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## EDUCATION AND TRAINING

# Educational quality improvement report: outcomes from a revised morbidity and mortality format that emphasised patient safety

M L Bechtold, S Scott, K Nelson, K R Cox, K C Dellsperger, L W Hall

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**Problem:** Although morbidity and mortality conferences (MMCs) are meant to promote quality care through careful analysis of adverse events, focus on individual actions or the fear of incrimination may interfere with identification of system issues contributing to the adverse outcomes.

**Design:** Participant attitudes before and after the intervention towards patient safety and conference redesign were assessed using an attitudinal survey. A list of contributing factors, recommended solutions and targeted system improvements was maintained with ongoing progress recorded.

**Setting:** Department of Internal Medicine training programme at University of Missouri–Columbia.

**Participants:** Residents and fellows from the above residency programme.

**Educational objectives:** (1) Distinguish between culture of blame/shame and patient safety culture, (2) identify gaps in quality contributing to adverse outcomes (3) identify strategies to close gaps and (4) participate in root cause analysis, demonstrating an ability to review an adverse event and recommend an action plan.

**Strategies for change:** An interdisciplinary team modified the internal medicine MMC to emphasise a better understanding of patient safety principles and system-based practice interventions. For each adverse event analysed, root causes were identified, followed by discussion of system interventions that might prevent future such events.

**Key measures for improvement:** (1) Attitudes of residents and fellows regarding patient safety, as measured on a 20-item, five-point ordinal scale survey, (2) system improvements generated from the patient safety MMC (PSMMC) and (3) attendance at PSMMC.

**Effects of change:** Clinical outcomes: 121 system improvement recommendations were made and 39 were pursued on the basis of likelihood of achieving high impact changes. 23 improvements were implemented, 11 were partially implemented or in progress, and 5 were abandoned due to impracticality or redundancy. Educational outcomes: 58 residents and fellows completed surveys before and after modification of conference format. 6/20 survey items showed substantial change with four of these changes occurring in the desired direction. Eleven of the remaining 14 responses changed in the desired direction. Average MMC attendance increased from  $41 \pm 8$  to  $50 \pm 10$  participants ( $p < 0.03$ ).

**Lessons learnt:** The new PSMMC initiated multiple improvements in the quality of patient care without sacrificing attendance or attitudes of the residents or fellows. The new PSMMC promotes opportunities for participants to improve quality of patient care in a safe and nurturing environment.

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In the USA, the morbidity and mortality conference (MMC) has been used to advance the education of the medical community, including residents, fellows and faculty. The modern MMC originated from two entities, the End Result System and the Anesthesia Study Commission, conceived by early hospital committees to review medical practices, analyse adverse events and medical errors, improve medical education and promote quality assurance.<sup>1–3</sup> Despite embracing these goals, variability in the modern MMC has often been brought about by fear of incrimination, lack of consistency among departments filing reports, participation of treating doctors, and modification of conferences to achieve educational goals.<sup>3</sup> MMCs within internal medicine residency programmes, as well as other fields of medicine, vary greatly with regard to frequency, leadership, presenters, case selection and audience.<sup>4–12</sup> Despite the differences, the educational goals seem to be similar, and include enhancement of quality of care and education regarding complex management issues.

Despite a growing focus on patient safety programmes in academic health centres, only 50% of internal medicine programmes use the MMC specifically to examine causes and

possible remediation for medical errors.<sup>12</sup> The MMC does provide a logical forum to further examine medical errors and promote patient safety, and to develop the Accreditation Council for Graduate Medical Education (ACGME) general competencies of practice-based learning and improvement and system-based practice.

### DESCRIPTION OF CONTEXT

The University of Missouri–Columbia, Department of Internal Medicine is located in an academic health centre on the primary campus of the University of Missouri–Columbia (box 1).

