Residency Education Through the Family Medicine Morbidity and Mortality Conference

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Background and Objectives: The value of the morbidity and mortality conference (M&MC) has received little examination in the primary care literature. We sought to understand the educational content of M&MCs by examining data from a family medicine training program. Methods: Archived morbidity and mortality conference data (July 2001–July 2003) were retrieved from two University of Michigan family medicine adult inpatient services (one community based and one university based). We used chi-square and t test to compare demographic variables and adverse events between hospital sites. We qualitatively analyzed written comments about adverse events. Results: Both family medicine services shared similar diagnoses, patient volume, length of stay, and gender distribution of patients, but the community hospital had an older average patient age (67.9 years versus 52.9 years) and a higher outpatient complication rate. Analysis of the qualitative data revealed patterns of adverse events, such as an association between avoidable admissions and inadequate pain control, that could be improved through educational intervention. Conclusions: Although family medicine residents’ experiences in university and community hospitals were comparable, there were differences in patient populations and case complexity. Modifying the M&MC format could enhance its effectiveness as an educational tool about adverse events.

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Medical error is one of the leading causes of morbidity and mortality in this country. While the magnitude of the problem is controversial,1 the Institute of Medicine’s 1999 report estimates that medical errors account for between 44,000 and 98,000 deaths annually, with an associated cost of between $17 billion and $29 billion.2 The most common types of medical errors reported by family physicians include errors in prescribing medications, errors in getting the right laboratory test done for the right patient at the right time, filing system errors, errors in dispensing medications, and errors in responding to abnormal laboratory test results.3 The Harvard Medical Practice Study showed drug complications, wound infections, and technical complications to be the most common adverse events in hospitalized patients.4 House officers at one institution recounted their most serious errors to be in diagnosis, prescribing, communication, and procedural complications.5 Those who accepted responsibility for their mistakes and discussed them were more likely to express constructive changes.5 It is unknown if these findings from previous studies generalize to family physicians working in inpatient settings.

Despite recent coverage in the popular media regarding patient safety, interest in education about medical errors and adverse events has a robust tradition. With historical roots from the early 1900s,6 the morbidity and mortality conference (M&MC) continues as an educational approach for reviewing adverse outcomes in patient care. The primary objective of the M&MC is to learn from adverse events to prevent recurrences. Although this teaching format is widely known and used, these conferences have had limited systematic examination in the field of primary care.6 Most of the published studies on M&MCs identified in the medical literature are from the departments of surgery and anesthesiology.7,8 By examining M&MC data from both a university-based inpatient family medicine service and a community family medicine service, we sought to address this void in the literature.
Our study aims were to describe the patient and hospitalization characteristics, as well as the major diagnoses encountered, in a family medicine residency training program. Since this program has two adult inpatient teaching services, one in a university hospital and the other in a community hospital, we compared the morbidity and mortality data from each service to understand how the residents’ learning experience differed by hospital site and to unearth any opportunities for improved patient care through educational interventions.

Methods

Design

We conducted a retrospective review covering two years (July 2001–July 2003) of archived M&MC reports from two University of Michigan adult inpatient family medicine services. We received approval to conduct this research from Chelsea Community Hospital and the University of Michigan Medical School Institutional Review Board for Human Subjects Research.

Setting

As part of the family medicine residency curriculum at the University of Michigan, all residents in the program rotate through both services. The university family medicine service is based in a 755-bed, tertiary care, teaching hospital in Ann Arbor, Mich. The other family medicine service is based in a 99-bed community hospital in the small city of Chelsea, Mich. The patients on the services typically present from the communities surrounding each hospital site and identify a University of Michigan-affiliated family physician or nurse practitioner as their primary care provider.

Description of Database

The senior resident for each service is responsible for compiling and presenting morbidity and mortality data at the end of the month with a long list and a short list. The long list includes all the patients who were admitted with information on age, gender, date of admission and discharge, diagnosis, primary care physician, and attending on service. The short list consists of cases involving adverse events selected by the resident from the long list. We define an adverse event as an undesirable, unintended—although not necessarily unexpected—event occurring during medical intervention, which may or may not have been caused by medical intervention. The resident categorizes each case on the short list by one or more predetermined types of adverse events: mortality, prolonged length of stay, avoidable admission, outpatient complication, procedure complication, medication error, medication reaction, adverse outcome of care, and other. Each short list case provides an opportunity for written comments, including an explanation of the reason for listing and recommended actions. The short list form is shown in Table 1.

