

USMLE Step 2 CK Preparation and Performance in the Post-Pass/Fail Step 1 Era: A Multi-Institutional Study

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Abstract

The transition of the United States Medical Licensing Examination (USMLE) Step 1 to pass/fail reporting has shifted educational emphasis toward Step 2 Clinical Knowledge (CK), creating uncertainty around optimal exam sequencing and preparation strategies. We conducted a multi-institutional, cross-sectional survey of medical students at three U.S. medical schools trained entirely in the post-pass/fail Step 1 era to examine patterns in exam order, study behaviors, preparation resource use, and their relationship to Step 2 CK performance. Among 241 included respondents, 156 (64.7%) took Step 1 first, while 85 (35.3%) took Step 2 CK first. In a multivariable model, taking Step 2 CK before Step 1, which reverses the traditional exam order, was not associated with a meaningful difference in Step 2 CK performance (adjusted difference, 0.3 points; 95% confidence interval, - 2.9 to 3.6). Neither dedicated study duration nor use of specific commercial resources was independently associated with performance; the score on the final Step 2 practice test was the only factor independently associated with the Step 2 CK score. These findings suggest that exam sequencing and prescribed resource lists may matter less for Step 2 CK performance than is commonly assumed, and that objective self-assessment through practice testing may be the most informative focus for advising and curricular guidance in the post-pass/fail Step 1 era.

Introduction

The United States Medical Licensing Examination (USMLE) Step 1 transitioned from scored to pass/fail reporting in January 2022 [1]. Prior to the scoring change, Step 1 scores had become a top priority for both medical students and program directors [2–4]. In the wake of this change, surveys have shown that residency program directors planned to or have already started using Step 2 Clinical Knowledge (CK) scores in place of Step 1 scores for residency selection [5, 6]. This change has multiple implications for students' strategy to prepare for both USMLE Step 1 and USMLE Step 2 CK. Although the harms of "Step 1 Mania" and the overall anxiety associated with this exam contributed to the change to pass/fail, that pressure has quickly transitioned to Step 2 CK [7, 8].

In the post-pass/fail Step 1 era, there are new questions about USMLE exam preparation for both medical schools and medical students. For medical schools, some have tested shortening the preclinical curriculum, which teaches the content tested on Step 1 [9, 10]. Some of the first medical schools to make this curricular change explored the idea of delaying Step 1 until after clerkships [10, 11]. This change was shown to yield modest increases in score and a decrease in Step 1 failure [12]. However, delaying Step 1 does not address whether taking Step 2 CK before Step 1 influences Step 2 performance, an increasingly salient question as Step 2 assumes greater importance. At medical schools with curricula supporting Step 1 testing after clerkships, students have become interested in whether the traditional order of taking Step 1 and then Step 2 should be reversed, with Step 2 in close proximity to clerkship completion and Step 1 taken afterwards.

Both at medical schools pioneering curricular changes and at medical schools with traditional curricula, students have long sought to optimize their USMLE exam preparation using third-party resources including review books, review videos, spaced-repetition flashcards, and question banks. The relationship between these resources and exam performance has been studied in single-institution studies [13, 14]. Though these often-expensive resources are nearly ubiquitous in exam preparation, a scoping review by Jeyaraju et al. found no clear association between a single resource and improved exam performance [15]. Jeyaraju and colleagues did show that the only factors predictive of higher scores on licensing exams (both USMLE and the Comprehensive Osteopathic Medical Licensing Examination [COMLEX]) were practice test items, practice exam scores, and less time in dedicated preparation [15].

These observations align with a broader principle in the learning sciences: repeated retrieval practice and formative self-assessment are among the more robust correlates of later test performance. Consistent with this, the scoping review noted above identified practice-test items and practice-exam scores, rather than any single commercial product, as the factors most closely associated with higher licensing-exam scores [15]. If practice-test performance reflects a learner's calibrated readiness rather than merely the quantity of preparation, it may carry more information about eventual outcomes than the timing of examinations or the particular resources a student selects. Whether this holds for USMLE Step 2 CK in the post-pass/fail environment, where students now face genuinely new choices about exam order, has not been established.

