Implementation of a Structured Morbidity and Mortality Rounds on an Internal Medicine Clinical Teaching Unit: A Quality Improvement Project

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Abstract
Morbidity and mortality rounds (MMRs) are widely used in a variety of medical settings; however, their implementation and quality are highly variable. In this quality improvement project, we implemented the Ottawa Morbidity and Mortality Model (OM3) at a quaternary teaching hospital inpatient internal medicine clinical teaching unit (CTU). We assessed adherence to the model using a locally developed scale and surveyed participants regarding acceptability of the change. We used several measures to improve adherence, including regular involvement of allied health professionals, screening of cases for appropriateness, providing a template to the residents who prepare cases for presentation, and limiting the number of presentations at each session. Adherence to OM3 improved over time and was consistently high by the end of our data-collecting period. The intervention was also widely accepted by participants, and rounds were found to be valuable to participants. Implementing a validated, structured format, such as OM3, can improve the quality of MMRs while being accepted by participants in an internal medicine teaching hospital.

Résumé
Les revues de morbidité et mortalité (RMM) sont largement utilisées dans divers contextes médicaux, mais leur mise en œuvre et leur qualité varient considérablement. Dans ce projet d'amélioration de la qualité, nous avons implanté l'Ottawa Morbidity and Mortality Model (OM3) dans une unité d'enseignement clinique (UEC) de médecine interne en milieu hospitalier universitaire de soins quaternaires. Nous avons évalué l'adhésion au modèle à l'aide d'une échelle conçue localement et interrogé les participants sur l'acceptabilité de ce changement. Nous avons utilisé plusieurs mesures pour améliorer l'adhésion, notamment la participation régulière de professionnels paramédicaux, la vérification de la pertinence des cas, la fourniture d'un modèle aux résidents qui préparent les cas à présenter et la limitation du nombre de présentations de cas à chaque séance. L'adhésion à l'OM3 augmente au fil du temps et est toujours élevée à la fin de notre période de collecte des données. Cette intervention est aussi largement acceptée par les participants, et les revues se sont révélées précieuses pour les participants. La mise en œuvre d'un format structuré et validé comme l'OM3
Methods

Context

Vancouver General Hospital (VGH) is a quaternary care teaching hospital and one of the core training sites for the University of British Columbia Internal Medicine residency. The internal medicine clinical teaching unit (CTU) admits roughly 100–120 patients at any given time. Each CTU team usually consists of a senior resident (second- or third-year resident), two first-year residents, up to three medical students, a clinical pharmacist, and an attending physician.

Morbidity and mortality rounds have been a regular educational activity at VGH CTU for over 10 years. MMRs are held near the end of each 4-week academic block. The chief medical resident (CMR) facilitates, and the senior resident from each team presents a case drawn from the block. There are five or six CTU teams at any given time. In addition to trainees, at least two faculty members are also present who are on service and involved in at least one of the cases presented.

Issues identified at MMRs are brought to the notice of the CTU director and/or quality improvement (QI) physician lead, both of whom regularly attend MMRs. These issues are then further discussed at the monthly CTU QI committee, where managers, directors, head nurses, physicians, and CMR discuss and try to resolve quality issues. If necessary, issues are further escalated to the hospital quality council, where more senior administration is present.

Specific aims

The aim of this project was to improve the quality of our MMRs by increasing our adherence to the OM3 elements by 20% within 10 months.
substantial input from nursing, pharmacy, or other stakeholders involved in patient care.

In order to standardize rounds, in 2016, the OM3 framework was adopted for CTU MMRs at VGH. However, it was not formally assessed prior to this project.

**Interventions**

Several interventions were introduced to improve adherence to OM3 elements through a series of plan-do-study-act (PDSA) cycles. The project timeline is depicted in Figure 1. Each year consisted of 13 four-week academic blocks with academic year beginning on July 1 and ending on June 30. The interventions were as follows:

**PDSA 1 – 2019, Block 1: Interprofessional involvement (nursing, pharmacy, dietary, and social work)**

Previously, residents were encouraged to invite interprofessionals involved in the case to attend MMRs. However, this was *ad hoc* and interprofessional attendance was infrequent and inconsistent. We formalized their involvement by sending a standing digital invitation with the year’s schedule of MMRs. Rounds were also discussed with our hospital’s CTU QI committee, which is attended by physicians, nursing leadership, pharmacy, and other allied health and hospital administrators.

