Evaluating the Impact, Use, and Predictive Validity of the New MCAT Exam

Catherine Lucey, MD
Vice Dean for Education
University of California, San Francisco School of Medicine

Joshua Hanson, MD, MPH
Associate Dean for Student Affairs, Associate Professor
The University of Texas School of Medicine at San Antonio

Kristen Goodell, MD
Associate Dean for Admissions
Boston University School of Medicine

Jorge A. Girotti, PhD, MHA
Associate Dean for Admissions and Special Curricular Programs
University of Illinois College of Medicine
Diversity is a core driver of high quality health care

- Minority physicians are significantly more likely to practice primary care and in underserved areas
- Similar race/ethnicity identification between physicians and patients results in better communication, increased patient satisfaction, and routine preventive care visits
- Communicating in patients’ native language often improves adherence to treatment
- Medical students agree that there are benefits of a diverse student body, including the opportunity to learn from others from different backgrounds and the preparation to care for a diverse society

AAMC Diversity in the Physician Workforce Facts and Figures 2014.
About half of medical school matriculants self-identify as white.

Percentage of U.S. Medical School Matriculants by Race/Ethnicity, 2017

- American Indian or Alaska Native: 0.2%
- Asian: 21.0%
- Black or African American: 7.1%
- Hispanic or Latino: 6.5%
- Native Hawaiian/Other Pacific Islander: 0.1%
- White: 49.6%
- More than One Race: 8.9%
- Other: 1.8%
- Unknown Race/Ethnicity: 3.6%
- Non-U.S. Citizen/Non-Perm. Resident: 1.3%


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The path to becoming a physician starts early

Pre-College Experiences
- Early environment
- Family support
- K-12 education
- Extracurricular experiences

Premedical Preparation
- # colleges attended
- Quality of instruction
- Coursework
- Extracurricular experiences

Medical School Admissions
- Holistic review (Including MCAT)
- Diverse class

Medical Education
- Family and financial support
- Academic and other support
- Culture and climate

Residency Program
- Academic and other support
- Culture and climate

Residency Selection
- Holistic review (Including USMLE)
- Diverse cohort

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Group differences in academic achievement are associated with societal inequalities

- MCAT, LSAT, GMAT, GRE and other tests of academic achievement show population group differences
  - MCAT measures specific content knowledge and skills in natural, behavioral, and social science subject areas

- Presence of differences does not equate to test bias (i.e., construct irrelevant content or alterations in administration)

- Structural racism and privilege likely contribute to the differences seen across the spectrum of exams

Compared with majority examinees, minority examinees:
- More likely to experience adverse environmental factors (poverty, food insecurity, low quality day care)
- More likely to have had disrupted or low quality K-12 education
- Less likely to have high quality exam prep experiences or advising experiences in college
Fairness was front and center in designing and developing the new exam

<table>
<thead>
<tr>
<th>Type of Fairness</th>
<th>Definition</th>
<th>Influence on New MCAT Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Societal Fairness</td>
<td>Aspiring physicians from different groups have equity in access to preparation materials and opportunities to prepare for the exam.</td>
<td>Blueprints, test preparation resources</td>
</tr>
<tr>
<td>Procedural Fairness</td>
<td>Admissions officers and their committees have ample information and resources to make appropriate and balanced use of MCAT scores in admissions.</td>
<td>New score scales, score reports, and resources for admissions officers</td>
</tr>
<tr>
<td>Exam Fairness</td>
<td>MCAT scores have the same meaning and predict student performance equally well for examinees from different backgrounds.</td>
<td>Item development/review, test form development</td>
</tr>
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</table>
Overview of the MCAT Validity Research Program
21 medical schools and 2 pre-health advisors are working together to evaluate the new exam
The MCAT validity research program is complex

- Multiple research questions in three broad areas
- Qualitative and quantitative data from
  - Examinees
  - Applicants
  - Medical students
  - Medical schools
- Multiple methods and data collection designs (longitudinal, cross sectional)
- The validity study will last about nine years (2014 to 2023)
The MCAT validity research addresses multiple goals