Analysis

Quantitative Data. Each medical diagnosis was coded with ENCODE-FM, a systematic clinical terminology developed in Canada that is designed for primary care use and maps to ICD-10. We compared demographic variables and adverse events between university and community hospital settings using chi-square and t test, where appropriate. We performed logistic regression when multiple variables were significantly associated with one of the adverse events. A probability of $P<.05$ was used to establish statistical significance. All statistical analyses were performed using SPSS statistical software version 11.0 (SPSS Inc, Chicago).

Qualitative Data. We read all of the written comments about each case and looked for recurrent themes about why adverse events occurred. From these we sought ideas to guide educational interventions.

Results

Description of the Family Medicine Services

In the period between July 2001 and July 2003, the family medicine service at the university hospital had 1,205 admissions, and the family medicine service at the community hospital had 1,206 admissions. The average age of the patients on the family medicine service at the community hospital was older than the patients on the university service (67.9 years versus 52.9 years, $P<.05$). In comparing the family medicine services at the university hospital to the community hospital, there were no significant differences in the gender distribution of patients (39.3% male patients versus 43.7% male patients, respectively) or average length of inpatient stay (2.9 days versus 2.7 days). A total of 245 unique medical diagnoses were recorded on the M&MC reports during this time frame on the university hospital service, and 209 unique medical diagnoses were encountered on the community hospital service. The two most common diagnoses for both services were chest pain and pneumonia (Table 2).

A similar number of adverse events were listed for both family medicine services (Table 3), with each service reporting an average of 15% of patients on the short list. Compared to the university hospital, the community hospital had a higher rate of death (odds ratio [OR]=2.9, 95% confidence interval [CI]=1.4–6.1, $P=.002$). Since the community hospital also had a significantly older patient population, we ran logistic regression by age, hospital site, and age-by-hospital site interaction, with the finding that only advanced age retained a significant association with this adverse event. The only other adverse event to significantly differ by service site was outpatient complications; these are...
more than twice as likely to occur in the community hospital (OR=2.3, 95% CI=1.1–4.9, \( P = .023 \)).

**Qualitative Evaluation of the Comments on Adverse Events**

Most cases had written comments with important details regarding each type of adverse event. On the university hospital service, 37\% (n=15) of avoidable admission cases were judged to lack criteria for admission by the residents; on the community hospital service, pain control (n=5) was the most common reason given for avoidable admission. Prolonged length of stay cases were often associated with delayed studies or failed procedures at the university hospital (n=6), whereas difficulty in transferring patients to other medical services or outpatient care facilities was mentioned more frequently at the community hospital (n=5). For cases involving death, initiating comfort care was mentioned in 31\% (n=9) of the cases on the community hospital service versus 10\% (n=1) of the cases on the university hospital service.

The short list comments were pooled to examine all the short list entries from both services. Acute renal failure, most commonly from nonsteroidal anti-inflammatory drugs and diuretics, accounted for 13\% (n=8) of the recorded medication reactions for both services. Allergic reactions were only noted in the community hospital service, resulting in 26\% (n=8) of medication reaction cases occurring there. One half of the cases concerned antibiotics, the other half involved angioedema from angiotensin-converting enzyme inhibitors. Analysis of the source of medication errors revealed an equal distribution between physicians and nurses. Physician errors (n=9) usually involved writing the wrong dose of medication. Most nursing errors

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**Table 1**

The Short List Form for the University of Michigan Department of Family Medicine Morbidity and Mortality Conference, With Case Examples

<table>
<thead>
<tr>
<th>Case #</th>
<th>Age</th>
<th>Date</th>
<th>PCP</th>
<th>Attending on service</th>
<th>Reason for Listing</th>
<th>Explanation</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>64</td>
<td>8/16</td>
<td>EG</td>
<td>MF</td>
<td>4</td>
<td>INR of 15</td>
<td>Closer supervision of coumadin regimen</td>
</tr>
<tr>
<td>21</td>
<td>45</td>
<td>8/18</td>
<td>TD</td>
<td>MF</td>
<td>5</td>
<td>Pneumo-thorax after thoracentesis</td>
<td>Appropriate actions taken—no specific recommendations</td>
</tr>
<tr>
<td>24</td>
<td>88</td>
<td>8/21</td>
<td>KG</td>
<td>MF</td>
<td>8</td>
<td>IV fluids caused heart failure</td>
<td>Monitor fluid intake carefully in elderly</td>
</tr>
<tr>
<td>27</td>
<td>32</td>
<td>8/24</td>
<td>CB</td>
<td>MF</td>
<td>9</td>
<td>Left against medical advice</td>
<td>Involve risk management early</td>
</tr>
</tbody>
</table>