**PDSA 2 – 2019, Block 7: Templated presentation for presenters**

Given ongoing heterogeneity in presentations and concern about the time burden on residents for preparing cases, a presentation template adapted with permission from co-lead of the OM3 model (personal communication of E. Kwok with Penny Tam, May 8, 2018) was circulated to residents with an introductory email from CMR. This provided “fill in the blank” slides with simple instructions on what information to include in the presentation. The goal of this template was to simplify and standardize presentations (see Appendix 1).

**PD SA 3 – 2019, Block 11: Increasing time for discussion**

Previously, rounds were of 1-h length, with up to six cases being presented. Now, senior residents are asked to email a brief case summary to CTU QI physician lead to assess appropriateness based on the OM3 criteria and provide feedback on aspects of the case to highlight. The number of cases presented in 1-h duration was limited to four because of concern that too many cases limited time for productive discussion around implications of the case and potential changes to address the preventable harm.

**Measures**

The following two measures were used to assess our aims:

1. A locally developed scale was used to grade the adherence of each presentation to OM3. Each presentation was assigned a score from 0 to 6 for adherence to each of the six OM3 criteria (Table 1), with each criterion being assigned a score of 0 (criterion not satisfied), 0.5 (criterion partially satisfied), or 1 (criterion satisfied). The six criteria included: appropriate case, structured case analysis, interprofessional involvement, facilitator presence, action item, and bottom line. This analysis was performed on presentation slides submitted by senior residents and adjudicated by authors Bennet Schwartzentruber and Penny Tam, with any discrepancy resolved by consensus.

![Figure 1](image_url). Project timeline from initial adoption of OM3 through formal data-collecting period, and intervention to improve adherence to OM3.
Results

Adherence to OM3

Adherence to the OM3 model increased over the 17-month period of data collection. The adherence score for the pre-intervention period was 3.93 out of a possible score of 6.00, and the mean score for post-intervention increased to 5.51, which was an improvement of 40.5%. This exceeded our aim of 20% improvement.

Comparing the subcategories of adherence, regular interprofessional involvement had the greatest impact on overall adherence. Prior to our intervention, allied health professionals were rarely present at MMRs, but after PDSA1, rounds were attended regularly by at least one allied health professional. This accounted for most of the inflection point seen in Figure 2.

The absolute change for each of the OM3 elements is shown in Table 1, where interprofessional involvement had an absolute change of 0.84.

Resident and faculty surveys

Surveys were circulated to participating residents for each block for 8 months. Between three and seven responses were received for each block, with a mean score of 5.25. MMRs were found to be useful, receiving a mean score of 4.33/5.00 over eight blocks of data. Residents also expressed a high degree of comfort with selection of cases (mean score 4.19/5.00), identifying systems or cognitive issues (mean score 4.13/5.00), and forming bottom lines and action items (mean score 4.05/5.00). There was also a high degree of comfort discussing the cases openly with a mean score of 4.20/5.00. The question with the lowest score was residents’ knowledge that bottom lines and action items were acted on at a systems level with a mean score of 3.60/5.00. Figure 3 shows the trend in these scores over time. The resident survey is provided in Appendix 2.

Surveys were collected from nine staff internists at a single time point, mid-way through our data collection. These also demonstrated a high degree of satisfaction with the OM3 model for MMRs, as shown in Table 2. The question with the lowest score was residents’ knowledge that bottom lines and action items were acted on at a systems level with a mean score of 3.60/5.00. Figure 3 shows the trend in these scores over time. The resident survey is provided in Appendix 2.

Analysis

Each presentation was analyzed using a scale from 0 to 6 on adherence to OM3. Mean adherence scores were calculated for all presentations allowed in each block. In addition, mean scores were calculated for each subcategory of adherence.

Case presentations were submitted to the authors by email in pdf or PowerPoint format prior to MMRs. After MMRs, cases were analyzed by two of the authors (Schwartzentruber and Penny Tam). Initially, both authors analyzed each case to establish agreement. After this, cases were analyzed by one or the other author, and in case of uncertainty, scores were resolved by consensus. Each case was assigned a score of 0–6 as described above. Mean scores were calculated for all presentations in each academic block. Additionally, mean scores for each subcategory of adherence were calculated pre- and post-PDSA cycle 1, with values from 0 to 1. Given high mean scores of above 5 out of 6 after PDSA1, subsequent analyses between PDSA1 and PDSA2 and between PDSA2 and PDSA3 were not performed.

Numerical values based on the Likert scale were assigned to survey results: from 1 for “strongly disagree,” 3 for “neutral” to 5 for “strongly agree.” Mean values for each question as well as total mean scores were calculated for each block and trended over time.