There still remains significant uncertainty for medical schools responsible for advising students and making curricular decisions, as well as for individual students preparing for USMLE exams. For students, burnout and anxiety during Step 1 preparation is well documented, which we anticipate translates to the new emphasis on Step 2 [16]. To address these concerns, we conducted a multi-institutional cross-sectional survey across three institutions examining students' preparation strategies. Specifically, we asked whether (1) the order of Step 1 and Step 2 CK, (2) the duration of dedicated study, and (3) the use of specific commercial resources were associated with Step 2 CK performance, and (4) whether objective practice-test performance was associated with Step 2 CK scores. We hypothesized that, after adjustment, practice-test performance, rather than exam sequencing or resource choice, would be most closely associated with Step 2 CK outcomes.

Materials and Methods

Study Design and Setting

We conducted a multi-institutional, cross-sectional survey of medical students at Vanderbilt University School of Medicine (VUSM), Harvard Medical School (HMS), and the University of Virginia School of Medicine (UVASOM). Data collection occurred between February 2023 and fall 2024. Eligible participants had taken at least one USMLE examination after the transition of Step 1 to pass/fail reporting.

Survey Development and Administration

Survey items were informed by a brief needs assessment conducted among medical students who had not yet taken either USMLE Step 1 or Step 2 CK. The needs assessment identified areas of uncertainty related to exam sequencing, duration of dedicated study, use of preparation resources, and practice testing, which guided item selection for the final survey.

The survey was developed by the study team with input from medical students and faculty advisors and was administered using REDCap. An initial section asked about training year, exam order, and the spacing between examinations. Branching logic then displayed a preparation section for each examination the student had completed, covering preparation resources used, length of dedicated study, question bank completion, the number of practice tests taken, whether a full-length test day was simulated, the form and score of the final practice test, and the official examination score. Question formats included multiple-choice items, binary responses, and numeric entries. Minor modifications were made for Harvard Medical School and the University of Virginia School of Medicine to account for curricular differences across institutions. The survey was distributed via class listservs to cohorts most likely to have recently completed at least one USMLE examination.

Variables and Outcomes

Primary independent variables included exam order (Step 1 before Step 2 CK vs Step 2 CK before Step 1), duration of dedicated study, use of commercial preparation resources, number of practice tests completed, and the score on the final Step 2 practice test. The final practice-test score was the three-digit score on the last full-length practice examination a student took before Step 2 CK, either a National Board of Medical Examiners (NBME) self-assessment (Forms 9–12) or a UWorld Self-Assessment. The primary outcome was the self-reported USMLE Step 2 CK score. Both practice-test and official scores were self-reported.

Statistical Methods

Analyses were restricted to participants who completed USMLE examinations under the pass/fail Step 1 scoring system. Students who had completed a numerically scored Step 1 examination were excluded.

Descriptive statistics were calculated for participant characteristics and preparation strategies overall and by institution. Categorical variables are reported as counts and proportions, and continuous variables as means with standard deviations (SD) or medians with interquartile ranges (IQR), as appropriate.

To evaluate associations between preparation strategies and Step 2 CK performance, we fit a multivariable linear regression model with Step 2 CK score as the dependent variable. Independent variables included exam sequence, duration of dedicated study, UWorld and AMBOSS question bank

completion, timing of Anki use, number of practice examinations, whether a full-length test day was simulated, and the final Step 2 practice-test score. The regression analysis was conducted using complete-case analysis, excluding observations with missing data for model covariates, yielding a final analytic sample of 139 participants. No imputation was performed for subjects with missing data.

Model assumptions were assessed with residual diagnostic plots (residuals versus fitted values, normal quantile–quantile, scale–location, and residuals versus leverage). Because all included participants passed the pass/fail Step 1 examination, no statistical modeling of Step 1 outcomes was performed. All analyses were conducted using R version 4.4.0.

Use of Generative AI

A large language model (Claude, Anthropic) was used to assist with reformatting the manuscript to journal guidelines and with copy-editing. It was not used for data collection or statistical analysis. The authors reviewed and revised all content and take full responsibility for the manuscript.

