Clerkship Order and Performance on Family Medicine and Internal Medicine National Board of Medical Examiners Exams

Jo-Ann Reteguiz, MD; Jesse Crosson, PhD

Background and Objectives: Taking National Board of Medical Examiners (NBME) subject examinations later in the year is known to lead to higher scores. The effect of taking these exams in a particular order is not well understood. Methods: Scores on family medicine and internal medicine examinations from 312 students in 2 academic years were analyzed to determine the effect of clerkship order on student performance. US Medical Licensing Examination (USMLE) Step 1 scores were used to control for prior academic achievement. Students were separated into groups based on the time of year they took each clerkship and prior experiences. Results: When controlling for USMLE scores, NBME scores varied in relation to time of year and order of clerkship experiences. Students who took internal medicine first performed better on the family medicine exam. Taking psychiatry, obstetrics-gynecology, or surgery clerkships prior to the internal medicine exam improved scores on the internal medicine examination. Conclusions: The timing and order of family medicine and internal medicine clerkship experiences affects performance on the NBME family medicine and internal medicine exams. Clerkship directors should consider this effect when evaluating medical students.

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The subjective nature of faculty evaluations in clinical clerkships and the difficulty of standardizing these evaluations has led many clerkship directors in both family medicine and internal medicine to rely on standardized tests to aid in determining student grades. These tests include departmentally constructed exams, objective structured clinical exams, and the subject examinations produced by the National Board of Medical Examiners (NBME) known as the “shelf” exams. The shelf exams provide clerkship directors with a reliable and convenient testing method that requires no faculty time for developing test questions. A recent report showed that 61 family medicine and 108 internal medicine clerkship directors rely on these shelf exams when determining final clerkship grades.1

A number of reports in recent years have suggested that student performance on the exams varies with regard to the amount of clinical experience that students have before taking the exam. In fact, taking the exam later in the year has been found to lead to higher scores in pediatrics, obstetrics-gynecology, surgery, and internal medicine clerkships.2-4 This phenomenon is often referred to as “the clerkship timing effect.” Tekian et al5 hypothesized that students taking the exams later may do better because they are more experienced at independently integrating new clinical knowledge, skills, and problem-solving abilities. Magarian and Mazur6 found that while differences attributable to timing were not evident in testing of students at the start of the internal medicine clerkship, those taking an end-of-clerkship subject exam later in the year did perform better than those tested earlier in the year. They hypothesized that students taking the internal medicine clerkship later were more efficient at using their time for learning activities and thus gained greater knowledge in the same period of time. Manetta et al7 found that experience on the surgery or internal medicine clerkship prior to the obstetrics-gynecology clerkship was associated with improved scores on the obstetrics-gynecology subject exam. The effect of clerkship timing and the order of clerkship experiences on family medicine subject exam scores and the relationship between family medicine and internal medicine subject exam performance has not previously been reported.
This study examined the relationship between NBME scores from the family medicine and internal medicine clerkships across 2 years at one medical school. We hypothesized that students taking internal medicine after family medicine would perform better on the internal medicine exam and those taking family medicine after internal medicine would do better on the family medicine exam. We also hypothesized that those students taking either exam later in the year would do better than students taking the exam earlier in the year.

Methods

In the academic years 1998–1999 and 1999–2000, all students taking the family medicine and internal medicine clerkships in the third year of medical school took the NBME subject exams in both family medicine and internal medicine. Students indicated a preferred order for their clerkship experiences and were placed in a particular offering of either clerkship by preference-based lottery. There were eight possible times to take the family medicine clerkship and four possible times to take the internal medicine clerkship.

Subject examinations were administered at the end of each of these 12 times that the clerkships were offered. Exam scores and prior clinical experiences in the third year were recorded for each student. The prior experiences of students ranged from no experience to all other clerkships completed before the family medicine or internal medicine clerkship. Final clerkship grades were not considered in the study because the two clerkships calculate grades using different components, and they weight components differently.

