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# What is the effect of taking a practice surgery shelf exam on final shelf exam score?

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Office of Medical Education

Scholarship in Medicine Final Report

**By checking this box, I indicate that my mentor has read and reviewed my draft proposal prior to submission**

## **Abstract**

*Objective:* The purpose of this study was threefold. The first objective was to determine the effect of a practice surgical shelf exam taken during the surgery clerkship on NBME surgical shelf exam score at the conclusion of the clerkship. The second was to determine the effect of the practice shelf exam on USMLE Step 2 CK exam score. The last objective was to assess the value of a practice shelf exam score in predicting final surgical shelf exam score. *Methods:* Students from three classes within BSOM were separated into a group of students who took a practice shelf exam during their surgical clerkship and another group of students who did not.

Independent measures t-tests were used to compare the GPA, Step 1 scores, Step 2 CK scores, and NBME surgical shelf scores of the two groups. Linear regression analysis was used to determine the correlation and  $R^2$  value between practice shelf exam scores and final shelf exam scores. *Results:* There was a significant difference in Step 1 scores ( $p=0.046$ ) for the two groups. There was no significant difference in GPA ( $p=0.765$ ), mean scores on the final shelf exam

( $p=0.233$ ), or Step 2 CK scores ( $p=0.099$ ) of the two groups. The correlation between practice exam scores and NBME shelf exam scores was 0.560 with an  $R^2$  value of 0.313. This showed a moderate correlation between practice and NBME shelf exam scores with a limited amount of the variance in final shelf exam score accounted for by practice shelf exam score.

Key Words: NBME, shelf exam, USMLE, medical education, surgery clerkship

## **Introduction/Literature Review**

The National Board of Medical Examiners (NBME) provides subject specific exams to assess the educational achievement of medical students during clerkships. Subject specific shelf exams can be predictive of achievement on licensing exams such as the United States Medical Licensure Examination (USMLE) Step 2 Clinical Knowledge (CK) exam<sup>1</sup>. The NBME offers shelf exams as a measure of students' achievement in both basic science and clinical knowledge specific to a clinical specialty<sup>2</sup>. The exams reflect a student's learning in a specific domain and their educational development from their overall experiences in medical school<sup>3</sup>. Although the validity of using shelf exam scores to evaluate clinical skills and to determine overall clerkship grades has been called into question<sup>4</sup>, subject specific exams remain useful tools for development and assessment of clinical knowledge<sup>5</sup>.

The Boonshoft School of Medicine (BSOM) required the NBME shelf exams as part of the final grade for each clerkship until the 2019-2020 academic year<sup>6</sup>. From 2017 to 2019, The Department of Surgery at BSOM administered the practice surgery shelf exam to prepare students for the final shelf exam and the USMLE Step 2 CK exam. Performance on the NBME subject specific shelf exam in surgery and Step 2 CK is dependent on a multitude of variables making it difficult to isolate the effect of any one change in a medical school's curriculum on test scores.

Review of the literature found several articles examining how the lengths of various clerkships influence their respective exam scores. Bostwick et al studied three cohorts who had six, four, and three week long psychiatry clerkships. They found the six week cohort performed better on the psychiatry shelf exam compared to both the four and three week cohorts with no significant difference between the four and three week clerkships<sup>7</sup> although it was later pointed

out that this difference could be a result of a student selection bias instead of longer clerkship duration<sup>8</sup>. The students in the curriculum studied by Bostwick et al chose between a three or four week core clerkship and a six week combined core and elective psychiatry clerkship. Cutler mentions that students with more interest in psychiatry, who are likely to prepare more diligently in their preferred subject and to perform better on a psychiatry shelf exam, are also more likely to select the longer six week combined clerkship<sup>8</sup>. This could have biased results of the study as less interested and therefore lower scoring students would choose the three and four week clerkships. An analogous study looked at differences in scores on OB/GYN shelf exams between eight and six week clerkships and found differences in levels of achievement between the two groups. However, for students who had their clerkships and shelf exams later in the academic year, the scores were similar regardless of duration of clerkship<sup>9</sup>. The dependence of significant difference on clerkship scheduling suggests the discrepancy in scores may be caused by differences in clerkship order and student clinical experience rather than clerkship duration<sup>10</sup>. Huang et al found no significant difference in outcomes between six and four week clerkships in family medicine. In addition, improvements were seen in some aspects of the four week cohort's outcomes over the six week cohort<sup>11</sup>.

Few studies exist investigating how clerkship duration affects performance on surgical shelf exams specifically and NBME subject exams overall. Lind et al found eight week surgical clerkships resulted in higher surgical shelf scores than six week clerkships although there was no difference in Step 2 CK scores or achievement on the surgery subsection of the Step 2 CK exam between the two groups<sup>12</sup>. In a study examining the consequences of shortening clerkships by 25% across all specialties, no significant differences in scores on shelf exams were found except

between the pediatrics clerkships<sup>13</sup>. The remaining six clerkships, including the surgery clerkship, did not suffer a decline in performance on subject specific exams.