Results

Student Characteristics and Exam Sequencing

A total of 302 students initially responded to the survey (HMS $n = 62$; UVASOM $n = 84$; VUSM $n = 156$). Students were excluded if they had not taken at least one USMLE examination or if they had completed a numerically scored USMLE Step 1 examination. Excluded respondents were typically students pursuing research years, dual-degree programs, or graduate training. After applying these exclusion criteria, 241 students were included in the analytic cohort (HMS $n = 43$; UVASOM $n = 68$; VUSM $n = 130$). All respondents were in the clinical phase of training, with 56% in the third year and 44% in the fourth year. Overall, 156 of 241 students (64.7%) took Step 1 as their first USMLE examination, while 85 (35.3%) took Step 2 CK first, including 2 who had not yet taken Step 1. Mean Step 2 CK score among respondents with available data ($n = 206$) was 261 (SD 13.1). Participant characteristics by institution are summarized in Table 1.

Table 1
Summary of participant characteristics by institution

	HMS (N = 43)	UVASOM (N = 68)	VUSM (N = 130)	Overall (N = 241)
Year				
M3	3 (7.0%)	2 (2.9%)	130 (100%)	135 (56.0%)
M4	40 (93.0%)	66 (97.1%)	0 (0%)	106 (44.0%)
Exam order				
Step 1, then Step 2	39 (90.7%)	8 (11.8%)	91 (70.0%)	138 (57.3%)
Step 2, then Step 1	1 (2.3%)	60 (88.2%)	22 (16.9%)	83 (34.4%)
Only Step 1 completed	3 (7.0%)	0 (0%)	15 (11.5%)	18 (7.5%)
Only Step 2 completed	0 (0%)	0 (0%)	2 (1.5%)	2 (0.8%)
Exam spacing				
Exams taken consecutively following clerkships	4 (9.3%)	51 (75.0%)	16 (12.3%)	71 (29.5%)
Exams taken $\geq$ 1 month apart	39 (90.7%)	17 (25.0%)	48 (36.9%)	104 (43.2%)
Missing	0 (0%)	0 (0%)	66 (50.8%)	66 (27.4%)
Step 2 CK score^a				
Mean (SD)				261 (13)
Median [IQR]				264 [255, 268]
Score of final Step 2 practice test^a				
Mean (SD)				257 (16)
Number of Step 1 practice tests taken				
Median (IQR)	4 (3–5)	3 (2–4)	4 (3–4)	4 (3–4)
Number of Step 2 practice tests taken				
Median (IQR)	5 (4–6)	5 (4–6)	5 (4–6)	5 (4–6)
Weeks of dedicated study for Step 1^b				
Median (IQR)	5–6 weeks (3–4 to 7–8)	3–4 weeks (1–2 to 3–4)	3–4 weeks (3–4 to 5–6)	3–4 weeks (3–4 to 5–6)
Weeks of dedicated study for Step 2^b				

	HMS (N = 43)	UVASOM (N = 68)	VUSM (N = 130)	Overall (N = 241)
Year				
Median (IQR)	5–6 weeks (5–6 to 7–8)	5–6 weeks (3–4 to 5–6)	5–6 weeks (3–4 to 5–6)	5–6 weeks (3–4 to 5–6)

HMS, Harvard Medical School; UVASOM, University of Virginia School of Medicine; VUSM, Vanderbilt University School of Medicine; M3, third-year medical student; M4, fourth-year medical student; SD, standard deviation; IQR, interquartile range. ^a Self-reported. ^b Study duration was reported in predefined categorical ranges and summarized using the median and interquartile range of the response categories.

Study Resources

Use of commercial preparation resources was common but heterogeneous across participants. For Step 1, the most frequently used resources were UWorld (90%), First Aid (73%), Anki (62%), Sketchy (57%), and Pathoma (43%), with AMBOSS (20%), Boards and Beyond (19%), and other resources (6%) used less often. For Step 2 CK, UWorld remained near-universal (86%), while use of Anki (49%), First Aid (28%), AMBOSS (26%), and Sketchy (23%) varied, and book- or video-based resources such as Pathoma (4%) and Boards and Beyond (4%) were used infrequently; other resources were reported by 14% of students. Thus, question banks, particularly UWorld, were near-ubiquitous for both examinations, review books and video-based platforms were used more frequently for Step 1 than for Step 2, and Anki flashcards were used by approximately half of students for both examinations (Fig. 1).