Setting

The data were collected at a public medical school located in an urban center in the Northeast. Total class size averages approximately 158 students each year. During each of the 2 academic years included in this study, 1998–1999 and 1999–2000, students were required to complete clinical clerkships in both internal medicine and family medicine during their third year of medical school.

During the 12-week required internal medicine clerkship, students rotated through three inpatient sites: the main urban affiliate hospital for 1 month, the Veteran’s Administration Healthcare System for 1 month, and one of two community-based hospitals for 1 month. Throughout the clerkship, students were assigned to an ambulatory practice site on the same day of the week (8 hours per day) for 11 weeks.

During the required 6-week family medicine clerkship, students were assigned to an ambulatory teaching site 4 days per week (8 hours per day) and attended educational sessions at the medical school once a week.

The internal medicine clerkship was given four times during the academic year. Each clerkship group had between 34 and 48 students. The family medicine clerkship was offered eight times each academic year, and each clerkship group had between 18 and 24 students.

Preceptors in the ambulatory teaching sites and students rotating through both clerkships were provided with a list of topics covered in the clerkship (Table 1). Although the internal medicine and family medicine approach to these topics is different, the topics covered in the two clerkships overlap to some extent. Preceptors were expected to provide students with exposure to patients with diagnoses from those shown in Table 1, and students were expected to seek experience with each of these topics. Students completed logs to record their experience with each of these topics during both clerkships.

Testing

After completing each of the clerkships, students were required to take the relevant NBME subject shelf examination. The end-of-clerkship internal medicine and family medicine NBME subject examination scores were scaled to have a mean of 70 and a standard deviation of eight. Students had 2 hours to complete each examination. Only the NBME examination scores from first attempts were tabulated for students who failed either clerkship. This examination constituted 30% of the final grade for the internal medicine clerkship and 35% of the final grade for the family medicine clerkship. US Medical Licensing Examination (USMLE) Step 1 scores were recorded along with these NBME scores for each student to provide an estimate of prior academic achievement.

Data Analysis

Mean scores were calculated for the USMLE Step 1 exam and the NBME family medicine and internal medicine subject examinations for each of the groups of students taking the clerkships and for each academic year. Variations in means between the two academic years were assessed using t tests, and variations among the groups of students taking the clerkships were assessed using analysis of variance. Multiple linear regression was used to determine the relative contributions of USMLE scores, clerkship order, time of year the clerkship was taken, and performance on prior shelf exams to predicting both family medicine and internal medicine shelf exam scores. Variables were constructed for each clinical clerkship experience to indicate whether a particular student had completed a particular clinical clerkship before the family medicine or internal medicine clerkships so that the influence of each experience on family medicine and internal medicine scores could be assessed independently. A variable recording the number of weeks of clinical experience prior to the start of the clerkship was used to account for the time of year that the student took the shelf exam.
Table 1

Topics for Students in the Family Medicine and Internal Medicine Clerkships

<table>
<thead>
<tr>
<th>Topics Covered in Both Clerkships</th>
<th>Family Medicine</th>
<th>Internal Medicine</th>
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<tbody>
<tr>
<td>Abdominal pain</td>
<td>Only Topics</td>
<td>Only Topics</td>
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<tr>
<td>Adult health maintenance</td>
<td>Anxiety</td>
<td>Altered mental status</td>
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<tr>
<td>Asthma</td>
<td>Allergic rhinitis</td>
<td>Anemia</td>
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<tr>
<td>Back pain</td>
<td>Dermatitis</td>
<td>COPD</td>
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<tr>
<td>Chest pain</td>
<td>Ear infection</td>
<td>Common cancers</td>
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<tr>
<td>Cough/respiratory tract infection</td>
<td>Normal pregnancy</td>
<td>Congestive heart failure</td>
</tr>
<tr>
<td>Depression</td>
<td>Sex/conception</td>
<td>Fluid, electrolyte, and</td>
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<tr>
<td>Diabetes mellitus</td>
<td>Somatoform disorder</td>
<td>acid-base disorders</td>
</tr>
<tr>
<td>Dysuria/urinary tract infection</td>
<td>Stress management</td>
<td>HIV infection</td>
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<tr>
<td>Headache</td>
<td>Vaginitis</td>
<td></td>
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<tr>
<td>Health promotion</td>
<td>Well-child examination</td>
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<tr>
<td>Hypertension</td>
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<td>Joint pain/osteoarthritis</td>
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<tr>
<td>Nutrition/cholesterol</td>
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<tr>
<td>Screening/disease prevention</td>
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<tr>
<td>Smoking cessation</td>
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</table>

