Adv in Health Sci Educ (2013) 18:279–289
DOI 10.1007/s10459-012-9371-2

Academic and professional career outcomes of medical school graduates who failed USMLE Step 1 on the first attempt

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Received: 6 December 2011 / Accepted: 26 March 2012 / Published online: 7 April 2012

Abstract This study sought to determine the academic and professional outcomes of medical school graduates who failed the United States Licensing Examination Step 1 on the first attempt. This retrospective cohort study was based on pooled data from 2,003 graduates of six Midwestern medical schools in the classes of 1997–2002. Demographic, academic, and career characteristics of graduates who failed Step 1 on the first attempt

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were compared to graduates who initially passed. Fifty medical school graduates (2.5 %) initially failed Step 1. Compared to graduates who initially passed Step 1, a higher proportion of graduates who initially failed Step 1 became primary care physicians (26/49 [53 %] vs. 766/1,870 [40.9 %]), were more likely at graduation to report intent to practice in underserved areas (28/50 [56 %] vs. 419/1,939 [21.6 %]), and more likely to take 5 or more years to graduate (11/50 [22.0 %] vs. 79/1,953 [4.0 %]). The relative risk of first attempt Step 1 failure for medical school graduates was 13.4 for African Americans, 7.4 for Latinos, 3.6 for matriculants >22 years of age, 3.2 for women, and 2.3 for first generation college graduates. The relative risk of not being specialty board certified for those graduates who initially failed Step 1 was 2.2. Our observations regarding characteristics of graduates in our study cohort who initially failed Step 1 can inform efforts by medical schools to identify and assist students who are at particular risk of failing Step 1.

Keywords Health professional career outcomes · Relative risk · Underrepresented in medicine · Underserved areas · United States Licensing Examination (USMLE) Step 1 failure

Introduction

The United States Medical Licensing Examination (USMLE) is a three-step examination for medical licensure in the United States. Each of the three Steps of the USMLE sequence complements the other; no Step can stand alone in assessment of readiness for medical licensure. Step 1 assesses the understanding and application of important concepts of the sciences basic to the practice of medicine, with special emphasis on principles and mechanisms underlying health, disease, and modes of therapy. Step 1 is usually taken during the second year of medical school. Step 2 is devoted to principles of clinical sciences and patient-centered skills. Step 2 is usually taken during the fourth year of medical school. Step 3 assesses the application of medical knowledge and understanding of biomedical and clinical sciences essential for the unsupervised practice of medicine. Step 3 is usually taken after completing the first year of graduate medical education (USMLE 2011).

Passing Step 1 is a critical milestone for aspiring physicians. The first time pass rate on Step 1 for all 17,494 US and Canadian M.D. degree candidate examinees was 94 % in 2009 (NBME 2010). As more than 1,000 students initially failed Step l in 2009, most medical schools are now faced with at least some students who initially fail Step l. We therefore conducted a study to address two questions: (1) In what ways are medical school graduates who passed Step 1 on the initial attempt significantly different from graduates who did not pass Step l on the first attempt? and (2) Are there differences between these two groups in their professional development beyond graduation?

Some studies in the literature to date on students who failed Step l have assessed within-medical-school outcomes, with one single-institution study suggesting that Step 1 failure was associated with increased risk of failing a subject examination and the associated clerkship (Myles and Galvez-Myles 2003). Another single-institution study reported that students who failed Step l the first time were somewhat less likely to ultimately pass both Step 1 and Step 2 prior to graduation and also less likely to match to a residency position (Biskobing et al. 2006). These authors also noted that after graduation a somewhat smaller percentage of these graduates received a medical license and became board certified; however, these findings were based only on students who pursued residency training in

Internal Medicine, Pediatrics, or Family Medicine (Biskobing et al. 2006; Myles and Galvez-Myles 2003).