- Provides evidence about the value of the new MCAT exam in admissions decisions
- Answers questions about the fairness and consequences of introducing the new MCAT exam for examinees, applicants, and medical students
- Presents data to admissions officers that they can act on to improve their admissions decisions
- Uses findings about the needs of aspiring physicians from underrepresented backgrounds to improve test preparation resources and outreach
The MCAT validity research agenda includes three broad areas:

- Predicting Medical Student Performance
- Admissions Decision Making
- Academic Preparation, Diversity, and Fairness
We’re testing 3 hypotheses about predicting medical student performance

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Description</th>
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<tr>
<td>Evaluating the</td>
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<td>predictive validity</td>
<td>medical school?</td>
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<td>Examining the</td>
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<td>of the newest test</td>
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<td>section</td>
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<td>Comparing the</td>
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<td>predictive validity</td>
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<td>exam to other</td>
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<td>predictors</td>
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</table>
We’re testing 2 hypotheses about admissions decision making

**Acceptance of a wide range scores**

Will medical schools increase the percentage of applicants with total scores in the middle of the MCAT score scale who are invited to interview and receive acceptance offers?

**Use of section scores**

Will admissions committees use information about applicants’ strengths and weaknesses from the MCAT score reports to identify applicants who best fit their academic missions and goals?
We’re testing 9 hypotheses about academic preparation, diversity, and fairness, for example:

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Question</th>
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</thead>
<tbody>
<tr>
<td><strong>Change in breadth of academic preparation</strong></td>
<td>Will more individuals learn about psychology, sociology, and biochemistry in preparation for the MCAT exam?</td>
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<td></td>
<td>What resources, information, and outreach will provide equity in access for students from sociodemographic groups underrepresented in medicine?</td>
</tr>
<tr>
<td><strong>Diversity of aspiring physicians</strong></td>
<td>Will the diversity of examinees, applicants, and medical students who took the new exam change?</td>
</tr>
<tr>
<td><strong>Fairness in score meaning</strong></td>
<td>Will scores from the new exam predict academic performance equally well for medical students from different racial, ethnic, or disadvantaged backgrounds?</td>
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</tbody>
</table>
This presentation focuses on three questions:

1. How well did scores from the new MCAT exam predict students’ pre-clerkship and USMLE Step 1 performance?
2. How did admissions officers work with new MCAT scores in 2017-2018 admissions decisions?
3. What can we learn about preparation resources needed by examinees from underrepresented backgrounds?
How well did scores from the new MCAT exam predict students’ pre-clerkship and USMLE Step 1 performance?
Findings presented today come from the 2016 entrants with new scores.
We are presenting validity findings for four pre-clerkship outcomes

<table>
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<tr>
<th>Performance Outcome</th>
<th>Type of Outcome</th>
<th>Source of Outcome Data</th>
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<tr>
<td>Progression to Clerkship On Time</td>
<td>Pass/Fail</td>
<td>National</td>
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<tr>
<td>Passing the Step 1 Exam on the 1\textsuperscript{st} Attempt</td>
<td>Pass/Fail</td>
<td>National</td>
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<tr>
<td>Summative Performance Across Pre-Clerkship Courses</td>
<td>Continuous</td>
<td>Validity Schools</td>
</tr>
<tr>
<td>Step 1 Scores from the 1\textsuperscript{st} Attempt</td>
<td>Continuous</td>
<td>National</td>
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How Well Do MCAT scores Predict Performance on the Pass/Fail Outcomes:

Progression to Clerkship on Time

Passing the Step 1 Exam on the First Attempt
Nationally, 2016 entrants with a wide range of scores progressed to clerkships on time.

Note: The number of students with scores below 494 is too small to interpret meaningful differences in their progression rate compared with those who scored at or above 494.
Nationally, 2016 entrants with a wide range of scores passed the Step 1 exam on the first attempt.