At the time of the introduction of the new patient safety MMC (PSMMC) in the Department of Medicine, the academic health centre was emerging from an extensive period of financial stress. Leadership within the medical centre began to focus on the improvement of quality and patient safety as an important strategic priority, after years of preoccupation with

**Abbreviations:** ACGME, Accreditation Council for Graduate Medical Education; CQI, continuous quality improvement; MMC, morbidity and mortality conference; PSMMC, patient safety MMC

### Box 1: Characteristics of the University of Missouri Academic Health Center

- Inpatient care sites
  - University of Missouri Hospital (233 bed tertiary referral centre)
  - Harry S Truman Veterans Administration Hospital (118 bed inpatient medical and surgical facility)
  - Columbia Regional Hospital (189 bed community hospital)
  - Rusk Rehabilitation Hospital (60 bed inpatient rehabilitation facility)
- Outpatient care sites
  - Numerous clinics located on the primary medical campus and in the greater Columbia area
- Number of accredited residency programmes: 20
- Number of accredited fellowship programmes: 20
- Number of internal medicine categorical residents/year: 15
- Number of medicine-paediatrics residents/year: 4
- Number of one year transitional medicine residents: 5
- Total number of internal medicine department fellows: 48
- Student programmes represented at University of Missouri–Columbia campus: medicine, nursing, health management, health professions and pharmacy

financial survival. A newly established chairman of the Internal Medicine Department identified quality of care as an important focus area early in his tenure. He hired a full-time quality improvement coordinator for the department and encouraged development of a variety of educational interventions focusing on quality and patient safety in the medicine training programmes.

Although the University of Missouri–Columbia began incorporating specific patient safety and quality improvement activities into the medical school curriculum in 2003, no similar curriculum was systematically introduced into the medicine residency at that time. Tracking of educational outcomes among students showed some deterioration in key patient safety attitudes and behaviours following their exposure to the clinical environment in the third year of medical school.<sup>13</sup> In an effort to foster a clinical environment that valued and reinforced principles of quality improvement and patient safety, and to further promote the competencies of practice-based learning and improvement and system-based practice, the Department of Internal Medicine at the University of Missouri–Columbia redefined the traditional MMC in 2004. In this redesign process, the department examined the work from the VA National Center for Patient Safety and Ohio State University's experiences, establishing an open forum for discussion and solutions related to poor patient outcomes and medical errors in a blame-free environment.<sup>14 15</sup>

### DESIGN AND STRATEGIES FOR CHANGE

Before the PSMMC was implemented, the departmental MMC consisted of presentation of a case by a senior resident, followed by offering of expert opinion from a variety of faculty members in the audience. Although residents noted the educational value of these discussions, there were few discussions of patient

safety principles, and many of the teaching points focused on individual provider performance under difficult circumstances. This traditional MMC was modified by an eight-person interdisciplinary team consisting of the department chairman, the programme director, a senior medicine faculty member, two chief residents, the department quality improvement coordinator and two institutional patient safety and continuous quality improvement (CQI) experts. This design team met six times over 3 months to review and revise the goals and learning objectives for the training experience (box 2), establish methods for tracking educational outcomes of the conference, and plan the training of conference facilitators. One of the primary objectives of conference redesign was to actively address ACGME general competencies of practice-based learning and improvement and the system-based practice approach.

Before the initiation of the PSMMC, potential small group facilitators were identified on the basis of previous educational efforts and were asked to participate in an interactive 2-h training session. The facilitator training included review of a video re-enactment of an "old school" MMC, in which blame was attributed to the participating resident. Goals and objectives of the new PSMMC were discussed, and facilitator responsibilities were reviewed, including suggestions for encouraging dialogue from all small group members. Facilitator trainees then analysed a case involving a medical error, identifying root system causes of the described adverse event and brainstorming together regarding system interventions that might prevent similar occurrences in the future. Following completion of the training, small group facilitators were asked to participate in the new PSMMC.

An ongoing roster was maintained of cases for possible use at the conference, using input from the mortality review process, the institutional patient safety reporting system and direct referral of cases from house staff or attending physicians. Conference cases were selected on the basis of potential to highlight important healthcare system safety issues. Cases were

### Box 2: Goals and learning objectives for the patient safety morbidity and mortality conference

#### Goals

- Education to teach system thinking, in support of ACGME core competencies of system-based practice and practice-based learning and improvement
- Forum for discussion of adverse events and reasons contributing to their occurrence
- Assistance in transformation of departmental culture to one which values patient safety and quality improvement
- Expansion of the knowledge and skills for residents, fellows and faculty through the modified root cause analysis process