Most studies on Step 1 have focused on Step 1 numeric score correlates of within-residency outcomes, without distinguishing between graduates who initially failed Step 1 and graduates who initially passed. Step 1 scores have been shown to correlate with in-training examination scores in Internal Medicine (Perez and Greer 2009), Emergency Medicine (Thundiyil et al. 2010), Orthopedic Surgery (Carmichael et al. 2005), and Obstetrics and Gynecology (Armstrong et al. 2007). There also was reportedly a low correlation between Step 1 and in-training exams in orthopedic surgery (Klein et al. 2004; Carmichael et al. 2005), several studies showing a correlation between Step 1 and in-training examination scores reported stronger in-training examination correlations with Step 2CK (clinical knowledge) than with Step 1 scores (Perez and Greer 2009; Thundiyil et al. 2010; Black et al. 2006).

Most of these studies described above focused on a single institution over several years. The one study involving multiple institutions focused on 1 year of data and was limited by a small sample size (Armstrong et al. 2007). The difficulties of generalizing from such studies are highlighted in a systematic review of medical school assessments in relation to future clinical-practice performance (Hamdy et al. 2006). While the authors found low to moderate correlations between medical school measures of achievement and residency performance, there was evidence that high correlations between measures were a result of their common method of measurement, that is, measures based on multiple choice questions correlated best with other similarly scored measures, i.e., Step 2 CK correlated with Step 3 (Forsythe et al. 1986; Perez and Greer 2009).

Purpose

This retrospective cohort study aimed to determine the academic and professional career outcomes for a multi-institutional sample of medical school graduates who failed Step 1 on the first attempt. Graduates with and without first-attempt passing scores on Step 1 were compared on socio-demographic background characteristics and on their subsequent academic performance and career paths to provide insight into their professional development beyond graduation.

Methods

Collaborating investigators from six Midwestern medical schools (1 private, 5 public) were funded by a research grant from the Central Group on Educational Affairs of the Association of American Medical Colleges (AAMC) and developed a database of individualized records for their 1997–2002 graduates (Andriole et al. 2010). Follow-up data were obtained through the 2007–2008 academic year. Each school received project approval from the local institutional review board. The database included linked records for medical school graduates from 1997–2002 who had completed both the AAMC Matriculating Student Questionnaire (MSQ) and the AAMC Graduation Questionnaire (GQ) with identifiers. Medical Marketing Services, Inc., a licensed American Medical Association (AMA) Physician Masterfile vendor, provided data from the AMA Physician Masterfile regarding practice characteristics; and each school provided first-attempt Step 1 3-digit scores and pass/fail results, first-attempt Step 2CK (clinical knowledge) 3-digit scores and Alpha Omega Alpha (AOA) honor society election. AAMC Faculty Roster records for

faculty appointments were obtained from the AAMC. The six school-specific databases were stripped of individual identifiers and merged into a single database for analysis.

For analysis, graduates were divided into two groups based on passing or failing Step l on their initial attempt. The two groups were compared on demographic and background variables obtained from the MSQ, including gender, race and ethnicity, age at matriculation, first-generation college graduate, parent's income, premedical debt, and number of medical school acceptances. Self-reported race and ethnicity were categorized to indicate whether or not the graduate was an under-represented minority in medicine. This included graduates who were African American, Latino, American Indian or Alaska Native. In addition, data for age at medical school graduation and intention to practice in an underserved area were obtained from the GQ. Subsequent academic performance indicators included first-attempt Step 2CK 3-digit scores and AOA election. From the AMA Physician Masterfile we obtained self-reported practice specialty and practice type, as well as specialty board certification status by a member board of the American Board of Medical Specialties as reported by the American Board of Medical Specialties to the AMA Physician Masterfile as of December 2007. AAMC Faculty Roster System data were used to identify graduates who held full-time faculty appointments at U.S. medical schools during the 2007–2008 academic year.

Data analysis

Continuous variables including parent's income, age at matriculation and graduation, and USMLE Step 2CK scores were converted to dichotomous variables based on the sample median values. Chi-squares were then calculated for comparisons of all categorical variables whether or not they initially failed Step 1. Relative risks and 95 % confidence intervals of initial Step 1 failure were calculated for each of gender, race/ethnicity, age at matriculation and first generation college graduate status. We calculated relative risks because initial Step 1 failure rates were $\geq$10 % among certain demographic groups and because odds ratios overstate the relative risk for more common outcomes. Tests were performed using SPSS 18.0 (SPSS, Inc., Chicago, IL, 2010) and MedCalc® Version 12.1.1 (MedCalc® Software, Mariakerke, Belgium, 2011). Retrieved November 25, 2011, from: http://www.medcalc.org/calc/relative_risk.php), with two-tailed p values $<.05$ considered significant.