% of 2016 Entering Medical Students Who Passed USMLE Step 1 on the First Attempt

- 472-489 (N = 11): 64%
- 490-493 (N = 76): 83%
- 494-497 (N = 254): 83%
- 498-501 (N = 694): 92%
- 502-505 (N = 1,248): 94%
- 506-509 (N = 1,564): 97%
- 510-513 (N = 1,480): 99%
- 514-517 (N = 1,091): 99%
- 518-528 (N = 665): 100%

Note: The number of students with scores below 494 is too small to interpret meaningful differences in their progression rate compared with those who scored at or above 494.
How Well Do MCAT Scores Predict Performance on the Continuous Outcomes:

Summative Performance Across Pre-Clerkship Courses

Scores from the Step 1 Exam (First Attempt)
At validity schools, MCAT total scores show a medium to large correlation with 2016 entrants’ performance across pre-clerkship courses.

Correlation of MCAT Total Score with Summative Performance across Pre-clerkship Courses: Median and Interquartile Range (N_{school} = 16)

- Correlation at the 75th percentile: 0.59
- Median correlation: Medium Effect
- Correlation at the 25th percentile: 0

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At MD-granting medical schools, MCAT total scores also show a medium to large correlation with 2016 entrants’ Step 1 scores.

Correlations of MCAT Total Score with Step 1 Scores:
Median and Interquartile Range (N_{school} = 97)

0.58
Medium
Effect

Note: Schools that do not have 30 or more students’ Step 1 scores were excluded from the analysis.
These validities compare well to those for other admissions tests.

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Exam</th>
<th>Type of Exam Score</th>
<th>Type of Outcome</th>
<th>Median Validity Coefficient</th>
<th>Unit of Analysis</th>
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<td>AAMC (2018)</td>
<td>New MCAT</td>
<td>Total score</td>
<td>Performance across pre-clerkship courses</td>
<td>.59</td>
<td>School (N_{school}=16)</td>
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<tr>
<td>AAMC (2018)</td>
<td>Old MCAT</td>
<td>Total score</td>
<td>Performance across pre-clerkship courses</td>
<td>.54</td>
<td>School (N_{school}=17)</td>
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<td>Talento-Miller &amp; Rudner (2005)</td>
<td>GMAT</td>
<td>Total score</td>
<td>Mid-program grades</td>
<td>.47</td>
<td>Study (N_{study} = 272)</td>
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</table>

References:
Nationally and on average, 2016 entrants with higher MCAT scores obtained higher Step 1 scores

Mean USMLE Step 1 Scores by MCAT Total Score
(2016 entrants)

Note: The number of students with scores below 494 is too small to interpret meaningful differences in their mean Step 1 scores compared with those who scored at or above 494.
At every MCAT total score, some students performed better than expected, and others performed less well.

Mean USMLE Step 1 Scores by MCAT Total Score (2016 entrants)

- 90th percentile of Step 1 scores for students who had an MCAT score of 500.
- 10th percentile of Step 1 scores for students who had an MCAT score of 500.

Passing score = 194

Note: The number of students with scores below 494 is too small to interpret meaningful differences in their mean Step 1 scores compared with those who scored at or above 494.
MCAT scores provide comparable prediction for students from different sociodemographic backgrounds

- Research studied these early relationships for students grouped by:
  - Race/ethnicity
  - Socioeconomic status
  - Gender

- So far, MCAT scores neither over- nor under-predict the performance of students from these groups based on two types of performance outcomes:
  - National outcome: Progression to clerkship on time
  - Validity school outcome: Performance across pre-clerkship courses
Together MCAT scores and GPAs provide better information than either alone.
At the validity schools, MCAT scores and UGPAs predict 2016 entrants’ performance across pre-clerkship courses. Combined, they predict better than either one alone.
At MD-granting medical schools, MCAT scores and UGPAs predict 2016 entrants’ Step 1 scores. Combined, they predict better than either one alone.

**Correlations of Academic Metrics with Step 1 Scores:**
Median and Interquartile Range ($N_{\text{school}} = 97$)

- MCAT total scores only: 0.58
- Undergraduate GPA only: 0.46
- MCAT Total Scores + Undergraduate GPA: 0.62

Note: Schools that do not have 30 or more students’ Step 1 scores were excluded from the analysis.
What we have learned so far

- Students with a wide range of MCAT scores progressed to their clerkships and passed the Step 1 exam at high rates.
  - You identified students with the right mix of experiences, attributes, and academic preparation at these score ranges capable of succeeding at your schools.
- MCAT scores do a good job of predicting pre-clerkship and Step 1 performance.
- MCAT scores are only one signal of student’s preparation for medical school.
  - At every MCAT total score, some students do better than expected, some do less well than expected.
- MCAT scores show comparable prediction for medical students from different sociodemographic backgrounds.
- MCAT scores and UGPAs predict students’ pre-clerkship and Step 1 performance well. Combined, they predict better than either one alone.
Predictive validity findings will be reported annually through 2022 for medical students who took the new exam.