Multivariable Model for Step 2 CK Performance

The final regression model incorporated exam order, study-period length, resource utilization metrics, number of practice tests, and the final practice-test score. After adjustment, only the final practice-test score remained a significant predictor of the actual Step 2 CK score ($\beta = 0.71$ points per one-point increase on the practice test; 95% confidence interval [CI], 0.62 to 0.81; $p < 0.001$). Exam order, duration of dedicated study, completion percentage of question banks, and use of specific resources were not significant predictors (all $p > 0.05$); for exam order, the adjusted difference associated with taking Step 2 CK before Step 1 was 0.3 points (95% CI, – 2.9 to 3.6). The full model is summarized in Table 2.

Table 2
Multivariable linear regression model of Step 2 CK score

Term	Estimate	Standard error	95% CI	p value
Final Step 2 practice test score	0.714	0.050	0.615 to 0.813	< 0.001
Step 2 CK taken before Step 1	0.348	1.636	−2.889 to 3.585	0.832
Duration of Step 2 study period	−1.226	0.971	−3.147 to 0.695	0.209
Number of Step 2 practice tests	−0.818	0.478	−1.764 to 0.128	0.089
Did not simulate a full-length Step 2 test day	−0.500	1.755	−3.972 to 2.972	0.776
UWorld question bank completion percentage	0.026	0.032	−0.037 to 0.089	0.419
AMBOSS question bank completion percentage	0.040	0.039	−0.037 to 0.117	0.308
Timing of Anki use for Step 2 (coded 0–3) ^a	0.314	0.610	−0.893 to 1.521	0.607
(Intercept)	83.422	14.357	55.018 to 111.826	< 0.001

Model fit: $R^2 = 0.671$; adjusted $R^2 = 0.651$; $n = 139$ (complete-case analysis). Estimates are unstandardized coefficients from a multivariable linear regression with Step 2 CK score as the dependent variable. CI, confidence interval. Study duration was entered as an ordinal variable of six categories (from less than 1 week to 8 or more weeks). Reference categories: Step 1 taken before Step 2 CK; simulated a full-length test day. ^a Coded 0 = did not use Anki; 1 = began at the start of dedicated study; 2 = began at the start of the first year of medical school; 3 = used on and off throughout; entered as a single numeric term.

Discussion

In this multi-institutional study conducted after the transition of USMLE Step 1 to pass/fail reporting, reversing the traditional order of the two examinations was not associated with a meaningful difference in Step 2 CK performance (adjusted difference, 0.3 points; 95% CI, − 2.9 to 3.6). Neither dedicated study duration nor the use of specific commercial resources was independently associated with performance. The single factor independently associated with the Step 2 CK score was the score on the final Step 2 practice test. Taken together, these findings address a key area of uncertainty for students and medical schools and support advising policies that permit flexibility in exam order rather than prescribing a fixed sequence.

Our results extend prior literature examining USMLE preparation strategies. Previous studies have focused primarily on the timing of Step 1 relative to clerkships or on the effectiveness of individual study resources [13–15]. Our findings add to this literature with the novel observation that reversing the traditional order of Step 1 and Step 2 CK was not associated with a significant difference in Step 2 CK outcomes. Because this question is specific to the post-pass/fail era and has not previously been examined across multiple institutions, this insight can guide students and medical school administrations alike when formulating study plans and planning curricula.

The prominence of practice-test performance as the sole independent correlate warrants careful interpretation. Full-length practice assessments are explicitly designed to approximate the content and scoring of the actual examination, so a strong association between the final practice score and the actual score is expected and should not, by itself, be read as evidence that additional practice testing causes higher scores. The final practice-test score more plausibly functions as an integrated marker of a learner's knowledge and readiness shortly before the examination. This interpretation is consistent with the direction of two other estimates in our model: a greater number of practice tests and a longer dedicated study period were each associated with numerically lower scores, though neither reached statistical significance. The most likely explanation is reverse causation rather than harm from these behaviors: students who perceive themselves to be less prepared may complete more practice tests and study for longer. These patterns reinforce the value of using practice-test performance as a formative gauge of readiness rather than as a target to be maximized.