Results

Our database of individualized de-identified records included data for 2,003 graduates with complete records for all data of interest; these 2,003 graduates included 43 % of our schools' 4,678 graduates from 1997 to 2002 and followed up through the 2007–2008 academic year. Fifty of the 2,003 medical school graduates in our study sample (2.5 %) initially failed Step 1. As shown in Table 1 a higher proportion of these graduates became primary care physicians (26/49 [53 %] vs. 766/1,870 [40.9 %]), were more likely to report intent to practice in underserved areas (28/50 [56 %] vs. 419/1,939 [21.6 %]), and more likely to take 5 or more years to graduate (11/50 [22.0 %] vs. 79/1,953 [4.0 %]). Compared to whites, the relative risk of first attempt Step 1 failure for medical school graduates was 13.4 for African Americans and 7.4 for Latinos. Compared to medical school graduates who matriculated to medical school at $\leq$22 years of age, the relative risk of 1st attempt Step 1 failure was 3.6 for graduates who matriculated to medical school at >22 years of

Table 1 Comparison of graduates from six midwestern medical schools with and without passing scores on USMLE Step 1 first attempt

	Failed USMLE Step 1 on first try						Statistical significance
	No (N = 1,953)		Yes (N = 50)		Total (N = 2,003)		
	N	%	N	%	N	%	
Prematriculation characteristics							
Women	810	*41*	35	*70*	845	*42*	<.001
Under-represented minority	162	*8*	26	*52*	188	*9*	<.001
African American	86	*4*	19	*38*	105	*5*	
American Indian /Alaska Native	13	*1*	0	*0*	13	*1*	
Latino	63	*3*	7	*14*	70	*3*	
1st generation college graduate	402	*21*	19	*38*	421	*21*	.002
Had premedical debt	666	*34*	26	*52*	692	*35*	.007
Parent's income (>$75,000)	877	*45*	11	*22*	888	*44*	.002
Age at matriculation >22 years	799	*41*	36	*72*	835	*42*	<.001
Multiple medical school acceptances	1,028	*53*	20	*40*	1,048	*52*	.116
Academic characteristics							
USMLE Step 2CK score >220	958	*49*	2	*4*	960	*48*	<.001
Elected to AOA	290	*15*	0	*0*	290	*14*	.003
>5 years to complete degree	79	*4*	11	*22*	90	*4*	<.001
Career characteristics							
Practice type: direct patient care	987	*51*	29	*58*	1,016	*51*	.445
Intent to practice in underserved area	419	*21*	28	*56*	447	*22*	<.001
ABMS-member board certified	1,501	*77*	25	*50*	1,526	*76*	<.001
Full-time faculty position appointment	244	*13*	2	*4*	246	*12*	.071
Specialty choice							.241
Primary care specialties	766	*41*	26	*53*	792	*41*	
Non-primary care medical specialties	347	*19*	10	*20*	357	*19*	
Surgical specialties	426	*23*	8	*16*	434	*23*	
Support specialties	331	*18*	5	*10*	336	*18*	
Specialty unknown					84	*4.2*	

Primary care specialties are general internal medicine, family medicine and pediatrics; Medical specialties include subspecialties within internal medicine, family medicine and pediatrics as well as allergy/immunology, dermatology and its subspecialties, psychiatry and neurology and their subspecialties, occupational medicine, public health and preventive medicine and related specialties, and medical genetics specialties. Surgical specialties include general surgery and its subspecialties, colon and rectal surgery, neurological surgery, obstetrics-gynecology and subspecialties, ophthalmology, orthopedic surgery, otolaryngology, plastic surgery, thoracic surgery and urology. Support specialties include anesthesiology and critical care, emergency medicine, nuclear medicine, pathology and its subspecialties, physical medicine and rehabilitation, and radiology and related subspecialties

age. Compared to men, the relative risk of 1st attempt Step 1 failure for medical school graduates was 3.2 for women. Compared to medical school graduates who were not 1st generation college graduates, the relative risk of 1st attempt Step 1 failure was 2.3 for first generation college graduates (see Table 2).