Ethical considerations

This was a QI project, which under Article 2.5 of the Tri Council Policy Statement was not subjected to institutional ethical review. Therefore, ethical approval was not required.
in hospital-wide MMRs, the current project showed successful implementation in an internal medicine teaching service. A strength of our adherence scale was its simplicity, which made post hoc analysis of presentations easy with a high degree of agreement between authors. Acceptability and perceived usefulness to trainees were important findings, given the burden of preparing these presentations on busy senior residents, and the concern that additional reading of the OM3 framework could add to this burden. In hindsight, it might have been informative to ask residents whether use of the framework led to a perceived increase or decrease in their workload. There was a slight decrease in “appropriate case” selection from 0.96 to 0.90 out of 1.00 (−0.06). We suspected that this small change represented sampling bias, rather than a trend, but we would need further data to clarify whether this was a negative unintended effect of our intervention.

Regular interprofessional involvement in MMRs had the most significant impact on adherence during our data-collection period, although improvements were also observed on other adherence criteria. This is a critical element of patient quality and safety, as engagement of multiple stakeholders enriches discussion and is important to making systemic changes.

Discussion

This QI project demonstrated that implementation of a validated structured approach to MMRs for internal medicine at a teaching hospital was feasible with a high degree of adherence to the OM3 format. Furthermore, this change was widely acceptable to participants, many of whom were trainees in internal medicine. These findings agreed with the results of Kwok and colleagues. While their intervention was

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<thead>
<tr>
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<tbody>
<tr>
<td>Appropriate case</td>
<td>0.96</td>
<td>0.90</td>
<td>−0.06</td>
</tr>
<tr>
<td>Structured case analysis</td>
<td>0.67</td>
<td>0.94</td>
<td>0.27</td>
</tr>
<tr>
<td>Interprofessional involvement</td>
<td>0.13</td>
<td>0.97</td>
<td>0.84</td>
</tr>
<tr>
<td>Facilitator</td>
<td>1.00</td>
<td>1.00</td>
<td>0</td>
</tr>
<tr>
<td>Bottom line</td>
<td>0.74</td>
<td>0.90</td>
<td>0.16</td>
</tr>
<tr>
<td>Action item</td>
<td>0.63</td>
<td>0.92</td>
<td>0.29</td>
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year, and also with the busiest time of year for medical inpatient services. It is unclear which of these factors may have been contributing. Satisfaction scores did not otherwise change significantly over time. Given consistent average scores of above 4/5, we interpreted this as sustained acceptable satisfaction with rounds despite changes.

One limitation of our data was that the first intervention undertaken—that of adopting OM3—was done before the start of data collection, and it could have been informative to analyze presentations before OM3 was implemented. This might have demonstrated a more pronounced improvement across the criteria over time starting from overall lower levels of adherence. Another limitation was that while our locally developed scale performed well in assessing the adherence of presentations to OM3, there were other aspects of MMRs that were not captured, such as quality of the discussion, and ability of MMRs to effect changes to the cognitive and systems issues they identify. Further, the binary nature of variables lacked granularity. For example, a discussion where nurses, pharmacists, physiotherapists, and physicians were involved could be more productive than when only a single nurse was present with physicians, but both situations would receive a score of “1” on this criterion.

Future studies would be useful to validate our scoring of adherence to OM3. Other studies could evaluate the use of OM3 in specialties other than internal medicine or across specialties, which would allow for a more comprehensive understanding of its impact on patient care and satisfaction with rounds.

Our surveys demonstrated that for both residents and staff, knowledge of the actions taken in the hospital resulting from previous MMRs could be improved. Formerly, feedback on the actions taken was not a regular part of rounds, and these results encouraged us to add regular feedback on actions taken to the introductory slides presented at the start of rounds.

Of note, in January 2019, there was a brief decrease in satisfaction scores across most categories, which correlated with a change in chief medical resident at the end of calendar year, and also with the busiest time of year for medical inpatient services. It is unclear which of these factors may have been contributing. Satisfaction scores did not otherwise change significantly over time. Given consistent average scores of above 4/5, we interpreted this as sustained acceptable satisfaction with rounds despite changes.

