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Validity and reliability of a novel written examination to assess knowledge and clinical decision making skills of medical students on the surgery clerkship

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Objective examination;
Assessment

Abstract

BACKGROUND: The Surgery Clerkship Clinical Skills Examination (CSE) is a novel written examination developed to assess the surgical knowledge, clinical decision making, communication skills, and professionalism of medical students on the surgery clerkship. This study was undertaken to determine its validity.

METHODS: Data were prospectively collected from July 2011 through February 2013. Multivariate linear and logistic regression analyses were used to assess score trend; convergent validity with National Board of Medical Examiners surgery and medicine subject scores, United States Medical Licensing Examination Step 1 and Step 2 Clinical Knowledge scores, and evaluation of clinical reasoning and fund of knowledge; and the effect of clerkship order. Exam reliability was assessed using a modified Cronbach's α statistic.

RESULTS: During the study period, 262 students completed the CSE, with a normal distribution of performance. United States Medical Licensing Examination Step 2 Clinical Knowledge score and end-of-clerkship evaluations of fund of knowledge and clinical reasoning predicted CSE score. Performance on the CSE was independent of clerkship order or prior clerkships. The modified Cronbach's α value for the exam was .67.

CONCLUSIONS: The CSE is an objective, valid, reliable instrument for assessing students on the surgery clerkship, independent of clerkship order.

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Objective appraisal of student performance on the surgery clerkship has traditionally relied on the National Board of Medical Examiners (NBME) clinical surgery subject examination or "shelf." This exam, consisting of multiple-choice questions, is a valuable instrument in student assessment but one that measures primarily a single dimension of student performance: achievement in the domain of surgical knowledge. Medical knowledge is 1 of 6 Accreditation Council for Graduate Medical Education core competencies put forth as outcome-based standards in medical education.[1–3] Although

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medical knowledge can be easily, effectively, and reliably assessed through a standardized format of multiple-choice questions, the other 5 core competencies describe behaviors and habits that require alternative methods of evaluation.[2,4,5]

Medical education theory classifies methods of trainee assessment into 4 categories of achievement: "knows," "knows how," "shows," and "does," depicted by Miller's pyramid (Fig. 1).[6] Multiple-choice questions assess what a medical trainee knows, or the trainee's ability to recognize the correct answer from a list of possible responses. The cognitive skill measured in this way is different from clinical decision making, which is a skill better assessed through open-response, task-based exam formats corresponding to the "knows how" level of Miller's pyramid. Written case-based simulation is one such method of "knows how" assessment.[6,7] This exam format allows the sampling of a large number of clinical topics within a single exam administration, testing essential elements in decision making and critical steps in the successful resolution of the clinical problem; clinical judgment or reasoning and problem solving abilities of examinees are measured with professional realism.[8–10] Compared with multiple-choice question exams, these exams are less influenced by cueing and do not overestimate examinees' ability.[11] The major limitation of these examinations is case specificity, which results in lower reliability than may be achieved with multiple-choice question exams.[5,7]

Survey data from 2007 and 2008 show that the NBME clinical surgery subject examination is used by 90% to 95% of medical school surgery programs in the United States and is given an average weight of 31% in the determination of final clerkship grade.[12,13] Of surgery programs surveyed by the NBME, 99% report that they are somewhat to very satisfied with the ability of the subject exam to evaluate students' knowledge. Yet only 29% of surgery programs surveyed reported themselves to be more than somewhat satisfied with school curriculum match to subject exam content, and 4% reported being not at all satisfied.[12] As the NBME's *Surgery Subject Examination Score Interpretation Guide* states, "Subject examination scores should not be used alone, but rather in conjunction with other indicators of examinee performance in determination of grade."[14] Of the medical school surgery programs surveyed, 37.7% reported the use of an objective structured clinical examination, and 37.7% reported the use of a written exam other than the NBME clinical surgery subject examination.[13]

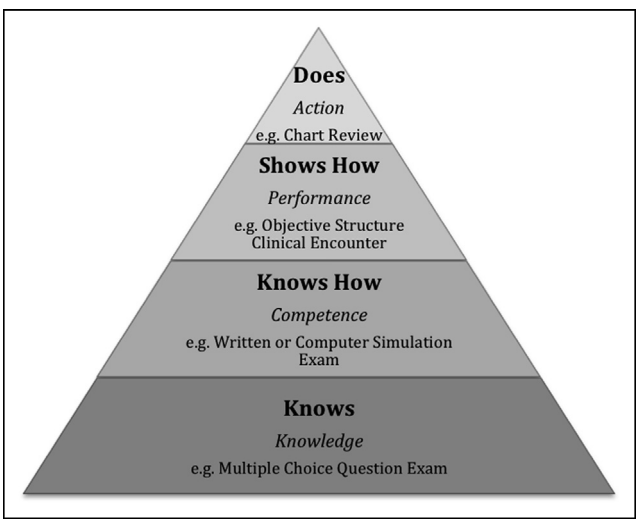

Figure 1 Miller's pyramid framework for clinical assessment. Adapted with permission from Miller.[6]

Locally developed written exams have the benefits that they can be tailored to medical school educational objectives and can be designed to differentiate within a peer group.[15] Toward this end, the Surgery Clerkship Clinical Skills Examination (CSE) was developed at our institution. The goals of exam development were to create an objective, reliable, validated instrument for assessing students' skill in applying surgical knowledge to clinical scenarios and to assess the additional Accreditation Council for Graduate Medical Education competencies of patient care, communication, and professionalism, educational objectives that are not appropriately measured by the NBME clinical surgery subject examination. The CSE also served to replace unstructured oral exams that were traditionally used on the surgery clerkship at our institution but were discontinued because of resource-intensiveness, subjectivity in grading, and student feedback suggesting a negative experience with the evaluation process.

An additional issue with the NBME surgery subject exam is that scores have been observed to trend seasonally, with students who complete the surgery clerkship later in the clinical year performing significantly better than those who complete the surgery clerkship earlier in the course of the clinical year.[14,16–18] The presence of seasonal variation in scores results in a lack of comparability between students completing the surgery clerkship at different points in the clinical year, raising questions about fairness in grade assignment.[16] We hypothesized that scores on the CSE would not exhibit such a seasonal trend, because of general surgery case specificity with less overlap with the subject areas of medicine, surgical subspecialties, and obstetrics and gynecology.

Methods

Exam development

The CSE is a written, case-based, clinical simulation exam composed of 5 case scenarios per exam drawn from a pool of >20 scenarios. A dedicated surgical education research fellow developed the scenarios with faculty consensus regarding content and scoring rubric. Each scenario constitutes 100 points and is scored using a detailed keyword rubric by senior residents after training and establishment of interrater reliability >.90. Graders are trained with a formal orientation followed by practice

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