The literature on the effects of shortening various clerkship durations is ambivalent with more studies suggesting there is not a significant difference in test scores between the two groups. The most recent and specific article comparing exam performance on the surgical shelf exam shows the differences in means of OSCE and surgical shelf exam scores between students in six and eight week clerkships do not differ<sup>14</sup>. Review of the literature did not find information on the use of practice exams and their effect on final shelf exam scores.

In addition to clerkship duration, other predictors of success on the surgical shelf exam include the USMLE Step 1 exam and preclinical NBME scores<sup>15,16</sup>. The order in which students take specific clerkships can also influence scores<sup>4</sup>. The amount of experiences a student has in the clinic may affect shelf scores as well. It has been shown increased clinical experience increases shelf scores more than studying<sup>17</sup>. The learning modality used in didactics can affect shelf scores. BSOM utilizes team based learning (TBL) throughout its clerkships in which students work together during didactics to answer and discuss questions related to clinical scenarios. Student taught educational activities, similar to TBL, have been shown to improve surgical shelf scores<sup>18</sup>.

We decided to examine the effect of a practice shelf exam on final NBME surgery shelf scores to determine if practice shelf exams can improve student performance. We believe the practice shelf exam offers students an additional opportunity to prepare for final subject specific shelf examinations and therefore can improve scores. To date, the effect of administering a practice shelf exam on final surgical shelf exam scores at BSOM has not been evaluated. This study looks to fill this knowledge gap by examining how the practice shelf exam may alter final

exam scores, if at all. If the practice exam does not improve clinical and basic knowledge development, as measured by an increase in surgical shelf exam scores, its value as an educational tool would be called into question. The results of this study may help educators evaluate the benefit of the practice shelf exam in surgery as a requirement of their curriculums.

### **Research Questions**

RQ1: What is the effect of a practice shelf exam on NBME shelf exam score?

RQ2: What is the effect of a practice shelf exam on USMLE Step 2 CK score?

RQ3: Is there any predictive value of the practice exam score for final shelf exam score?

### **Methods**

#### *CONTEXT*

Up until the 2019-2020 academic year, BSOM required the NBME shelf exams as part of the final grade for each clerkship. The shelf exam was removed from the curriculum starting with the class of 2021 to allow more time for hands-on clinical learning instead of test preparation. Prior to the discontinuation of the shelf exam requirement, the Department of Surgery included a practice shelf exam during the surgery clerkship in order to prepare students for success on the clerkship specific subject exam and subsequently the USMLE Step 2 CK exam. Administration of the practice shelf exam started in 2017 and ended when the NBME final shelf exam requirement was removed from the curriculum in 2019. The surgical clerkship schedule and structure at BSOM also changed during this time. The classes of 2018 and 2019 had eight week long surgical clerkships in which half of 2019 and none of 2018 took practice shelf exams. The class of 2020 had six week long surgical clerkships during which all of the class took practice

surgical shelf exams. Based on the findings from the literature review, we did not think the change in length of clerkships greatly affected shelf scores between classes. A comparison of the BSOM classes and differences between their schedules were included below in Table 1.

Table 1: Differences in Clerkship Schedule and Structure between BSOM Classes

<b>Class</b>	<b>Took Practice Shelf Exam</b> (Number of students)	<b>Clerkship Length</b> (Weeks)	<b>Didactics</b> (Hours per week)
<b>Class of 2018</b> (Academic Year 2016-2017)	<b>0</b>	<b>8</b>	<b>7</b>
<b>Class of 2019</b> (Academic Year 2017-2018)	<b>53</b> (50% of class took exam)	<b>8</b>	<b>7</b>
<b>Class of 2020</b> (Academic Year 2018-2019)	<b>62</b> (100% of class took exam)	<b>6</b>	<b>6</b>

Other than length of clerkships, changes in the schedule were minimal. The classes of 2018, 2019, and 2020 had the same number of TBL activities throughout their clerkships. All three classes spent an average of 60 clinical hours in the operating room per week. The class of 2020 had one less hour of didactics per week as four didactic activities were eliminated between the 2017-2018 and 2018-2019 academic years. We believe the decrease in didactic sessions did not influence test scores because the number of student teaching TBL activities and hours of

clinical experience in the operating room, strong predictors of success on the surgical shelf exam, remained the same.

#### *DATA COLLECTION*

The Office of Medical Education provided deidentified data from the classes of 2018, 2019, and 2020. The data included Step 1 score, GPA, surgery practice exam score if applicable, surgery shelf exam score, and Step 2 CK exam score.