Table 2 Relative risk of 1st attempt USMLE Step 1 failure

	RR	95 % CI	*p* value
African American	13.4	7.4–24.2	<.0001
American Indian/Alaska Native	2.5	0.2–40.5	.50
Latino	7.4	3.2–16.9	<.0001
Matriculation age >22	3.6	2.0–6.6	<.0001
Women	3.2	1.8–5.8	.0001
1st generation college graduate	2.3	1.3–4.0	.0036

Graduates who initially failed Step 1 also were more likely to come from families with lower mean incomes ($59,688 vs. $97,011; t = 5.02, $p = .001$), to be older at matriculation (25.9 vs. 23.3 years; t = 3.17, $p = .003$) and older at graduation (30.8 vs. 27.2 years; t = 3.89, $p = .001$). There was no significant difference in the number of medical school acceptances reported by graduates initially failing or passing Step 1 (1.8 vs. 2.2; t = 1.52, $p = .129$). Graduates who initially failed Step 1 also had lower mean scores on Step 2CK (180.4 vs. 219.4; t = 12.90, $p = .001$), which is consistent with prior studies (Case et al. 1996) and they also had longer duration of enrollment prior to graduation (5.1 vs. 4.2 years; t = 4.92, $p = .001$) compared to graduates who initially passed Step 1.

As shown in Table 1, graduates who initially failed Step l did not differ significantly from graduates who initially passed Step l in specialty choice, type of practice or full-time faculty appointment. However, graduates who initially failed Step 1 were disproportionately less likely to be board certified at the time of follow-up. This was so also when examined by specialty type: among graduates who entered primary care (general internal medicine, family medicine and pediatrics), 74 % of the graduates who initially failed Step 1 were board certified versus 92 % of graduates who initially passed Step 1 ($\chi^2 = 11.15$, $p = .001$). The relative risk of not being specialty board certified for graduates in the study sample who initially failed Step 1 was 2.2 (95 % CI: 1.6, 2.9).

Discussion

In our sample of medical school graduates, 2.5 % of first-time test-takers had failed Step 1, which is lower than the average of 6.3 % (range 5.0–7.7 %) of all U.S./Canadian examinees who failed Step 1 on the initial attempt from 1995 to 2000 (NBME 2010), when graduates in our study sample would typically have initially attempted USMLE Step l. Some proportion of students who initially fail Step 1 do not graduate from medical school; indeed, a recent national study of medical school matriculants from 1994–1999 reported that 10.1 % of U.S. medical students who initially failed Step 1 (496/4,920) had withdrawn or were dismissed from medical school (Andriole and Jeffe 2010). In addition, we observed that only a small proportion of students who initially failed Step l obtained scores on Step 2 at or above the sample median score for Step 2, which is consistent with the previously reported relationship between Step l and Step 2 scores (Case et al. 1996).

Most graduates in our study sample had attended medical schools with policies that precluded graduation without a passing Step 1 score. Four schools required students to achieve a passing score for academic promotion, one school required a passing score only for graduation; the other school had no Step 1 passing-score requirement for either promotion or graduation. Our collaborating institutions were similar to all medical schools nationally regarding the proportion of schools that required passing scores on Step 1 for promotion and/or graduation. In

2008–2009, 112 schools (89 % of 126 medical schools) required students to pass Step 1 for advancement and/or graduation (Barzansky and Etzel 2009).

Our observations regarding socioeconomic and early career path characteristics of graduates who initially fail Step 1 can inform medical school policies with regards to admissions, student counseling, financial aid and academic support programming congruent with specific medical school goals.

