The Utility of the Matrix Format for Surgical Morbidity and Mortality Conference

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With the limitations posed by increasing work hour restrictions, surgical residency programs are focusing more on maximizing the educational benefit of their conferences. The Morbidity and Mortality (M&M) conference serves as a forum to discuss adverse events and patient care improvement using evidence-based medicine. The matrix format (MF) is an enhancement to the traditional format (TF), focusing on the case selection process and a postconference newsletter reiterating the relevant literature review and discussion points. Our institution adopted the MF to evaluate both its short- and long-term educational values. Surveys were distributed to residents and faculty within the Department of General Surgery to assess their interest and satisfaction, perception of educational value, and efficiency with the MF compared with the TF. Responses were obtained from 22/22 (100%) residents for the TF and 11/23 (48%) for the MF. Faculty responses were 19/19 (100%) and 9/16 (56%), respectively. Reasons for an overall decreased response with the MF were not investigated further, as participation was strictly voluntary. Our results confirmed an overall approval of the MF by both residents and faculty. Faculty reported an improved efficiency of the conference (P < 0.039), encompassing improved content and presentation quality. Residents reported an improved overall interest and satisfaction with the MF (P < 0.001) as well as an improvement in the educational value (P < 0.007). Residents spent less time preparing presentations and reported learning greater educational benefit to the conference when preparing their own presentations (P < 0.001). In conclusion, the MF resulted in a greater overall satisfaction for residents and attending surgeons with an increased investment by the audience and overall improvement in perceived educational benefit.

SURGICAL RESIDENCY PROGRAMS across the United States have focused their efforts on improving surgical education efficiency through improved didactics due to increased duty hour restrictions. Although the value of traditional training methods developed by Halsted at the beginning of the 20th century remains important, educating surgical residents in today's world demands a broader myriad of tools and methods to prepare them for the constantly changing field of healthcare in surgery.1-4 Many authors have extensively reviewed the formal organizations that spearhead surgical education such as the Accreditation Council for Graduate Medical Education (ACGME), noting the various improvements and requirements recently established to improve the quality of surgical training.2, 5, 6 One such example is the ACGME core competencies that residents must achieve by the end of training.5, 6 Several groups have recognized the Morbidity and Mortality (M&M) conference as one avenue to address these six competencies.3, 4, 7-9

The M&M conference is frequently referred to as the "golden hour" of surgical education and is a required component for ACGME residency approval. The conference creates an open forum to discuss adverse events or deaths related to patient care with a department-wide, evidence-based discussion surrounding those cases. The expectation is a discussion to help prevent similar mistakes in the future, resulting in improved patient care.3, 7, 10, 11

The exact format of the M&M conference varies between institutions. Traditionally, senior-level residents present moderator-selected complications on a weekly basis and discussions are driven by those directly involved in the case, most notably the attending surgeon. Any reading on the operative case or complication is done exclusively by the presenter.
Additionally, the short time interval between the submitted lists and case presentation produces lower quality presentations that often fail to produce an evidence-based discussion. The end product is a passive method of learning and education for the residents and other attendees.

Dr. Leo Gordon advocated a more efficient and effective use of this conference to enhance the education of surgeon trainees by developing a matrix format (MF). Using this format, cases are carefully selected by a designated moderator for presentation based on merit and educational value. Each case is researched, adequately prepared, and presented to a department on a weekly basis. Because the cases are determined weeks in advance, residents are assigned reading assignments pertaining to these cases prior to the conference to encourage a better evidence-based discussion. Gordon described the MF as "multiple educational threads compiling spokes on an educational wheel; a loop which allows for the defining of surgical complications, revisiting them at specific intervals, and assessing the educational value of error identification at later times." Based on our literature review, there is no research comparing the traditional format (TF) to the MF for the M&M conference.

Methods

In an effort to maximize the education benefit of the conference, we performed an Institutional Review Board-approved study in which we compared faculty and resident perceptions of the TF versus the MF. Participation in the study was voluntary. Using the anonymous online website, Survey Monkey, we distributed a survey to the faculty and residents on the conference roster two months prior to the format change to evaluate perceptions on the TF, which had been in place for three years prior to our transition. The conference moderator then implemented the MF at the midpoint of the academic year after introducing the specifics to the entire department using a series of meetings and instructional emails. During the MF period, postgraduate year 1 (PGY-1) to PGY-3 residents were assigned weekly readings pertinent to pathophysiology, treatment options, and complications being presented. PGY-4 and PGY-5 residents were assigned the task of conducting an evidence-based literature review. Presentations were assigned 2–5 weeks prior to the scheduled conference date to allow adequate preparation time. Presentations adopted a standardized format and incorporated an audience response system at the conclusion of each presentation to administer questions about teaching points in a board-type format. A matrix newsletter was composed and distributed by the moderator after the conference that reiterated important teaching points, clinical pearls, and repeated answers to presentation questions from the prior week. At the conclusion of the academic year, a second survey was distributed to the attendees to evaluate the MF.