#### Learning objectives

- Distinguish between a culture of blame/shame and a culture that promotes safety through a system analysis of adverse events
- Identify gaps in quality contributing to an adverse outcome
- Identify strategies to close gaps
- Participate in a modified root cause analysis, demonstrating an ability to critically review an adverse event and recommend a plan of action

**Table 1** Patient safety morbidity and mortality conference timelines

| Timeline                     | Preparation   |
|------------------------------|---|
| 1–3 months before conference | Cases sent to CQI coordinator   |
| 3–4 weeks before conference  | Cases presented to facilitator for selection  |
| 3–4 weeks before conference  | Resident and CQI coordinator identify themes highlighted  |
| 1–3 weeks before conference  | Resident submits case write-up for review   |
| 1 week before conference     | Case write-up completed   |
| Conference: 60 min           |   |
| 2–4 min                      | Status reports from previous conference projects provided   |
| 5 min                        | Case presentation by resident   |
| 15 min                       | Large group case analysis brainstorming   |
|                              | <ul style="list-style-type: none"> <li>● Why did it happen?</li> <li>● Identify contributing causes</li> </ul>  |
| 20 min                       | Small group work—moderated by trained group facilitators  |
|                              | <ul style="list-style-type: none"> <li>● What can we change to prevent this from happening again?</li> <li>● Propose solutions to prevent recurrence</li> </ul> |
| 10 min                       | Small group representative reports back to large group  |
| 5–10 min                     | Departmental action plan outlined with items assigned   |
| Follow-up                    |   |
| Within 1 week                | Documentation of outcomes   |
|                              | Monitor participant evaluations   |
| 2–4 weeks                    | Responsible party addresses assigned action and develops action plan  |
| Monthly                      | Verbal updates at conference  |
|                              | Develop and disseminate electronic monthly performance improvement (PI) update for residents/fellows/faculty  |
|                              | Track system actions to ensure completion   |

CQI, continuous quality improvement.

not chosen for the conference if they were felt to have a high possibility of litigation or if the primary issues raised were peer review issues rather than system performance issues. Prior to the conference, a one-page summary describing key elements of a case was prepared. The cases were presented at the PSMMC by assigned senior residents. The 60-min conference consisted of several subsections (table 1).

The conference format was designed to be fast paced and participatory. Periods of group reflection regarding a patient safety event were followed by challenges to translate observations into action plans during small group discussions. Other healthcare professionals, including nurses, pharmacists and administrators, were often invited to attend the conferences, depending on the issues highlighted by the case under review.

## KEY MEASURES FOR IMPROVEMENT

We evaluated the impact of this intervention on patient safety attitudes of residents and fellows, the generation of improvements in patient care and conference attendance.

### Population studied

All internal medicine residents and fellows from the University of Missouri–Columbia who attended at least one PSMMC were included in the study analysis. Those residents and fellows who did not attend at least one PSMMC were excluded. Of the 111 residents and fellows in the programme, 90 participated in the initial survey, and 58 completed the follow-up survey, providing paired-means data for review. Most survey non-responders were post-graduate fellows.

### Statistical analysis

Surveys were distributed by the chief resident to residents and fellows before initiation of the new MMC format in October 2004 and following the eighth conference presentation in June 2005. The survey consisted of a 20-item, five-point ordinal scale (strongly disagree to strongly agree) designed to measure changes in resident/fellow attitudes toward conference redesign, including attitudes related to blame/shame, systems thinking, patient safety culture, error reporting and disclosure.

Participants were provided a unique identifier allowing comparison of initial and follow-up surveys while maintaining anonymity of the participants. The survey results are reported as mean scores for each survey item before and after the revised MMC format. For each survey item, a change score was formed as the difference between each participant's follow-up and initial responses.

The mean change and the 95% confidence intervals for the mean change are reported for each survey item. Positive mean differences indicate that on average there was greater agreement with the survey item after the MMC format revision and negative mean changes indicate less agreement. For each survey item, the multidisciplinary oversight team determined the preferred response in the light of the goals and objectives of the PSMMC. The confidence intervals reflect the precision of the estimated mean change and give a range of values expected if the study could be replicated many times. Confidence intervals that do not include zero correspond to changes that are significant at the 0.05 level. Where significant movement in the mean towards the preferred answer was noted, the items were considered to show change in the desired direction. Where significant movement in the mean away from the preferred answer was noted, the items were considered to show change in the undesired direction.