The following interventions, utilized by the six Midwestern medical schools in our multi-institutional study group, were usually triggered by USMLE Step 1 failure and/or poor academic performance evidenced by examination failures during the first 2 years of medical school:

1. Tutoring
2. Advice, guidance, direction re: Step 1prep courses
3. Financial assistance to engage in these programs
4. Neuropsychiatric testing
5. Time off for additional prep time
6. Referral (a local learning specialist)
7. Continued support from Counselors re: Motivation, study plan, sticking to study plan, and stress management throughout the study process

There is evidence to suggest that medical schools can develop comprehensive programs to proactively identify and support students at risk for Step 1 failure (Lieberman et al. 2008).

The University of Texas Medical Branch (UTMB), for example, developed a 6 week pre-entry program and implemented explicit preparation for Step 1 resulting in only 3 first attempt Step 1 failures for its 129 African American medical students over the past 6 years. Similarly, only 12 first attempt Step 1 failures were noted among its 188 Latino medical students.

The following criteria are used to identify and invite students to attend the UTMB 6-week pre-entry program:

(1) Biology, Chemistry, Physics, Math (BCPM) Grade Point Average (GPA) <3.5, which is about 1 standard deviation below the mean at UTMB—may consider undergraduate institution to further refine assessment, e.g. Harvard vs. non-research intensive undergraduate institution
(2) Medical College Admission Test (MCAT) composite Verbal Reasoning, Biological Science and Physical Science score <26
(3) Nontraditional students who have been out of school for >2 years
(4) Single parents
(5) Any perceived learning disability by self-declaration or screening

Stipends are provided through the Health Career Opportunity Program (HCOP) and Hispanic Center of Excellence (HCOE) grants or institutional support. UTMB also enrolls a few academically advanced students to serve as tutors once medical school starts.

The following criteria are used to identify students to screen for learning disabilities:

(1) Scoring 2 standard deviations below the mean in 6-week pre-entry program
(2) Scoring 2 standard deviations below the mean on first exam during the first year of medical school

A Ph.D. learning specialist performs the initial screen and if positive the student is referred for comprehensive evaluation and treatment. Students may also qualify for testing accommodations through the Americans with Disabilities Act (ADA) office.

At UTMB the following services are provided for Step 1 preparation:

(1) During orientation all students are encouraged to obtain the book entitled, *First Aid for the USMLE Step 1* (Le et al. 2011). This helps students to organize materials presented in their basic science courses for intensive study in the latter half of the second year.
(2) Beginning in January of the second year of medical school, UTMB provides a 3 months subscription to *Kaplan USMLE Step 1 Q-bank* and *USMLEWorld* (Kaplan 2011; USMLEWORLD 2011). Students are encouraged to use both resources. *Kaplan* is thought to test more on student knowledge base; whereas, *USMLEWorld* is thought to more closely approximate real-time questions and clinical vignettes.
(3) The National Board of Medical Examiners—Comprehensive Basic Science Examination (CBSE) is administered to all students in March of the second year of medical school (NBME 2011). Another CBSE is made available in April and thought to be more indicative of how students may perform on Step 1 (Morrison et al. 2010).
    - Students scoring below the 60th percentile are required to retake the test in April. They are also encouraged to take more self-assessment exams as needed to ensure a passing score on the Step 1 exam.
(4) The UTMB PrepTest Course for Step 1 is taught by third year students identified by superior performance on their Step 1 exam. Five lectures are presented over 2 weeks, subjects reviewed include: (1) Anatomy, (2) Pharmacology, (3) Microbiology, (4) Biochemistry, (5) Physiology, (6) Biostatistics, and (7) Behavioral Science. Ten timed practice exams are administered during the 2 week course. For each exam, students are required to complete 60 questions in 50 min to provide a realistic view of the actual time needed to successfully complete Step 1.

Students who are thought to be at risk for academic difficulties may delay taking Step 1 by 1–2 months. During this 2 month period students are encouraged to complete *USMLEWorld* and the *Kaplan USMLE Step 1 Q-bank* twice.

An alternative strategy that improved Step 1 scores was implemented by the University of Illinois College of Medicine at Urbana Champaign and involved decompressing the first year of medical school over a 2 year period. Students may select this option until 1 week after receiving the results for the second examination in early November (Kies and Freund 2005).

