trigger reflection on the entire clinical course of the patient as opposed to mainly focusing on specific (negative) events (Box 1). This commonly resulted in a discussion on ward-related (pre and postoperative) issues, rather than a focus on technical, intraoperative issues, which was, as described previously, considered one of the problems with traditional M&M practice.[46,47]

As a result of the short interval between patient discharge and the QAM, a short feedback loop was established, as opposed to discussing a case weeks or even months later. The memory of the course of events was still vivid for the surgeons involved with the case, which added to the depth of the discussion.

A total of 38 participants responded to the survey, which corresponds to 65.5% of the clinical staff (appendix 1, http://links.lww.com/SLA/C589). A total of 21 surgical attendings (response: 68%) participated in the survey, versus 17 residents and physician assistants (PA) (response: 63% of total). The observation-based findings were supported by a majority of the respondents agreeing that the QAM was useful as a means to trigger reflection on one's own decisions and performance (60.6% agrees). Secondly, the respondents reported that the new format benefits completion of administrative work (73.7% agrees) and addressing logistic issues for upcoming surgeries (73.6%). The addition of patient complaints, incident reports or sentinel events was suggested as an extension that could improve the QAM even more.[48,49]

CHALLENGES WITH A NOVEL TYPE OF MEETING

To substitute traditional M&M practice for a different patient safety initiative demands a different way of reflecting on outcomes. In a typical busy surgical practice, bringing all staff together for a collective meeting is challenging. Implementation of earlier patient safety initiatives, such as the WHO Surgical Safety Checklist,[50,51] show that time may be needed after introduction. For the introduction of a novel meeting format for regular team reflection, a different mindset needs to be established and participants need to adjust to a new type of discussion.

A challenge can be found in the support of the electronic patient record system in registration of complications. The ability to reflect relies heavily on an adequate system to record outcomes (presently mainly complications), because it determines the content of a meeting and allows comparison with other centers. To date, there is no standard system for automatic complication detection in Netherlands which means the registration is largely done manually. This adds to the already considerable burden of registration of clinicians and is susceptible to being incomplete. Moreover, the extraction of, for instance, a complication rate per selected procedure can be complicated, time-consuming and mainly only performed for study purposes. Ideally, local data on procedures and adverse events would be easily accessible to use in a QAM. Finally, documentation of the discussion of an adverse event in the patient record system can be perceived as contributory to quality improvement in some countries, but may result in legal liabilities in others. Alternatively, to keep the possibility to reevaluate later on, notes on adverse events or lessons learned might be documented anonymously in a separate document.

FUTURE PERSPECTIVES AND PRACTICAL IMPLICATIONS FOR RESILIENCE IN SURGERY

The implementation of a team reflection on short-term outcomes can be complimented with evaluating long-term outcomes

