

Characteristics of the Courses That Best Predict COMLEX–USA Level 1 Performance

Donald J. Sefcik, DO
 Walter C. Prozialeck, PhD
 Thomas H. O'Hare, DO

The performance of medical students and other health professional students in their basic science coursework and on standardized tests has been shown to have a strong correlation to subsequent scores on national licensing examinations.¹⁻⁴ Osteopathic and allopathic medical students in the lowest quintile of grade point average (GPA) during the first 2 years of medical school have been identified as being at the greatest risk of failure on the Comprehensive Osteopathic Medical Licensing Examination–USA (COMLEX–USA) level 1 and the United States Medical Licensing Examination step 1, respectively.^{4,5} In 1994, Swanson et al,⁶ using the total basic science coursework GPA during the first 2 years for students at seven allopathic medical schools, demonstrated that there was a correlation of .72 to .83 to USMLE step 1 performance. In another study, Baker et al⁵ demonstrated that the total GPA obtained during the first 2 years of training had a .70 correlation with performance on the COMLEX–USA level 1 (taken June 1998). While these studies clearly indicate that the GPA at the end of the second year correlates well with performance on licensing examinations, it is not an early enough screening measure to identify and intervene with students at risk of failing the COMLEX–USA level 1.

National licensing examination scores have also been correlated to student performance in individual courses and subject areas. Holtman et al,⁷ comparing student performance on individual basic science subject tests to scores obtained by first-time takers of the USMLE step 1 in 2000, demonstrated a correlation of .59 to .71 for the various subject areas; the two subjects with the strongest correlation were pathology (.71) and pharmacology (.70). Baker et al⁶ demonstrated correlations for various courses, ranging from medical terminology (–.06) to pharmacology (.63).

The National Board of Osteopathic Medical Examiners has developed and administers the COMLEX–USA, an examination series with three levels “designed to assess the osteopathic medical knowledge considered essential for osteo-

pathic generalist physicians to practice medicine without supervision.”⁸ Each level of the COMLEX–USA assesses knowledge that corresponds to the educational experiences of the test candidate. The COMLEX–USA level 1 emphasizes the scientific understanding of the mechanisms of medical problems and disease processes. The COMLEX–USA level 2 emphasizes medical diagnosis, focusing on the medical history and physical examination of patients. The COMLEX–USA level 3 emphasizes the management of patient problems.⁸

The COMLEX–USA level 1, a written multiple-choice examination, is administered over 2 days as four testing sessions, each lasting 4 hours. Most students take the COMLEX–USA level 1 in June, immediately after completing their second year of medical school. It focuses on the basic medical sciences of anatomy, behavioral science, biochemistry, microbiology, osteopathic principles, pathology, pharmacology, and physiology. The standardized score of the COMLEX–USA level 1 is a mean of 500, with a standard deviation of 72; to pass, a standardized score of 400 must be obtained.⁸

Test blueprints describe the two dimensions of each level.⁸ The COMLEX–USA level 1 dimension I, clinical presentation, is divided into 19 sections, each representing a common patient sign or symptom. The clinical presentation sections are comparably emphasized (based on listed percentages) at all three levels. COMLEX–USA level 1 dimension II, physician tasks, is divided into six sections. The physician tasks are not comparably emphasized at all three levels. The scientific understanding of mechanisms comprises 75% to 85% of COMLEX–USA level 1. In the dimension II axis, the scientific understanding of mechanisms constitutes 5% to 8% and 5% to 10% of COMLEX–USA levels 2 and 3, respectively.⁸

In an attempt to further clarify the relationship between the performance of osteopathic medical students in their basic science coursework and subsequent scores on the COMLEX–USA level 1, a retrospective analysis of basic science coursework grades for the classes of 2002 and 2003 at Midwestern University's Chicago College of Osteopathic Medicine (CCOM) was performed. The study addressed the following three questions:

- Does the total GPA for the first 2 years of study, and more specifically, the final grades in the first- and second-year

Dr Sefcik is assistant dean and professor in the Department of Family Medicine and adjunct clinical professor in the Department of Emergency Medicine at Midwestern University's Chicago College of Osteopathic Medicine, where Dr Prozialeck is chairman and professor of pharmacology and Dr O'Hare is associate dean and professor in the Department of Emergency Medicine.