**Table 2** Implemented system changes

| November 2004 – October 2005   | Frequency |
|--|-----------|
| Information technology modifications   | 5         |
| Education and training   | 5         |
| Policy development/modification  | 4         |
| Development of standardised reference materials                                  | 3         |
| Modification of committee structure  | 2         |
| Modification of medical documentation form                                       | 2         |
| QI abstracts—American College of Physicians and American Thoracic Society        | 1         |
| Development of hospital-wide interdisciplinary team to investigate similar cases | 1         |

QI, quality improvement.

### Box 3: Case studies of system changes arising from PSMMC

#### Case 1

- Issue raised by case

Diabetic patient experienced a hypoglycaemic episode which was treated but not reported to doctors. Insulin dosing was not adjusted. Shortly thereafter, patient experienced a more severe hypoglycaemic episode, requiring treatment with concentrated glucose and transfer to the intensive care unit

- Actions taken in response to issue

- An advanced practice registered nurse (APRN) from internal medicine worked with glycaemic control quality improvement team, intensive care units and medical floors to update and standardise methods for monitoring and reporting hypoglycaemic episodes
- Hospital-wide deployment of standardised hypoglycaemic management order sheet, which was widely accepted and use

#### Case 2

- Issue raised by case

Patient experienced respiratory depression following the administration of postoperative narcotic analgesia. Patient stabilised after the administration of naloxone

- Actions taken in response to issue

- Formation of an internal medicine quality improvement team to determine the utility of naloxone as a useful trigger tool to identify clinically important adverse events related to narcotic overdoses
- Subsequent chart review and analysis of data from patients receiving naloxone yielded several patient characteristics that indicated high risk of experiencing adverse events from narcotic use
- Information forwarded to institutional pain management committee for incorporation into ongoing quality improvement efforts

Sign-in sheets were maintained for the conference. A list of contributing factors, recommended solutions and targeted system improvements was maintained with ongoing progress recorded.

## EFFECTS OF CHANGE

### Clinical outcomes

In association with the cases discussed during the 11 months, conference participants identified 150 contributing factors and 121 system improvement recommendations. At the completion of the conferences, facilitators determined that 39 (32%) of the system recommendations should be pursued based on the likelihood of achieving high impact changes. These targeted changes were assigned to department/facility representatives with 23 (59%) improvements implemented over the next year, 11 (28%) partially implemented or in progress and 5 (13%) abandoned due to impracticality or redundancy. Categories of system changes successfully implemented included enhancements in information technology, development of new educational programmes, and modifications to medical

**Table 3** Residents and fellows completing the attitudinal survey, by postgraduate training year

| Resident or fellow postgraduate year | Number of residents/fellows completing paired surveys |
|--------------------------------------|---|
| Resident year 1                      | 21  |
| Resident year 2                      | 12  |
| Resident year 3                      | 13  |
| Resident year 4                      | 6   |
| Total residents                      | 52  |
| Fellow year 1                        | 4   |
| Fellow year 2                        | 2   |
| Fellow year 3                        | 0   |
| Total fellows                        | 6   |
| Total survey participants            | 58  |

documentation (table 2). Examples of innovations initially suggested that were eventually abandoned included assigning an independent decision maker for triage of patients (deemed impractical after further discussion), documentation of intravenous fluid administration on electronic record (impractical as the critical element of the electronic medical record for this function not yet available at institution) and forming admission criteria for the intensive care unit and step-down units (found to be redundant).

Many of the specific system modifications implemented, such as establishment of preprinted orders for pneumococcal vaccine administration, reinforcement and education of warfarin management, improvement of direct admit patient triage through the emergency room, and enhancement of communication between medicine team members and emergency department doctors, were designed to improve patient safety, resident efficiency and communication. Box 3 shows two examples of specific system interventions arising out of issues examined at the PSMMC. Following the identification of system issues requiring the creation of performance improvement teams, seven residents volunteered for service on teams during the first 8 months of the PSMMC.