Questionnaires gathered information from attendees regarding self-reported learning, interest levels, educational value, changes in future practice, utility of reading assignments, and impressions of the matrix newsletter. Residents and faculty absent for three months of the 6-month period prior to a survey were excluded. This mainly included residents on off-service rotations and newly hired faculty.

Results

The TF and MF surveys were distributed to residents with responses in 22/22 (100%) and 11/23 (48%), respectively. Faculty responses were 19/19 (100%) and 9/16 (56%), respectively. The majority of faculty respondents had 0 to five years of experience with an academic rank of Assistant Professor.

In the six-month period using the TF, case presentations ranged from one to 11 cases per week (median = 5). In the 6-month period using the MF, approximately one to three cases were presented each week (median = 2). In spite of the longer presentation length in the MF, 70 per cent of residents reported spending less overall time preparing a presentation compared with the TF, with the other 30 per cent unchanged. In the TF, 5 per cent of respondents spent less than two hours, 60 per cent between two and four hours, and 35 per cent over four hours. With the MF, 30 per cent spent one to two hours, 30 per cent two to four hours, and 40 per cent over four hours.

Faculty and residents were asked a multitude of questions comparing the TF with the MF. Residents were asked to compare the educational benefit of the conference using the two formats and reported a significantly higher overall value for the MF (81.8 vs 59.1, t(32) = 2.87; P < 0.007). Residents also reported learning more from preparing their own presentations (81.8% vs 68.2%), t(32) = 14.48; P < 0.001). This represents a particularly important finding given that they reported spending less time (on average) on their presentations. Residents also acknowledged an improved educational benefit from other resident presentations (64.6 vs 52.5), although this failed to reach statistical significance (t(32) = 1.97, P = 0.17).

In terms of overall satisfaction with the MF style, an exact binomial sign test conducted on the combined responses of residents indicated that the MF was significantly preferred for both interest and satisfaction. We attributed these findings to the increased focus on the educational aspect of the conference (Table 1).
Regarding the interest and engagement in the conference by other attendees, residents clearly noted an increase among fellow residents and medical students with the MF (Table 2).

For preconference reading assignments, 90 per cent of residents found them to be pertinent to the cases presented, whereas 100 per cent of respondents favored using the SCORE curriculum for directed pre-reading on topics compared with in-conference "pimping." Residents also felt that the MF was more likely to result in changes in practice. The estimated rate of presentations influencing practice increased from 62 per cent in the TF to 90 per cent with the MF.

Residents were asked to estimate the frequency with which they "retained" educational material from the M&M conference. This increased from 40 per cent in the TF to 60 per cent after the implantation of the MF. Residents also estimated the frequency with which they learned nothing from the presentations. This percentage decreased from a mean of 18 per cent of presentations having no educational value in the TF to 0 per cent in the MF. In all, 73 per cent of residents admitted sleeping at some point during the TF conferences, whereas only 10 per cent admitted doing so in the MF presentations.

Faculty members were asked questions regarding the content and quality of residents' presentations. Their responses indicated that presentation content appropriateness improved in 89 per cent of presentations, whereas overall quality improved in 78 per cent of cases. Pertaining to conference efficiency, an exact binomial sign test revealed that the MF was considered significantly more efficient than the traditional approach \( (P = 0.039) \). In other words, faculty felt that the MF presentation quality better highlighted the important discussion points of the cases. This was likely a combination of more time for the residents to discuss the case with attendings prior to the conference and a more appropriate evidence-based review of the literature. Faculty preferences are summarized in Table 3.

### Discussion

The M&M conference remains an integral part of surgical education for residents. Although conference formats differ between surgical programs and even within fields, the need to ensure an educational link to the M&M conference remains a consistent theme.\(^2,3,7,12,13\) Improvements have been reported to enhance the educational value of the M&M conference over the last decade including presentation standardization, directed questions, increased audience participation, evidence-based discussions, scheduled protected time of conferences, resident logs, and inclusion of experts from associated departments.\(^3,4,7,9,11-17\) Our institution elected to use the MF to incorporate several of these individual changes.