We have a lot more to learn about how students do in their third clerkships and on their future USMLE exams, and their graduation from undergraduate medical school.
What do we know about the applicants to the classes we admitted in 2017 and 2018?
Our admissions committees build classes that help us meet our missions, goals, and diversity interests.
We give individualized consideration to each applicant

- How they might contribute to teaching and learning at our schools and to the practice of medicine

- How they help balance the class across the criteria needed by our schools to achieve desired outcomes
Admissions committees used holistic review practices to put MCAT scores in context in 2017-2018 selection

Percentage and Number of 2017-2018 Applicants Accepted into at Least One Medical School, by New MCAT Total Score and Undergraduate GPA Range

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<td>31%</td>
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<td>7/217</td>
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Some 2017 and 2018 applicants w/ high UGPAs and MCATs weren’t accepted

Percentage and Number of 2017-2018 Applicants Accepted into at Least One Medical School, by New MCAT Total Score and Undergraduate GPA Range

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11% of applicants with GPAs at or above 3.8 and MCAT scores at or above 518 were not admitted into any medical schools.
Other 2017 and 2018 applicants with modest credentials were accepted

Percentage and Number of 2017-2018 Applicants Accepted into at Least One Medical School, by New MCAT Total Score and Undergraduate GPA Range

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Is there room to increase diversity?

Let’s look at the characteristics of applicants with scores in different parts of the MCAT score distribution
The new score scales draw attention to the center of the scale

- Because on the old exam, students who entered medical school with scores in the center of the MCAT score scale succeeded
- The new scale uses a nice round number to draw attention to applicants who might otherwise be overlooked
- The new test also includes more questions per section, providing better information about examinees’ strengths and weaknesses on the exam
- The new score reports use confidence bands to describe measurement precision and score profiles to describe strengths and weaknesses
To help answer this question, we divided the distribution of examinees’ scores into three equal parts.

LOWER 3\textsuperscript{RD} 
- \textbf{32\%} 

MIDDLE 3\textsuperscript{RD} 
- \textbf{34\%} 

UPPER 3\textsuperscript{RD} 
- \textbf{33\%} 

Data from 2015 examinees who took the new exam.
About 30% of the 2017 and 2018 applicants had MCAT scores in the middle third of the score scale.
About 15% of 2017 and 2018 matriculants had MCAT scores in the middle third of the score scale.
Considering applicants with a wider range of MCAT scores provides more flexibility in building diverse classes.
Learning about preparation resources needed by examinees underrepresented in medicine
Group differences in academic achievement are associated with societal inequalities

- MCAT, LSAT, GMAT, GRE, and other tests of academic achievement show population group differences
  - Undergraduate GPAs of recent medical school applicants show similar group differences
- MCAT scores show comparable prediction for medical students from different sociodemographic backgrounds
- Societal inequalities likely contribute to the differences seen across the spectrum of exams and other measures of academic achievement
  - Food insecurity
  - Fewer experienced teachers
  - Less available support from home
  - Fewer role models and mentors
The new test blueprints were developed with fairness in mind

- Test concepts widely taught at undergraduate institutions, including minority-serving and under-resourced institutions
- Test psychology and sociology concepts like discrimination, stereotype threat, and socio-economic inequalities
- Pay increased attention to population health, studies of diverse cultures, and ethics
- Balance the percentage of questions devoted to natural sciences concepts with the percentage devoted to behavioral and social sciences concepts and information processing
- Provide examinees with more working time per question
Preparation resources were developed with fairness in mind