### Educational outcomes

During the 11 consecutive monthly conferences, the average MMC attendance increased from  $41 \pm 8$  to  $50 \pm 10$  ( $p < 0.03$ ) following initiation of the new format. Of the 90 residents and fellows who completed the initial survey, 58 (64%) also completed the postintervention survey, allowing paired-means testing. Thirty-two residents and fellows who completed the initial survey were excluded from the study. Reasons for exclusion were: leaving the programme before administration of the second survey; not attending at least one conference over the study period; having an unmatched survey; or choosing not to complete the second survey. Table 3 lists the number of residents and fellows from each postgraduate year of training who completed the matched surveys.

Six of the 20 survey items showed significant change with four of these changes occurring in the desired direction (towards the goals and objectives of the new PSMMC as defined). Eleven of the remaining 14 responses changed in the preferred or desired direction but did not reach statistical significance (table 4).

### LESSONS LEARNT

The new PSMMC provides a constructive venue for residents, fellows and faculty to express concerns about the healthcare system. Although altering the popular traditional MMC had inherent risk, the successfully executed transition has

**Table 4** Survey responses

| Item  | Sample size | Item means     |                  | Mean change (95% CI)   |
|---|-------------|----------------|------------------|------------------------|
|   |             | Initial survey | Follow-up survey |                        |
| Change in desired direction   |             |                |                  |                        |
| An effective MMC should focus on how a doctor should have performed   | 56          | 3.3            | 3.0              | -0.30 (-0.57 to -0.03) |
| Reporting systems do little to reduce future errors   | 57          | 2.7            | 2.4              | -0.37 (-0.73 to -0.01) |
| Analyses of medical errors and follow-up improvement actions have led to positive changes within our department             | 55          | 3.6            | 3.9              | 0.27 (0.03 to 0.51)    |
| When an MMC case is presented, I feel the doctor is blamed for the outcome even though the provider's identity is anonymous | 57          | 3.0            | 2.6              | -0.39 (-0.73 to -0.05) |
| Change in undesired direction   |             |                |                  |                        |
| Competent doctors do not make medical errors that lead to patient harm  | 58          | 1.9            | 2.2              | 0.26 (0.01 to 0.50)    |
| MMCs enhance my overall learning  | 58          | 4.2            | 3.9              | -0.28 (-0.49 to -0.06) |
| No change   |             |                |                  |                        |
| Most errors occur as a result of one individual's actions   | 58          | 2.1            | 1.9              | -0.10 (-0.29 to 0.09)  |
| I feel ashamed when one of my patients is presented at an MMC   | 55          | 3.0            | 2.7              | -0.26 (-0.57 to 0.04)  |
| In my opinion, personnel frequently disregard policies or guidelines that have been established                             | 56          | 2.6            | 2.5              | -0.13 (-0.38 to 0.12)  |
| After an error occurs an effective strategy is to work harder to be more careful  | 58          | 3.7            | 3.4              | -0.29 (-0.60 to 0.01)  |
| Patient safety is constantly reinforced in this department as a priority  | 57          | 3.8            | 3.9              | 0.09 (-0.13 to 0.30)   |
| The culture of medicine makes it easy for me to deal constructively with errors   | 58          | 3.1            | 3.0              | -0.07 (-0.36 to 0.22)  |
| Doctors routinely report medical errors   | 57          | 2.7            | 2.7              | 0.00 (-0.22 to 0.22)   |
| I am comfortable entering a patient safety net report   | 57          | 3.4            | 3.6              | 0.18 (-0.07 to 0.42)   |
| The purpose of MMC is to identify provider's technical and knowledge weaknesses   | 58          | 2.5            | 2.2              | -0.29 (-0.66 to 0.07)  |
| I am comfortable analysing an MMC to find the causes of errors  | 57          | 3.8            | 3.9              | 0.16 (-0.05 to 0.37)   |
| Doctors should report errors to an affected patient and their family  | 57          | 4.0            | 4.2              | 0.12 (-0.12 to 0.37)   |
| I feel comfortable disclosing an error to a faculty member  | 57          | 3.8            | 4.0              | 0.19 (-0.04 to 0.43)   |
| I am comfortable disclosing an error to a patient   | 58          | 3.5            | 3.7              | 0.21 (-0.04 to 0.46)   |
| Most errors are due to things that doctors cannot do anything about   | 58          | 2.5            | 2.6              | 0.03 (-0.22 to 0.29)   |