Address correspondence to Donald J. Sefcik, DO, Midwestern University, 555 31st St, Downers Grove, IL 60515.
 E-mail: dsefci@midwestern.edu

MEDICAL EDUCATION

Factor	Class of 2002	Class of 2003
Grade point average	.79	.78
Pharmacology	.80	.74
Topics in medicine	.79	.72
Pathology	.74	.70
Physiology	.72	.69

courses at CCOM, correlate with COMLEX–USA level 1 scores?

- Does the grade in the topics in medicine course, a second-year course that emphasizes pathophysiology and the application of basic science principles to clinical practice, correlate with COMLEX–USA level 1 scores?
- What characteristics identify the single course with the strongest correlation to the COMLEX–USA level 1 scores?

Methods

The subjects for this study, subsequent to approval by Midwestern University's institutional review board, were the members of CCOM's class of 2002 ($n = 171$) and class of 2003 ($n = 151$). Subjects were excluded from the study if they had not completed all basic science coursework during the 1999–2000 or 2000–2001 academic year, or did not have a first-time score available from the June 2000 or June 2001 COMLEX–USA level 1. A total of 154 students from the class of 2002 and 145 students from the class of 2003 qualified for inclusion in the study.

The preclinical curriculum at CCOM is essentially a hybrid curriculum in which traditional lecture and discipline-based courses have been modified to include small group workshops and problem-based learning activities. The basic science courses are taken in a traditional sequence, with courses such as anatomy, biochemistry, embryology, histology, immunology, and physiology being completed during the first year, and microbiology, pathology, and pharmacology taken during the second year. Clinical didactic coursework is integrated throughout the 2 years. The clinical courses include osteopathic principles and practice, introduction to clinical medicine, behavioral medicine, and topics in medicine. Courses at CCOM use a numerical scale on which to rate student achievement; a grade of 70 or above is passing.

Data that were collected and analyzed included the final cumulative grade obtained for courses taken during the preclinical phase of training, the total GPA recorded for the first

2 years of study, and the first-time COMLEX–USA level 1 score for each student. The respective course directors and department chairs provided student academic performance information and the examinations from each course. Course grades and class rank were obtained from the registrar's office. The office of the dean of CCOM provided COMLEX–USA level 1 data forwarded to the college from the National Board of Osteopathic Medical Examiners.

Results

Performance of the study groups on the COMLEX–USA level 1 was comparable to the reported scores for all first-time takers in June 2000 and June 2001. Mean scores for the classes of 2002 and 2003 were 518.3 and 515.5, with pass rates of 93.5% and 97.9%, respectively.

To evaluate the possible correlation between student performance in specific courses and on the COMLEX–USA level 1, correlation coefficients and significance levels for all preclinical courses were calculated using SPSS Base 10.0. The grades from the pharmacology, topics in medicine, pathology, and physiology courses demonstrated the strongest correlation to COMLEX–USA level 1 scores in both study groups. The total GPA demonstrated consistently strong correlations of .79 (class of 2002) and .78 (class of 2003). Single courses with the strongest and most significant correlations ($P < .001$) were pharmacology (.80 and .74) and topics in medicine (.79 and .72), respectively, during the second year, and physiology (.72 and .69) during the first year (Table 1).

Discussion

The results of this study showed a strong and significant correlation between COMLEX–USA level 1 scores and student academic performance during the first 2 years of osteopathic medical school. Hartman et al⁹ have previously reported cor-

Pharmacology Course Rank	Class of 2002 Level 1 Score	Class of 2003 Level 1 Score
Highest quintile		
□ Mean score	605.4	605.3
□ Pass rate, %	100 (31/31)	100 (29/29)
21st–79th Percentile		
□ Mean score	518.1	516.1
□ Pass rate, %	100 (92/92)	100 (87/87)
Lowest quintile		
□ Mean score	429.1	426.8
□ Pass rate, %	64.5 (20/31)	89.7 (26/29)

Table 3
Distribution of Course Multiple-Choice Items by Basic Science Content Areas

Content	Pharmacology		Topics in Medicine		Pathology		Physiology	
	2002, % (n=330)	2003, % (n=332)	2002, % (n=600)	2003, % (n=510)	2002, % (n=580)	2003, % (n=600)	2002, % (n=240)	2003, % (n=220)
Anatomy	0	0	3.5	0.2	3.8	3.3	2.1	0.4
Behavioral medicine	10.0	9.0	2.5	1.0	0	0	0	0
Biochemistry	8.4	8.1	2.5	2.7	4.5	5.0	0	6.3
Microbiology	17.3	12.4	8.3	5.1	7.9	8.5	0.4	0.4
Pathology	12.1	15.1	30.0	32.5	78.4	79.5	5.4	15.5
Pharmacology	25.5	25.9	8.8	7.6	0.7	1.3	10.4	8.1
Physiology	26.7	29.5	9.7	8.6	4.7	2.4	81.7	69.3
Clinical medicine*	0	0	34.7	42.4	0	0	0	0