Consistent with prior work, we found no independent association between specific commercial resources and exam performance [15]. Instead, objective self-assessment, as reflected by practice-test performance, emerged as the only significant predictor of Step 2 CK scores. These results carry several practical implications. First, because exam order was not associated with performance, schools and advisors may reasonably allow students to sequence Step 1 and Step 2 CK in the way that best fits their clinical schedule, career goals, and well-being, rather than defaulting to a single prescribed order. Second, because no individual commercial resource was independently associated with performance, advising conversations may be better spent helping students interpret their own practice-test performance than endorsing particular products. Third, integrating periodic, low-stakes practice assessments into the clinical curriculum may give students and advisors an objective, individualized signal of readiness that can inform both preparation and the timing of the examinations themselves. Such approaches may help mitigate anxiety while allowing learners to align examination timing with their clinical training and career goals.

Limitations

There are several limitations to the study. Most importantly, exam order was strongly patterned by institution: students who took Step 2 CK before Step 1 were concentrated at a single school, so exam order and institution are closely correlated, and the adjusted estimate for exam order should be interpreted in that context; we did not have sufficient power to fully disentangle these effects. Relatedly,

the complete-case analytic sample (n = 139) is modest relative to the number of model covariates, providing limited power to detect small associations; non-significant findings should therefore not be interpreted as evidence of no effect. Both the outcome and the key predictor were self-reported by the same students, which may inflate their association through shared-method and recall bias. Because the survey was distributed through class listservs which contained numerous faculty and administrators, the number of students who received it could not be determined; a response rate therefore could not be calculated, and non-response bias could not be assessed. Several survey fields distributed to VUSM students did not have mandatory response options enabled, which contributed to missing data in that cohort. Finally, the participating institutions are all U.S. MD-granting schools with relatively high mean Step 2 CK scores and no reported Step 1 failures, producing a restricted range of outcomes that may limit generalizability, particularly to lower-performing learners. Reporting bias is also possible, as higher-scoring students may have been more inclined to share their results. Together, these factors may partially explain the high median Step 2 CK scores observed and the absence of reported Step 1 failures [17].

Conclusions

In this multi-institutional study of medical students trained entirely in the post-pass/fail Step 1 era, the order in which students completed Step 1 and Step 2 CK was not associated with Step 2 CK performance, and no individual study resource or measure of study duration was independently associated with outcomes. Objective self-assessment through practice testing was the only factor independently associated with Step 2 CK performance. These findings support advising and curricular frameworks that permit flexibility in exam timing and emphasize individualized, practice-test-based self-assessment rather than rigid sequencing rules or prescribed resource lists. Further multi-institutional and prospective work with more diverse cohorts, with institution and learner ability explicitly accounted for in the analysis, is warranted to confirm these associations and to examine their generalizability across the full range of learner performance.

Declarations

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Competing Interests.

The authors report no conflicts of interest related to this work.

Ethics Approval.

This study was approved by the Vanderbilt University Institutional Review Board (IRB; #230131) and the University of Virginia IRB (#5915), and was determined exempt by the Harvard Medical School IRB.

Consent to Participate.

The survey's opening statement informed students that participation was voluntary, that responses would be anonymous, and that results might be used for research and publication. Completion of the survey was taken as consent to participate.

Use of Generative AI.

During preparation of this manuscript, the authors used Claude (Anthropic; model versions claude-opus-4-8 and claude-opus-5-5) to reformat the manuscript to the journal's guidelines and copy-edit. It was not used to collect or analyze the data. The authors reviewed and edited all content and take full responsibility for the manuscript.

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Author Contribution

Conceptualization: AL, AF. Study design: AL, AC, AW, AF. Data curation: AL, AC, AW. Formal analysis: AL, HY, MD. Writing original draft: AL, AC. Writing, review & editing: all authors.

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Data Availability

The de-identified data that support the findings of this study are available from the corresponding author upon reasonable request.