enhanced the overall experience for staff and faculty. The conference has remained a popular educational forum, with increased participation as measured by attendance. The growth in attendance noted seems to represent both higher levels of interest among medical residents as well as increased frequency of attendance by other healthcare professionals who are invited to participate in interprofessional care discussions. The response of the medicine residents and fellows has shown that they are capable and often enthusiastic about generating ideas for needed changes in systems of care. The attitudes of residents and fellows improved in key areas following the change, including the belief that positive departmental changes were likely to result from the analyses of medical errors and subsequent improvement actions.

This study was designed to evaluate positive or negative changes in participants' attitudes, effectiveness of group-based system analyses and execution of conference-induced improvements related to the patient care quality. The strengths of this study were: the inclusion of a representative and diverse population (64% of residents and fellows completed surveys at both assessment points); limited selection bias due to all residents and fellows encouraged to participate in the conference and surveys; anonymous surveys with only a four-digit code for paired analysis; voluntary participation in the conference and surveys; and recognition of suboptimal system issues.

Batalden and Davidoff have recently defined quality improvement as<sup>16</sup>

"the combined efforts of everyone—healthcare professionals, patients and their families, researchers, payers, planners, educators—to make the changes that will lead to better patient outcomes (health), better system performance (care), and better professional development (learning)."

This study shows that an educational intervention may be designed within a clinical department to bring about improvement in learning and also in system performance, in the anticipation that this will lead to better patient outcomes.

## LIMITATIONS

Limitations of this study include the lack of multiple populations being examined (only the University of Missouri's Department of Internal Medicine participated) and minimal fellow participation in the PSMC. Low levels of fellow participation are attributed to competing fellowship responsibilities occurring at time of the conference and emphasis on divisional, rather than departmental, morbidity and mortality reviews in many fellowship programmes. Although numerous system changes were implemented as a result of this conference, measurement of direct impact on the patient safety behaviours of all resident and fellow participants was beyond the scope of this initial study. However, seven resident participants did join performance improvement teams as a direct follow-up of issues arising during the first 8 months of this conference, representing a level of engagement in system issues which was not previously present. A potential area for further study would be to assess the impact of resident participation in this conference on other behaviours such as safety event reporting or participation on root cause analysis teams. Although several evidence-based interventions were introduced to positively impact on patient safety, the occurrence of numerous additional concurrent improvement activities within the healthcare system made it difficult to attribute improvements in patient outcomes specifically to the impact of this conference.

The survey revealed a slight decline in the attitude that the new PSMC enhanced overall learning. Prior to changing to the PSMC format, the MMC was the most popular resident conference (ranked by annual house staff survey), largely due

to the academic knowledge shared by faculty during the discussion of difficult cases. We postulate that this slight decline in perceived overall learning is a reflection of the shift in focus of the conference away from learning specific details of disease management toward embracing a greater understanding of complex areas within our healthcare system. One other attitude moved in the undesired direction in the second survey: participants were slightly more likely to feel that competent doctors do not make errors that lead to patient harm. Although information relating human fallibility to medical errors was presented in the initial conference of the year, this suggests that periodically revisiting this concept will be necessary as part of the ongoing PSMMC training.

## CONCLUSIONS

Although MMCs differ between programmes, the newly designed PSMMC allows another viable option for many programmes to analyse medical errors and improve systems in a proactive manner. The new PSMMC is an adaptation of the earlier morbidity and mortality designs, such as the End Result System and the Anesthesia Study Commission, with a similar goal of enhancing staff attitudes toward patient safety and system-based improvements.<sup>2,3</sup> The new PSMMC promotes opportunities for participants to express concerns in a safe setting, increase awareness of unsafe conditions and become active participants in design of interventions to improve healthcare systems. With more thorough training of residents, fellows and faculty members in these activities, future medical care systems may be greatly improved.

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