*Includes medical histories and physical examinations, diagnostic technology, patient education, disease management, and health promotion/disease prevention.

relations between level 1 scores and grades for years 1 and 2, and the first 2 years of medical school combined, of .74, .80, and .81, respectively.

Results of this study also demonstrated a strong and significant correlation between COMLEX–USA level 1 scores and student performance in several preclinical courses at CCOM, with the strongest correlation being in the pharmacology and topics in medicine courses that are taken during the second year, and the physiology course, which is taken during the first year. Baker et al¹⁰ reported relationships between academic achievement and pass rates on the 1999 COMLEX–USA level 1 from a multisite study of 18 osteopathic medical schools. Baker et al¹⁰ reported that students ranked in the lowest 5% of their classes, based on academic performance, were most likely to fail the level 1 with an overall pass rate of 63.5% and a mean of 416.3 (national pass rate for all candidates was 94% with a mean of 514.4).

To determine whether poor performance in the pharmacology course may have been predictive of poor performance on the COMLEX–USA level 1, student COMLEX–USA level 1 scores were matched with pharmacology course grades. As may be seen in *Table 2*, all students who failed the level 1 were ranked in the lowest 20% of the class.

An interesting question that arose from these observations was, “Why does student performance in some preclinical courses demonstrate a consistent and stronger correlation with COMLEX–USA level 1 scores?” Intuitively, it would seem that as the COMLEX–USA level 1 is highly integrated and includes materials from all basic science subject areas, the courses that best integrate subject matter across disciplines should show the strongest correlations. To examine

that possibility, the COMLEX–USA level 1 blueprint was used as a template to analyze the subject content, and an analysis of the examinations used in the pathology, pharmacology, physiology, and topics in medicine courses was conducted.

The investigators reviewed all multiple-choice items from the examinations for each of the four courses, considering whether an understanding of subject matter from other basic science areas was needed to select the best answer. If selecting the correct response to an item was based on an understanding of an associated discipline, it was assigned to the corresponding category (eg, anatomy, behavioral medicine, biochemistry, microbiology, or clinical medicine). Each examination question was placed into a basic science content or clinical medicine content area (*Table 3*).

Analysis of the content areas of the examinations administered to the classes of 2002 and 2003 revealed that pharmacology, the course with the strongest correlation to the COMLEX–USA level 1 scores, was also the course with the highest degree of basic science integration in its tests. This suggests that the performance of students in single courses may be useful in identifying candidates at risk of failing the COMLEX–USA level 1. Identifying such students would allow those students the opportunity to seek appropriate forms of intervention, including but not limited to attending review courses, intensifying self-study, and investigating methods to enhance both memory skills and test-taking abilities. Additionally, students could consider exercising the option of delaying the examination until the issues placing them at risk for failing the national licensing examination can be addressed and corrected.

MEDICAL EDUCATION

Based on this study, student performance at CCOM is being monitored in the physiology course during the first year and in the pharmacology and topics in medicine courses during the second year. Using physiology grades as a screening process, we hope to identify at-risk students early in the curriculum, offering an opportunity for intervention. Subsequently, the pharmacology and topics in medicine courses will be used to monitor students during the second year, providing an opportunity for additional intervention.

Hopefully, other osteopathic medical schools with comparable curriculum structures can perform additional research to corroborate the findings of this study. Such information could be useful in identifying students at risk of failing their COMLEX-USA examinations at their institutions and offering those students the opportunity to consider the various options available to them as they prepare for national licensing examinations.

In summary, the results of the present study indicate that student performance in certain preclinical courses at CCOM, including pharmacology, topics in medicine, and physiology, correlate significantly with student performance on the COMLEX-USA level 1. An analysis of the examination questions from these courses substantiates that they are the courses in the CCOM curriculum that best integrate preclinical subject matter across scientific disciplines. It is hoped that these courses will provide a means of identifying students at risk of failing the COMLEX-USA level 1 so that appropriate interventions and remedial actions may be taken.

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