COPD—chronic obstructive pulmonary disease

Results

A total of 316 students took both the family medicine and internal medicine clerkships. Four students who had deferred family medicine to the fourth year of medical school were eliminated from the analyses, leaving a total of 312 students (98.7% of the total), 151 for academic year 1998–1999 and 161 for academic year 1999–2000.

The mean USMLE and NBME scores for the 2 academic years are reported in Table 2. Internal medicine NBME scores for the 1999–2000 academic year were significantly higher than those for the 1998–1999 academic year (P=.01). Pooling the data from the 2 years, we found that USMLE scores did not vary significantly for the various family medicine or internal medicine clerkship groups (Tables 3 and 4), indicating a rough academic equivalence among the groups of students before starting the respective clerkships.

As we expected, family medicine shelf exam scores did vary significantly among the family medicine clerkship groups (Table 3). Post hoc comparisons using the Scheffé test showed that those students who had either no clerkship experience or only the psychiatry clerkship before the family medicine clerkship scored significantly lower on the exam than only those students who had internal medicine in combination with some other clerkship (pediatrics, obstetrics-gynecology, psychiatry, or surgery) before the family medicine clerkship (P≤.05). In addition, internal medicine shelf exam scores varied significantly among the four internal medicine clerkship groups (Table 4). Post hoc comparisons using the Bonferroni test showed that only the differences between the first and third clerkships were significant (P=.05). Thus, students who completed the pediatrics, obstetrics-gynecology, and surgery clerkships before the internal medicine clerkship performed better than those students who took the internal medicine clerkship before any other clerkship.

In the multivariate regression models constructed to account for NBME exam performance, a combination of length of prior clinical experience, the order of clerkship experiences, internal medicine shelf exam performance, and USMLE scores explained 66% of the variability in family medicine exam grades (P≤.001). Having other clerkships before the family medicine clerkship did not predict higher family medicine shelf exam scores. For internal medicine shelf exam scores, having the combination of family medicine and psychiatry prior to internal medicine; having the combination of pediatrics, obstetrics-gynecology, and surgery prior to internal medicine; family medicine shelf exam performance; and USMLE scores explained about 55% of the variability in the internal medicine exam scores (P≤.05). Interestingly, in the multivariate analysis, the amount of prior clinical experience was not significantly related to internal medicine exam performance, suggesting that the order of clerkships is more important than the time of year when students take specific clerkships in affecting student grades, at least in regard to performance in the internal medicine clerkship.
Medical Student Education

Discussion

This analysis of student performance data from NBME subject exams in family medicine and internal medicine and USMLE Step 1 scores demonstrates that particular prior experiences are associated with better performance on the subject exams. Specifically, our data show that taking internal medicine before family medicine and taking the family medicine subject exam later in the year are likely to lead to better student scores on the family medicine exam and that taking family medicine or a combination of other clerkships prior to the internal medicine clerkship is associated with higher internal medicine subject exam scores.

Several explanations of the effect of the order of clerkship experiences on NBME exam performance are possible. Students may do better on the second exam because of familiarity with the format of the shelf exam or because the prior clerkship gives them additional training in similar disease-based topics (Table 1). Previous research has found that the internal medicine and family medicine clerkships are significantly different in content, with the family medicine preceptorship providing unique opportunities to perform a variety of primary care clinical skills. Students have reported that the family medicine clerkship as a whole provides them with instruction in the importance of understanding family dynamics when treating patients.5,9 While some content overlap between internal medicine and family medicine is evident, the content differences between the clerkships mean that other factors may explain the patterns of exam performance described here. For example, exam performance may also be higher on the second exam because of similarities between the exams rather than between the clerkships.