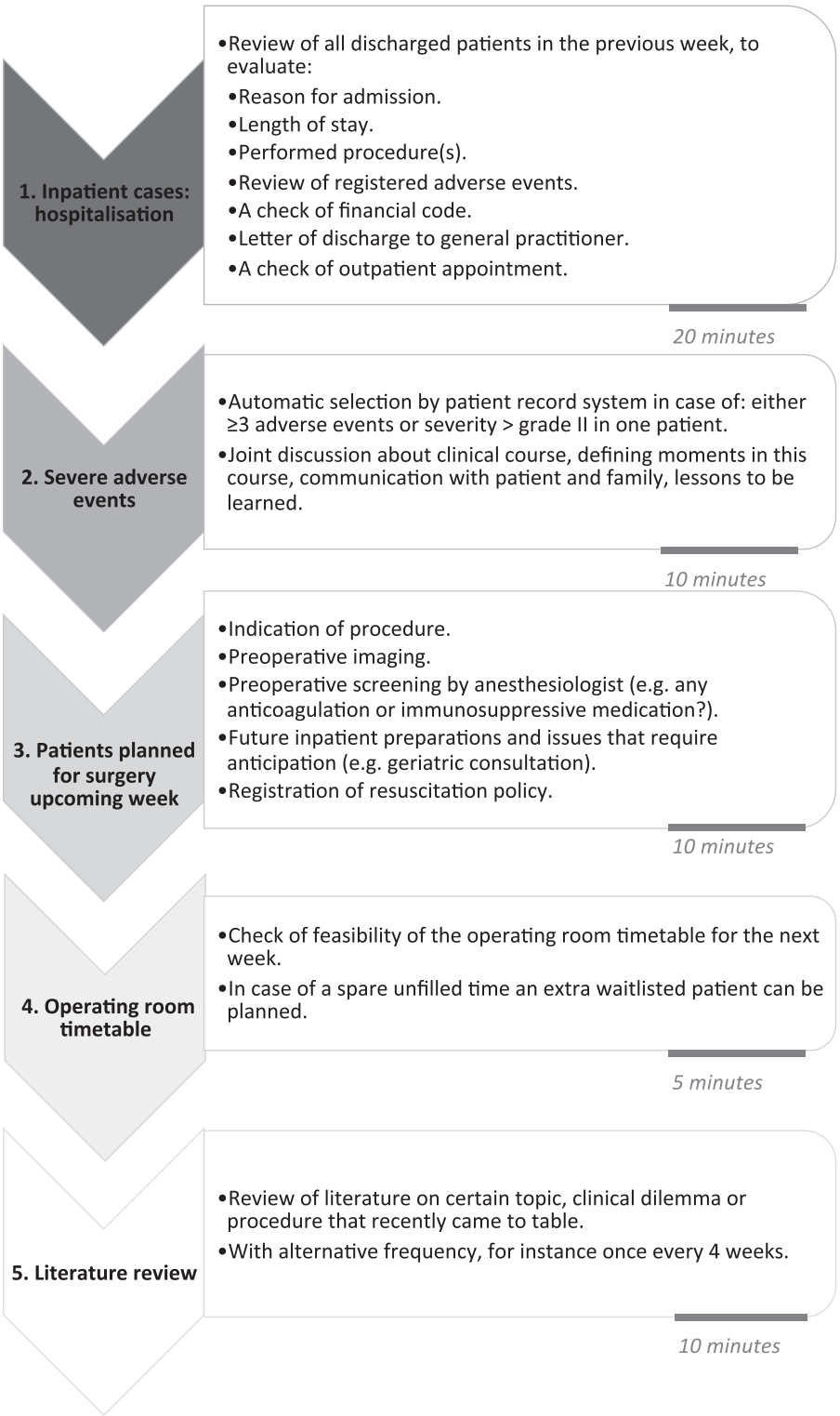

FIGURE 1. Flowchart representing a general format of the quality assessment meeting at a surgical service. The chronological order of topics is pictured, with the average amount of time per part. The primary part of the meeting consists of the discussion of all inpatient cases (part 1) which is followed by addressing part 2, 3, 4, and 5.

every 3 to 6 months. Since the surgical community uses an established system for classifying complications,[45,52] complications are frequently used in quality assessment in audits. Evaluating local outcome data in the context of the hospital standardized mortality ratio (HSMR), the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) or the Dutch Surgical Colorectal or Aneurysm Audit (DSCA and DSAA) provides an insight in local performance in relation to others.

Box 1 Observation based findings of the types of discussions at the quality assessment meeting.

Main results of observations of discussions at the Quality Assessment Meeting:

- **A focus on the entire clinical course rather than complications**: The fact that the meeting is set up to address all discharged cases, rather than solely those with complications, appears to instigate a broader discussion of the course of events per case, addressing aspects from not only the operative, but also the pre- and postoperative phase.
- **Evaluation of ''both sides of the same coin''**: Due to the wide scope of the meeting, cases with various outcomes following identical procedures are passed in review.
  - *Example: A patient was discharged 7 days after an aortic-bifemoral bypass procedure without any significant adverse events, whereas the length of stay of another patient undergoing the same procedure was 21 days due to a decompensated heart failure and surgical site infection.*
- **A representation of the ratio between successful and unsuccessful outcomes**: Discussion of all discharged patients gives a hint of the actual ratio between what goes wrong and what goes right. Rather than underlining a single severe adverse event, it is noted that the majority of outcomes are positive, which in itself is good for the moral, but also reinforces successful practices.
  - *Example: Discussion of an elderly patient who was to be admitted in the upcoming week led to timely involvement of geriatric medicine because of anticipated high risk of delirium. Following discharge, the patient's admission was retrospectively discussed in the QAM, which revealed that no such problems had occurred, reinforcing the team's decision to take precautionary measures. Moreover this case would have never been discussed at a traditional M&M meeting, because no adverse events had occurred.*
- **Even cases with a better than anticipated clinical course pass in review**.
  - *Example: A patient was anticipated as prone to, mostly cardiopulmonary, complications due to a history of extensive comorbidity. This patient experienced a uncomplicated course and a relatively short length of stay, which was considered to be a result of heightened anticipation by the resident in the postoperative phase. Discussion of this case led to suggestions for anticipation in similar cases in the future.*
- **Discussing cases with successful outcomes despite suboptimal care**: When successful outcomes are discussed in retrospect, this may help clinicians in being more candid about suboptimal practice or choices. The knowledge of a good outcome may counter anxiety about reputational damage or even malpractice liability.

With its original aim of a continuous cycle of ''defining the best, comparing with the best and learning from the best,''[53] benchmarking can be used as an interesting input for a team meeting such as the QAM. Rather than receiving annual results of national hospital benchmarking, the QAM forms a potential platform for comparison to ''the best.''[54]

A future evolvement of the meeting requires the addition of multidisciplinary discussions on teamwork.[31] Assessing team performance from a broader perspective, by adding the expertise and experiences of other specialties, could likely enlarge the impact of the QAM. Another next step is to investigate the feasibility of discussing larger numbers of cases or, as an alternative, discussing a selection of patients (eg, clustered by procedure).

Future research is needed to investigate the contribution of resilience engineering principles such as the QAM to overall quality and patient safety. As with the original M&M formats, whether regular team meetings improve clinical outcomes and patient safety is difficult to substantiate with data. Finding an outcome measure for M&M poses a challenge, because it is considered impossible to single out the specific effect of the meeting on clinical outcomes (eg, complication rates or mortality). These outcomes are considered subjected to many other factors in clinical practice as well. As a result, previous studies have used various other ways to estimate the effectiveness of M&M conferences, for instance by evaluating participants perceptions,[55–57] the influence on policy changes,[14,58] or on a participants' test results.[59,60] This demonstrates that, to date, it remains unclear what outcome can be used best to assess effectiveness of M&M meetings. In this paper, a local evaluation was performed by combining observations with a survey. In addition, mixed-methods studies should be used for the evaluation, combining qualitative data, such as participants' interviews and patient feedback, with quantitative outcome data such as complication rates, mortality, length of stay and readmissions.[61]

CONCLUSIONS

It is time to bring M&M conferences to the next level and transform this platform for case-based learning from adverse events to a meeting for team reflection and more systematic learning about how surgical teams manage to create safety in the majority of cases despite ever-present challenging conditions. The implementation of the new meeting format serves as an example of adjusting the traditional practice for M&M conferences according to modern principles from the field of resilience engineering and safety science, which suggests a new way of reflecting on outcomes. Other surgical teams should be inspired to experiment with regular reflection on personal and collective performance to unravel the intricacies of creating safety in surgical care and to enhance the resilience of surgical teams.

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