One limitation of our data was that the first intervention undertaken—that of adopting OM3—was done before the start of data collection, and it could have been informative to analyze presentations before OM3 was implemented. This might have demonstrated a more pronounced improvement across the criteria over time starting from overall lower levels of adherence. Another limitation was that while our locally developed scale performed well in assessing the adherence of presentations to OM3, there were other aspects of MMRs that were not captured, such as quality of the discussion, and ability of MMRs to effect changes to the cognitive and systems issues they identify. Further, the binary nature of variables lacked granularity. For example, a discussion where nurses, pharmacists, physiotherapists, and physicians were involved could be more productive than when only a single nurse was present with physicians, but both situations would receive a score of “1” on this criterion.

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other training sites, as many residents work at multiple academic sites that use different formats for MMRs. Although not the direct aim of this project, results of our rounds were presented to the faculty CTU QI committee for further discussion and implementation. More recently, data were extracted from our MMRs for hospital-wide quality and safety processes. Additional work locally could examine the impact of MMRs on systems level changes.

Conclusions

The OM3 framework is validated for MMRs that was successfully adopted in an inpatient internal medicine teaching hospital setting. We exceeded our aim of achieving 20% improvement in adherence to OM3 by achieving 40% improvement. Regular interprofessional participation was easily achieved and contributed significantly to meeting our aim. The change was sustainable as it did not require extra work for participants, and in fact may have simplified the process for senior residents by providing a framework and template for presentation. It was also widely accepted by participants. Further research could extend this approach to other specialties and settings, such as surgical specialties or other training sites. Communicating the outcomes of MMRs back to participants could be an important and neglected element of their success.

Conflict of Interest

The authors have no competing interests to declare.

Funding

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References

Appendix 1

MMR presentation template

**CTU M&M Rounds**

**VGH CTU M&M Rounds**

- Block
- Date
- Presenter

**CTU Team Colour**

Presenter

[house staff – optional]

**Case Presentation**

Appropriate case should have all 3 of:
1. Adverse Outcome
2. Preventable
3. Lessons to be learned about cognitive biases and/or systems issues

One slide only, pertinent case details only

**Case Analysis – select as many as apply**

- Cognitive Issues:
  - e.g., Anchoring
  - Confirmation bias
  - Premature closure

- System Issues:
  - e.g., Patient factors: communication barriers
  - Skill-set errors: error in EKG interpretation

**Bottom Line**

A high level summary and analysis of the events

Analagous to “assessment” in SOAP note

**Action Items**

Suggestions for changes to systems / processes to prevent recurrence

Certain interventions are more effective for improving patient safety, e.g., forcing functions, automation/computerization, standardization, policies, checklists

Analagous to “plan” part of SOAP note

**Confidentiality, Process, and Goals**

- M&M rounds are strictly confidential, protected by Section 51 of the Evidence Act
- No patient initials, dates, times, or individual staff will be named
- Goal is to improve quality of care and patient safety outcomes
- Discussion encouraged in a blame-free environment with a spirit of curiosity

**Multidisciplinary Opinion**

Consider inviting or obtaining comment from nursing, allied health, pharmacy or subspecialty

** Plan to spend minimum 50% of presentation time on group discussion of bottom line, action items and multidisciplinary input**
Appendix 2

Resident survey

<table>
<thead>
<tr>
<th>WITH REGARDS TO M&amp;M ROUNDS:</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am comfortable selecting cases for M&amp;M rounds</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
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<tr>
<td>I am comfortable identifying cognitive and systems issues in my M&amp;M case</td>
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<tr>
<td>I am comfortable forming a bottom line and action item</td>
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<tr>
<td>I am comfortable discussing cases openly</td>
<td>[ ]</td>
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<tr>
<td>I am aware that bottom lines/action items are acted on</td>
<td>[ ]</td>
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<td>[ ]</td>
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<td>[ ]</td>
</tr>
<tr>
<td>I think M&amp;M rounds are useful to improve patient safety</td>
<td>[ ]</td>
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</table>

Any other comments or suggestions?

Appendix 3

Faculty survey

<table>
<thead>
<tr>
<th>WITH REGARDS TO M&amp;M ROUNDS:</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
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<tbody>
<tr>
<td>The Ottawa M&amp;M model has improved our M&amp;M rounds</td>
<td>[ ]</td>
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<td>[ ]</td>
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<tr>
<td>The Cases are appropriate</td>
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<tr>
<td>Case analysis is useful</td>
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<tr>
<td>I am comfortable facilitating in discussion</td>
<td>[ ]</td>
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<tr>
<td>I would like training in facilitating using the OM3 model</td>
<td>[ ]</td>
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<tr>
<td>I am aware that action items are being acted on</td>
<td>[ ]</td>
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<tr>
<td>I am aware of the status/outcome of M&amp;M cases/issues</td>
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Any other comments or suggestions?