Since the order of clerkships does appear to affect student performance on the NBME exam, clerkship directors must decide what to do about this. One possible approach is to do nothing and assume that students will be able to adjust their schedules to maximize their performance in the field they have selected for their future career. This approach may lead students to prematurely lock themselves into a particular specialty.

Other authors have suggested that shelf exam scores be adjusted to neutralize the effect of order and timing on student exam performance.10,11 With such an approach, scores would be standardized across multiple test administrations by grading students in a pool with

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Table 3

Comparison of Exam Performance by Clerkship Experiences Before Family Medicine

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<td>USMLE 1</td>
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<td>219.0</td>
<td>215.0</td>
<td>222.9</td>
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<td></td>
<td></td>
<td></td>
<td>.018</td>
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<td>IM NBME</td>
<td>70.4</td>
<td>70.8</td>
<td>75.1</td>
<td>80.1</td>
<td>76.1</td>
<td>73.8</td>
<td>80.5</td>
<td>79.3</td>
<td>&lt;.0001</td>
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</table>

IM—internal medicine
FM—family medicine
OB-GYN—obstetrics-gynecology
USMLE—United States Medical Licensing Exam
NBME—National Board of Medical Examiners

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Table 4

Comparison of Exam Performance by Clerkship Experiences Before Internal Medicine

<table>
<thead>
<tr>
<th></th>
<th>No Clerkships Before IM</th>
<th>FM + Psychiatry</th>
<th>Pediatrics, OB-GYN, Surgery</th>
<th>All Clerkships Before IM</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams</td>
<td></td>
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</tr>
<tr>
<td>USMLE 1</td>
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<td>218.9</td>
<td>217.3</td>
<td>215.9</td>
<td>.759</td>
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<tr>
<td>IM NBME</td>
<td>73.6</td>
<td>74.1</td>
<td>77.3</td>
<td>76.6</td>
<td>.018</td>
</tr>
</tbody>
</table>

IM—internal medicine
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students in the same clerkship sequence from previous years to eliminate the effect altogether. Recently, the NBME has devised a method to address this timing effect with regard to the internal medicine exam. The NBME method has not, however, been used with family medicine exam scores. Adjusting scores to eliminate the effect of timing and order of clerkship experiences is equitable and could eliminate the disparity in performance that exists from one cohort of students to another. More importantly, the inexperienced preclinical medical student, when devising a sequence of clinical courses, would be relieved of the burden of deciding which specialty to take first to maximize later exam scores. This would permit clinical educators a chance to introduce their specialty to uncommitted students. Our research provides additional support for efforts to neutralize the timing effect of the order of clerkships.

There are some limitations to this study. Because subjects were not chosen randomly from the population of all students taking the two exams across the country, our results may not be generalizable to other settings. Further, we are unable to compare retrospectively the questions from the two subject examinations. It is not possible, therefore, to determine whether or not a content overlap on the internal medicine and family medicine exams exists; however, our data suggest that the NBME should seriously consider this possibility. Further, while our findings demonstrate that better performance on the family medicine or internal medicine subject exams is associated with particular prior clerkship experiences, we did not have access to subject examination scores from all clerkships, and we were thus not able to control for the student performance on these other clerkships.

Until some uniformity occurs, faculty of medical student and residency training programs should be aware that NBME subject examination scores from different points in an academic year should be interpreted in light of students’ clerkship experiences before taking the exam. While clinical performance is difficult to evaluate, and students often express a desire for more objective measures of their performance, our analysis suggests that NBME subject examination scores in family medicine and internal medicine should be adjusted to take into account the order of clerkship rotations (ie, prior clerkship experiences).

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REFERENCES