- The Khan Academy has over 1,100 free tutorials on exam content
- Practice materials and resources are available on AAMC’s website:
  - What’s on the MCAT Exam? Interactive Content Outline
  - Roadmaps to MCAT Content in Biochemistry, Psychology, and Sociology Textbooks
  - Guide to Creating a Study Plan
  - How I Prepared for the MCAT Exam Testimonials
  - Practice tests and question banks

Students-residents.aamc.org/mcatprep

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New outreach strategies targeted underrepresented groups

- Expand outreach directly to students from sociodemographic groups underrepresented in medicine
- Expand outreach to students through their advisors, with a particular focus on faculty at under-resourced institutions
- Distribute a monthly newsletter *Premed Navigator* with important information, resources, and tips
- Work with pre-health advisors on the MCAT Validity Committee to share findings and promote resources, such as the “Find an Advisor” resource for students at schools with no access to an advisor ([volunteer.advisor@naahp.org](mailto:volunteer.advisor@naahp.org))
Ongoing research examines how students prepare for the MCAT exam.

- **Pre-College Experiences**
  - Early environment
  - Family support
  - K-12 education
  - Extracurricular experiences

- **Premedical Preparation**
  - Number of colleges attended
  - Quality of instruction
  - Coursework
  - Extracurricular experiences

- **Medical School Admissions**
  - Holistic review (Including MCAT)
  - Diverse class

- **Medical Education**
  - Family and financial support
  - Academic and other support
  - Culture and climate

- **Medical Education**
  - Family and financial support
  - Academic and other support
  - Culture and climate

- **Residency Program**
  - Academic and other support
  - Culture and climate

- **Residency Selection**
  - Holistic review (Including USMLE)
  - Diverse cohort
We are conducting qualitative and quantitative research to understand students’ preparation strategies and barriers

- Do students from different sociodemographic groups use preparation resources at similar rates?
- What is easy and difficult for examinees when they prepare for the MCAT exam?
- What is easy and difficult about using the AAMC’s free and low-cost materials to prepare for the MCAT exam?
- Are these barriers different or greater for those from sociodemographic groups underrepresented in medicine?
- What additional resources and information do examinees and their advisors need?
Findings will be used to improve access to resources and information

- Interview examinees and advisors
- Revise PMQ
- Administer PMQ and compare results for examinees from different backgrounds
- Learn what barriers exist
- Develop new information and resources
Use of most preparation resources is slightly lower for examinees from lower-SES backgrounds.
Use of most preparation resources is slightly lower for examinees from schools with fewer resources

School Resources

- AAMC Online Interactive Online Tool: 18% (More Resources), 16% (Fewer Resources)
- MCAT Collection in Khan: 54% (More Resources), 48% (Fewer Resources)
- Official Guide (Paper or Electronic): 49% (More Resources), 43% (Fewer Resources)
- AAMC Flashcards: 22% (More Resources), 23% (Fewer Resources)
- AAMC Online Practice or Sample Test: 83% (More Resources), 74% (Fewer Resources)
- AAMC Online Item Banks: 58% (More Resources), 46% (Fewer Resources)
- Took an MCAT Prep Course: 45% (More Resources), 40% (Fewer Resources)
Interviews suggested hypotheses for the challenges faced by examinees

Some students…

- May lack the time to use resources because of work or family obligations
- May lack reliable access to computers or the internet to use the online preparation resources
- May lack access to quiet study places to concentrate on preparation
- May not be able to afford even the low-cost resources
- May not know how to create and execute a study plan
- May not know what resources are available or understand how to use them strategically
The next step is to revise the Post-MCAT questionnaire to learn more about these challenges

- How examinees develop and implement study plans
  - Building in enough time to fully prepare
  - Breaking preparation into small chunks
  - Schedule breaks to manage burnout

- Preparation strategies, such as
  - Pre-exam study tailored to areas of weakness
  - Use of practice tests to promote learning
The next step is to revise the Post-MCAT questionnaire to learn more about these challenges

- Preparation for the exam day, such as
  - Simulating the test day experience
  - Building endurance for the full test day
  - Planning food and drinks for scheduled breaks
  - Getting proper rest and nutrition the night before

- We will try out the new survey questions in 2019, and collect population data from examinees starting in 2020
Questions?

Stay tuned for new research findings

aamc.org/validitycommittee