Reason for listing:
1—Mortality, 2—Prolonged length of stay, 3—Avoidable admission, 4—Outpatient complication, 5—Procedure complication, 6—Medication error, 7—Medication reaction, 8—Adverse outcome of care, 9—Other

PCP—primary care provider

INR—international normalized ratio

IV—intravenous

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**Table 2**

The Five Most Common Diagnoses, by Hospital Site on Two University of Michigan Family Medicine Services, July 2001–July 2003

<table>
<thead>
<tr>
<th>Most Common Diagnoses (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University Hospital</strong></td>
</tr>
<tr>
<td>Chest pain (191)</td>
</tr>
<tr>
<td>Pneumonia (93)</td>
</tr>
<tr>
<td>Cellulitis (70)</td>
</tr>
<tr>
<td>Urinary tract infection (56)</td>
</tr>
<tr>
<td>Abdominal pain (54)</td>
</tr>
</tbody>
</table>
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(n=7) came from not giving a medication or administering the wrong dose. Coagulation disorders were noted often in two types of short list events. Elevated international normalized ratio (INR) from a poorly supervised coumadin regimen was cited as the cause for listing on 18% (n=6) of all outpatient complications, with more than half of those patients experiencing gastrointestinal bleeding. In addition, 33% (n=6) of all adverse outcomes of care cases were related to either gastrointestinal bleeding while on heparin or a sub-therapeutic drop in INR due to excessive vitamin K administration.

The two most common themes that arose from the adverse event category, “other,” were readmissions (n=34) and psychosocial issues (n=11). Pain control (n=8) was the most common reason cited for readmissions. For psychosocial issues, leaving against medical advice (n=6) was noted most often.

Discussion

Implicit in holding departmental M&MCs is the assumption of their educational value. Attendance at our monthly M&MCs is expected of both residents and faculty. A nonthreatening teaching environment encourages lively dialogue between the presenting resident and the audience. A change in our department’s M&MC format several years ago, with the introduction of the short list, focused the discussion on adverse event issues identified by the senior resident; previously, the audience asked questions about patients that were of interest to them from that month’s list of all admissions on the service (what we now call the long list). In addition to giving the resident more control over the content of the conference, the use of the short list with written comments also allows for a quantification of the types of adverse events experienced and draws attention to the most serious cases.

In our study, the family medicine service in the community hospital admitted more aged patients, which was associated with a higher death rate, thus increasing the residents’ exposure to end-of-life issues. Residents also have a greater prospect of facing patient death at the community hospital because family medicine residents manage their own patients in the intensive care unit (ICU). By contrast, in the university hospital, unstable patients are transferred off the family medicine service to an ICU staffed by internists. Since the higher number of deaths on the community hospital service may be due to an older patient population as well as from patient deaths in the ICU being counted on the short list, caution should be exercised in head-to-head comparison of the mortality rate between the two family medicine services. Information on the status of patients transferred to the ICU in the university hospital and the location of patient deaths (the ICU or regular ward) in the community hospital is not available. Keeping in mind that not every case transferred to the ICU needs to be on the short list, if an adverse event did occur on the family medicine service in the university hospital that resulted in the patient being transferred to the ICU, that case would be on the short list.

Another difference between the hospital sites is the higher outpatient complication rate seen at the community hospital. A plausible explanation is that one of the family medicine clinics is located on the same medical campus as the community hospital. Patients with complications, or failed outpatient treatment plans, can be easily sent from this clinic to the community hospital for an emergency room work-up or direct admission. In the university hospital, such patients could be admitted to the family medicine service or a variety of subspecialty services.

As in a previous study conducted using different methodology, we found similarity in the variety of diseases encountered in the family medicine services of university and community hospitals. However, there were more unique diagnoses on the university service. This suggests that there may be more complex cases on this service.