After adopting the new MF, surveys indicated improved satisfaction from both faculty and residents. Presenters spent less preparation time while the perceived educational value increased, a feat more important with the recent institution of work hour restrictions.\(^2\) In addition, the perceived engagement of attendees notably increased, a factor well-known to improve the quality of educational conferences.\(^16\)

Faculty also confirmed that the content and quality of presentations were greatly improved, contributing to a greater educational forum. In fact, other groups have also shown that simply standardizing the format of presentations increases educational benefit.\(^18\)

The majority of residents in our program found all elements of the newsletter useful, and the faculty used portions of the newsletter for their continued education. Similar resources have been considered useful for individual review in other programs that have introduced changes in their M&M format.\(^14\) Lower level residents generally appreciate revisiting basic clinical teaching points even when the most basic reviews are directed at medical students.\(^16\)

As previously stated, there were many known limitations to our study. The most obvious remains the small sample size, the result of a drop-off in responses for the MF survey. This may reflect the timing of the MF survey, which was at the end of the academic year in June. We hypothesize this timing resulted in less faculty participation, as conference attendance typically decreases in the latter half of the academic year.

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**Table 1. Resident Preference TF versus MF**

<table>
<thead>
<tr>
<th></th>
<th>TF (%)</th>
<th>MF (%)</th>
<th>( P ) value</th>
</tr>
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<tbody>
<tr>
<td>Educational benefit</td>
<td>59.1</td>
<td>81.8</td>
<td>0.007</td>
</tr>
<tr>
<td>Interest level</td>
<td>68.2</td>
<td>90.1</td>
<td>0.001</td>
</tr>
<tr>
<td>Learning (from own presentations)</td>
<td>68.2</td>
<td>81.8</td>
<td>0.001</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>54.5</td>
<td>63.6</td>
<td>0.001</td>
</tr>
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</table>

Residents preferred the MF to the TF for education, interest, learning, and satisfaction.

**Table 2. Resident's Perception of Audience Interest and Conference Engagement**

<table>
<thead>
<tr>
<th></th>
<th>TF (%)</th>
<th>MF (%)</th>
<th>( P ) value</th>
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<tbody>
<tr>
<td>Medical students</td>
<td>27.2</td>
<td>81.8</td>
<td>0.05</td>
</tr>
<tr>
<td>Residents</td>
<td>45.4</td>
<td>90.1</td>
<td>0.001</td>
</tr>
<tr>
<td>Faculty</td>
<td>90.1</td>
<td>81.8</td>
<td>0.15</td>
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Residents were asked if they felt attendees were mostly interested and engaged in the presentation. The above table represents the percentage of respondents who affirmed the interest and engagement of the various attendees.
Furthermore, we attribute the predominance of junior faculty participation to their greater interest in research compared with the senior level staff.

Reasons for decreased resident participation for the MF were not investigated further given that study participation was strictly voluntary. Another limitation was that educational retention was not tangibly measured, instead relying on subjective perceptions of the information retained. Objective measurement through examination at later time intervals would be useful to assess the true educational value as opposed to a self-assessment and should be an aim of future trials looking at the MF.3, 4

An additional consideration is the Hawthorne effect on respondents who understood that the surveys were aimed at measuring positive changes for research purposes or departmental evaluation. A prime example of this effect is whether or not residents accurately reported sleeping during conference. Our results showed a significant decrease in those who reported sleeping with the MF which could potentially be linked to increased attentiveness in the new format; however, all surveys suffer the limitation of dependence on respondent honesty and recollection.

A final concern is the effect of time points at which we began the new format. Junior residents continue to gain appreciation for M&M complications and the ability to better recognize changes in practice later in the academic year. We feel, however, that the consistent range of residents’ experience in our study makes this less impactful.

In summary, the majority of our department was satisfied with the adoption of the MF. This resulted in more detailed discussion of events, increased investment by the audience, improved attention by the audience, and greater overall satisfaction. In spite of the limitations of our study as stated previously, we believe that this demonstrates the utility of the MF as an educational conference to improve resident learning and patient care.

REFERENCES

| Table 3. Faculty Preferences for TF versus MF |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Format | Education (%) | Efficiency (%) | Quality Assessment (%) | Personal Interest (%) |
| TF | 9.5 | 9.5 | 20 | 20 |
| MF | 80 | 80 | 80 | 80 |

Faculty preferred the MF to the TF for education, efficiency, quality assessment, and personal interest.