#### *DATA ANALYSIS*

The data was checked for normality prior to statistical analysis. The students were separated with those who took the practice shelf exam in one group and those who did not take a practice shelf exam in the other. The independent measures t-test was used to compare the two groups with the outcome variables being GPA, Step 1 score, NBME shelf exam score, and Step 2 CK score. Step 1 scores and GPA were examined to check if the two groups were academically similar and to determine if there was a difference in academic performance between the two cohorts prior to their clerkships. NBME shelf exam scores and Step 2 CK scores were examined to assess the effects of taking a practice shelf exam on final shelf exam and Step 2 CK exam scores.

Linear regression was used to gauge how much of the variance in final shelf score could be accounted for by the practice shelf exam. This was used to evaluate the usefulness of practice shelf scores as predictors of success on the NBME shelf exam.

### **Results**

To determine if the group which took the practice shelf exam and the group which did not take the practice exam were academically equivalent, we compared the p-values of the independent measures t-tests for the GPA and Step 1 score outcome variables. There was no significant difference in GPA ( $p=0.765$ ) between the two groups (Table 2). There was a significant difference in Step 1 scores ( $p=0.046$ ) with the practice exam group having scored higher on average than the group that did not take the practice shelf exam (Table 2).

To determine the effect of a practice shelf exam on NBME shelf exam score and Step 2 CK score, we evaluated the p-values for NBME shelf score and Step 2 CK score variables. There was no significant difference in mean scores on the final shelf exam ( $p=0.233$ ) between the group which took the practice shelf exam and the group which did not (Table 2). Similarly, no significant difference was found between the Step 2 CK scores ( $p=0.099$ ) of the two groups (Table 2).

Table 2: Comparisons between practice surgery shelf exam groups

	<b>Took Practice Exam</b>	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>P-Value</b>
<b>NBME Shelf Score</b>	No	151	72.36	7.66	.233
	Yes	161	73.42	7.96	
<b>Step 1 Score</b>	No	151	<b>226.53</b>	19.68	<b>.046*</b>
	Yes	168	<b>230.92</b>	19.42	
<b>Step 2 CK Score</b>	No	150	241.13	16.07	.099
	Yes	161	244.24	17.05	
<b>GPA</b>	No	150	85.40	4.86	.765
	Yes	167	85.56	4.95	

\*Indicates a statistically significant difference

To determine if there is any predictive value of the practice exam score for final shelf exam score, we evaluated the correlation and  $R^2$  value found using linear regression. The correlation between practice exam scores and NBME shelf exam scores was 0.560 with an  $R^2$  value of 0.313. The results showed a moderate correlation between practice and NBME shelf exam scores with a limited amount of the variance (31.3%) in NBME shelf exam score being accounted for by practice shelf exam score.

## **Discussion**

The lack of significant difference when comparing the GPAs of the group that took the practice exam and the group that did not take the practice exam suggests the two groups were equivalent in academic performance and capability. The significant difference in Step 1 exam scores may be explained by the increases in average Step 1 exam scores between administrations of the test from year to year. The USMLE released data showing the mean Step 1 scores for first time takers of the test were 228 in 2016 and 230 in 2018<sup>19</sup>. The group that took the practice shelf exam consists mostly of students from the class of 2020 who took Step 1 in 2018, while the group that did not take the practice shelf exam is made mostly from students of the class of 2018 who took Step 1 in 2016. The yearly increase in mean exam scores may account for the statistical difference in Step 1 scores for the two groups compared in this study. This further suggests that the two groups were similar in academic performance prior to their surgery shelf exams.

The analysis showed no significant differences in shelf exam scores or Step 2 CK scores between the two groups. This shows taking a practice surgery shelf exam does not have an effect on NBME shelf exam scores or Step 2 CK scores. This finding calls into question the usefulness of requiring the exam as part of a surgery clerkship curriculum if the purpose of the exam is to improve performance on the shelf exam and Step 2 CK exam.

Linear regression showed only a moderate correlation between practice and NBME shelf exam scores with little variance in NBME shelf exam score (31.3%) being accounted for by practice shelf exam score. This, in combination with an insignificant difference in NBME shelf exam scores between the two groups, shows the surgery practice shelf exam does not have value as a predictor of final shelf exam score. An accurate predictor of NBME shelf exam scores could identify students who may need additional preparation in order to pass the shelf exam or Step 2 CK exam. The results of the regression analysis suggest administering the practice exam does not help identify these students.

### **Conclusion**

The work in this study was conducted to determine the effect of a practice surgery shelf exam on NBME shelf exam and Step 2 CK scores in addition to determining the value of the practice exam in predicting final shelf exam scores. This study is limited in scope and includes only information from classes at Wright State Boonshoft School of Medicine. Future work should include more data from additional classes and schools outside of Wright State in order to apply the conclusions to larger populations of students in other curriculums. The results of the study suggest the surgery practice shelf exam does not increase final shelf exam score or Step 2 CK score and is not a valuable predictor of performance on the final shelf exam. This calls into question the usefulness of the exam when used during a surgery clerkship if its purpose is to improve final shelf exam score, Step 2 CK score, or to predict NBME shelf exam score.

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