These data confirm a common conviction of educators about the respective benefits of training in both university and community settings. On one hand, the exposure to unusual diseases and more complex cases, as well as access to an array of consultants, illustrates

<table>
<thead>
<tr>
<th>Short List Event Categories (%)</th>
<th>University Hospital</th>
<th>Community Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoidable admissions</td>
<td>40</td>
<td>34</td>
</tr>
<tr>
<td>Medication reaction</td>
<td>32</td>
<td>31</td>
</tr>
<tr>
<td>Prolonged length of stay</td>
<td>28</td>
<td>17</td>
</tr>
<tr>
<td>Mortality</td>
<td>10*</td>
<td>29</td>
</tr>
<tr>
<td>Outpatient complication</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>Medication error</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Adverse outcome of care</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Procedural complication</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Other</td>
<td>53</td>
<td>57</td>
</tr>
</tbody>
</table>

* Deaths from patients transferred to the university ICU service are not included

Table 3

Frequency of Short List Event Categories by Hospital Site on Two University of Michigan Family Medicine Services, July 2001–July 2003
the unique educational benefits of the university hospital setting. On the other hand, caring for patients in the community hospital offers learning opportunities relative to managing patients with fewer resources, working with a tighter-knit group of colleagues, interacting with an older patient population, providing continuity of care for patients moving into or out of the ICU from the ward, and more opportunity for end-of-life care.

Our qualitative analysis of the short list comments suggests educational opportunities. For example, data from cases involving avoidable admissions and readmissions (from the adverse event category “other”) suggest that both emergency medicine and family medicine residents could benefit from joint education about appropriate criteria for admission, as well as strategies for managing pain with the goal of avoiding unnecessary inpatient stays. Comments from cases with psychosocial issues (also derived from the adverse event category “other”) suggest that behavioral medicine teaching on how to negotiate with difficult patients, especially those who want to leave against medical advice, may be warranted. Combined discussions with nursing and family medicine residents about mechanisms to reduce medication errors could be helpful as well. Medication reactions and medication errors should continue to be highlighted at M&MCs, with the expectation of openly discussing the scope and types of these events. Since vigilance has human limits, the implementation of a computerized physician entry system may be the best safeguard against medication errors.11 Currently our university health system is adopting such a system. Examination of the M&MC data in the future might help illustrate whether computerized entry has an effect in reducing medication errors on the family medicine service.

A possible limitation to our study lies in the potential variation in personal thresholds of the residents for reporting adverse events on the short list. While some patients will be obvious short list cases, others will make it onto the short list at the discretion of the senior resident on service at the time. The short list categories, which are predetermined but not otherwise defined, may have slightly different interpretations by each resident. Some adverse events, such as avoidable admission or outpatient complication, are beyond a resident’s control and do not reflect inpatient care. Still, such events may be markers for quality in a health system. Our definition of adverse events encompasses issues pertaining to both clinical adverse events and utilization of resources. Although this is an imperfect method for examining adverse events, this system reflects the experience of the residents and captures a broad range of problems. Our study is limited to inpatient family medicine morbidity and mortality data and may not generalize to other inpatient primary care M&MCs, though previous research shows no significant difference in the outcomes of patients admitted to a family medicine service as compared to an internal medicine service.12

The educational effectiveness of the M&M&C could be improved through several approaches. Providing clear definitions for the short list categories could promote greater consistency in reporting, and further refining the short list categories could better track these adverse events. To incorporate advances in systems approaches to medical error prevention, the resident could present a root cause analysis of one case from the short list. Root cause analysis is a methodology for identifying the contributing factors that underlie variations in performance associated with adverse events.13 Alternatively, a near-miss case that involved a correction of a problem to avoid or mitigate its consequences could be presented.14 While every month may not have appropriate short list cases for such presentations, such discussions should help avoid individual “bad apple” blame, offer lessons, and suggest actions to improve the quality of care. Discussing whether the poor outcome was avoidable or not could be helpful for closure of unfortunate but unavoidable events and generate a stronger impetus to make system changes.

In addition, resolution is sometimes lacking at M&M-Cs despite the airing of grievances and proposing of recommendations. The service chiefs investigate some recurring issues, but shared responsibility among interested departmental members is another approach to examining these concerns. A family medicine patient safety committee, ideally composed of both residents and faculty, could be established to explore concerns raised at M&M-Cs. The participation of residents in quality improvement projects would provide a complementary education to clinical management of adverse events.

The precise educational role of M&M-Cs in family medicine residency training programs remains unclear. There have been no national studies to date evaluating the scope of family medicine M&M-Cs and no Accreditation Council for Graduate Medical Education requirement exists for family medicine M&M-Cs. Further innovation and research is needed to fully realize the value of the M&M&C as a tool for teaching, learning, and reducing adverse events in family medicine.

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