In addition, medical students with difficulties in reading fluency, but no history of a learning disability, may benefit from cognitive rehabilitation that addresses cognitive deficits related to test taking abilities (Laatsch 2009). The strong relationship between language and reading skills suggest that some students may fail the USMLE Step examination because of relative weakness in language processing and reading fluency. The therapy involves development of compensation strategies, enhancement of processing skills through repetition of tasks, and increased awareness of cognitive strengths and weaknesses (Laatsch 2009).

Graduates in our study who failed Step l on the initial attempt were disproportionately more likely to be women, which is consistent with a previous national study (Case et al. 1996), from racial/ethnic minority groups that are historically under-represented in medicine, first generation college graduates, and older students. Graduates who failed Step l also were more likely to report on the GQ having plans to practice in underserved communities, an important consideration in the context of our societal health care needs. Of note, the predictive validity for this GQ item has been established (Ko et al. 2005).

Our findings also have implications for physician workforce diversity, particularly in the context of the new Liaison Committee on Medical Education (LCME) accreditation standard MS-8, adopted July 1, 2009, which states that, "A medical education program must develop programs or partnerships aimed at broadening diversity among qualified applicants for medical school admission" (LCME 2011). As medical schools seek to meet this accreditation standard to develop a more racial, ethnic and socioeconomically diverse student population to better serve the health care needs of our diverse society, medical schools also need to be fully prepared to provide sufficient support to these students once they enter medical school to maximize the likelihood that they will meet with continued academic and professional success.

Finally, our results have implications for medical students themselves. According to the 2008 National Resident Matching Program survey of program directors, Step 1 score was the single most frequently cited factor by program directors when selecting applicants to interview (NRMP 2008). Among program directors who required applicants to submit Step 1 and/or Step 2CK scores, 84 % reported that they would seldom or never consider interviewing an applicant who had failed Step 1. Thus students with an initial Step 1 failure face continuing challenges, even if they subsequently pass Step 1 and fulfill all other medical school graduation requirements. Perhaps a message for medical students, at the start of their medical school careers, is that for test-taking and other skills deficits, investing in skill development might well pay off throughout medical school and even beyond medical school in board certification (Lypson et al. 2010). A concurrent message to medical schools might be that they must ensure that the circumstances exist to identify, support, and maximize the likelihood of success for these at risk students.

Our study has several limitations, First, our sample included graduates of six Midwestern medical schools who chose to complete both the MSQ and the GQ and consented to the release of their questionnaire data with identifiers; thus, the study findings from our collaborating schools might not be fully generalizable to all LCME-accredited or other types (e.g., DO) of medical schools nationally. In addition, we collected board certification and faculty appointment information at only a single point in time; a lack of board certification or faculty appointment at follow-up does not necessarily mean that these graduates will never be board certified or receive an academic medicine faculty appointment. Finally, we cannot infer causation from the results of this observational cohort study.

Conclusion

The 2.5 % of medical school graduates in our sample who initially failed Step 1differed significantly from medical graduates who initially passed Step 1 on the basis of sociodemographic characteristics at matriculation and on the basis of their professional plans and career development beyond medical school graduation. Our results can inform medical schools' efforts to identify and assist students who are at higher risk of failing Step 1 on the 1st attempt.

Acknowledgments We thank Jason Cantow, MS, MBA, formerly at the AAMC, for data provision and coding assistance, Irene Fischer, MPH, in the Health Behavior, Communication and Outreach Core of the Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine (supported in part by NCI Cancer Center Support Grant #P30 CA091842-03) for data management services, Susan M. Kies, EdD, formerly Associate Dean for Student Affairs at the University of Illinois College of Medicine at Urbana Champaign, and Leah Robinson, EdS, Academic Skills Counselor at Wayne State University School of Medicine, for clarifying details from related studies performed at their respective

medical schools. Preliminary results of this study were presented in abstract form at the annual meeting of Research in Medical Education conference at the annual meeting of the Association of American Medical Colleges, Washington DC, November 10, 2010. Funding: This study was supported by a Collaborative Projects Grant from the Association of American Medical Colleges Central Group on Educational Affairs.

Conflict of interest None.

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