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Figures

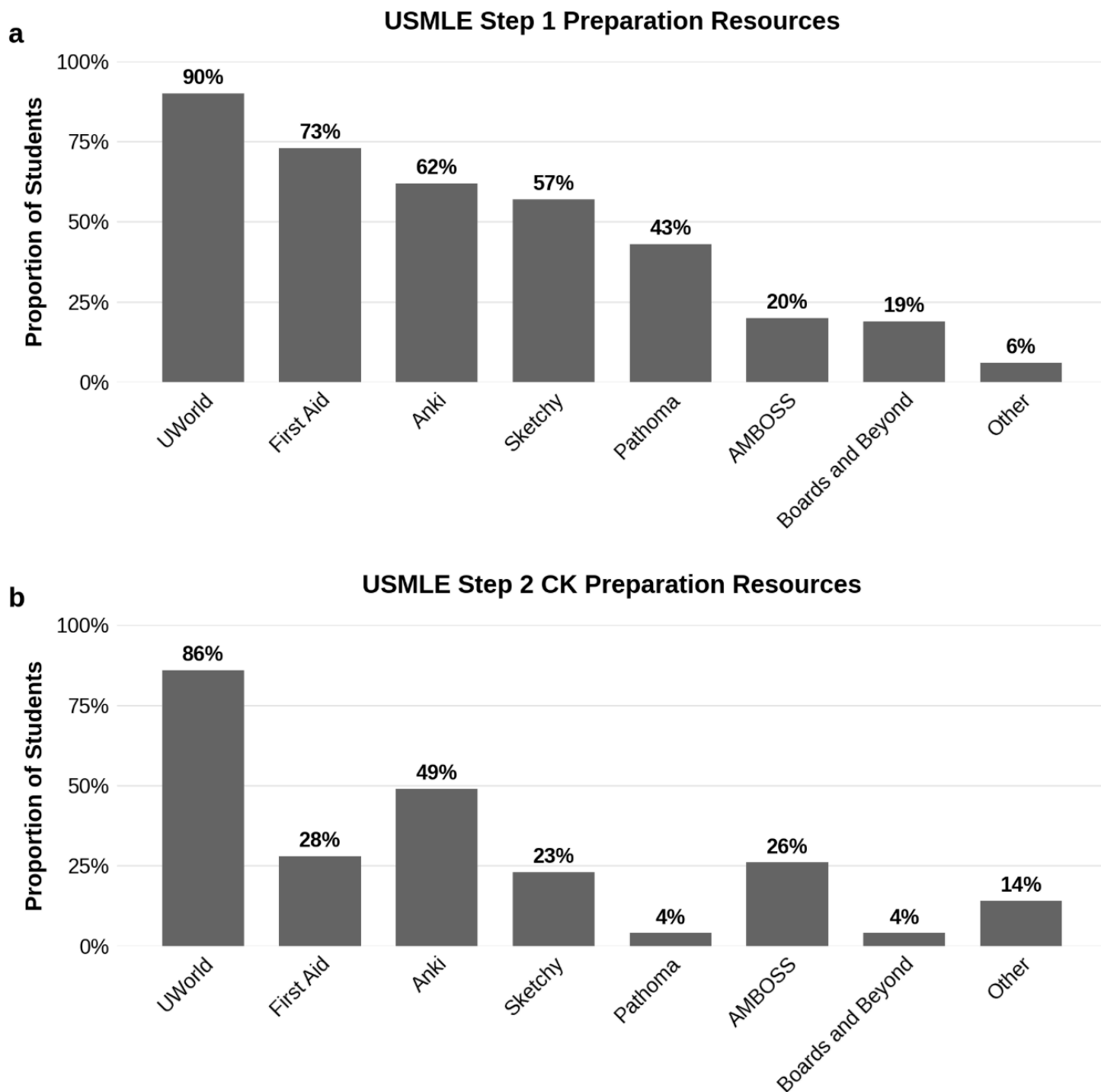


Figure 1

Commercial preparation resources used for USMLE Step 1 and Step 2 CK. Proportion of students reporting use of each preparation resource for (a) USMLE Step 1 and (b) Step 2 CK. Values represent percentages of respondents.