

Characteristics Top Performing Medical Students Display in the Medical School Admission
Process

by

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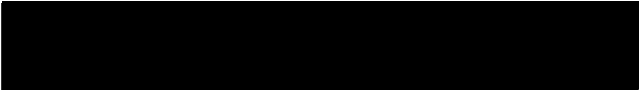
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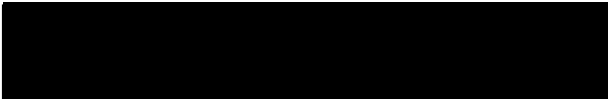
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DEDICATION

This thesis is dedicated to my father. He planted the seed that led me to where I am today. Thank you for everything.

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ABSTRACT

Characteristics Top Performing Medical Students Display in the Medical School
Admission Process

Matthew C Pflipsen, Masters of Health Professions Education, 2021

Thesis directed by: Dr. Steven Durning, Director, Center for Health Professions
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Introduction: Identifying characteristics of top performing medical students when they apply to medical school can be challenging. Because success in medical school is typically defined by academic achievement (e.g. exam scores, grades), undergraduate grade point averages and medical college admission test scores are often stressed by medical school admission committees as key discriminators. However, with a movement towards a holistic approach of applicants that de-emphasizes grades and exams, an argument can be made for using exceptional student performance characteristics to inform admissions policies and procedures. Methods: The purpose of this thesis was to discern a set characteristics displayed by a cohort of exceptional performing medical students. To achieve this, we explored the American Medical College Application Service (AMCAS) application for themes that could illuminate the characteristics of exceptional performing medical students at the time they applied for medical school admission. We defined exceptional performance as selection to both the Alpha Omega Alpha Honor Medical Society and the Gold Humanism Honor Society. Results: The

authors constructed seven themes from the AMCAS applications of exceptional performing medical students: success in a practiced activity, altruism, entrepreneurship, passion, perseverance, teamwork, and wisdom. Conclusion: This thesis lays the foundation for further research into the characteristics displayed by top performing medical students at the time they apply to medical school. Admission committees could eventually consider using such characteristics to inform their decisions on whom to accept to medical school.

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CHAPTER 1: Introduction

BACKGROUND

Medical school admissions committees are tasked with selecting students who they believe will be successful. Because success in medical school is typically defined by academic achievement, cognitive abilities are often stressed by medical school admission committees as the key discriminators. The two most widely accepted assessments of cognitive ability for medical school are Medical College Admission Test (MCAT) scores and undergraduate grade point averages (uGPA). Together, these measures assess critical thinking, knowledge of scientific principles, and performance in undergraduate academic course work.

Research supports the approach of relying on uGPA and MCAT scores as a measure of cognitive ability. These measures have been shown to correlate with United States Medical Licensing Examination (USMLE) Step 1 performance and pre-clinical academic grades.(32; 36; 75; 86; 90) In addition, both MCAT scores and uGPA help predict unimpeded progress towards graduation. An uGPA of 3.5, combined with an MCAT score of 30, predicts both a 90% chance of medical school graduation within 5 five years and passing the USLME Step 1 and 2 on the first attempt.(36) Subsequently, the ability of medical school admissions committees to select academically successful medical students is high, with medical school attrition rates at less than 3%.(4) It is not surprising that prior research found medical school deans consider MCAT scores and uGPA to be the two most important selection methods in the decision of who to call to interview for medical school.(66)

While the ability to graduate students from medical school is one measure of success for medical students, it does not address the question of what makes an exceptional performing medical student. Research suggests that on average, previous academic performance accounts for only 23% of the variance in overall performance at medical school and for less than 6% of the variance in overall performance of postgraduate year one (internship) medical performance.(41) Even among academically talented students, a prior study implies that their performance in the later years of medical school programs approaches parity with their non-academically talented peers.(56) This is unsurprising, given that a transition from an assessment of strict knowledge acquisition (cognitive/test-taking skills) to knowledge application (noncognitive/interpersonal skills) in applied practice occurs as one progresses through medical training. MCAT scores and uGPAs are not designed to predict the existence or acquisition of noncognitive personal characteristics, such as personality attributes, attitudes, behaviors, beliefs, and values.(35; 50) Typically, it is not until the clinically focused third year in traditional medical curricula in the United States that these characteristics can be more reliably assessed in the context of providing care to patients.(50; 86)

PERSONAL CHARACTERISTICS

Reviewing the current literature on high performing medical students provides insight into what personal characteristics may influence the overall performance of highly successful medical students. The most extensive research to date between personal characteristics and medical school performance has been in the area of personality traits and emotional intelligence. Research demonstrates that as a student progresses through medical school, personality traits of openness, conscientiousness, and extraversion

become increasingly important predictors of success in the clinical phase of medical education;(63) and in combination with empathy, have been shown to be predictive of clinical evaluations and humanism nominations.(47) Emotional intelligence, which is “the capacity to be aware of, control, and express one’s emotions, and to handle interpersonal relationships judiciously and empathetically”,(10) has had more equivocal findings. In specific courses involving role playing with simulated patients, the ability to regulate emotions correlated with higher course grades.(62) These courses assessed students’ interpersonal skills related to active listening, empathy, and communication; important characteristics for a physician to maintain effective doctor–patient relationships and to working successfully in teams. However, when it comes to formal assessment of clinical performance, studies have demonstrated weak to no correlations of emotional intelligence to either clinical nominations (a measure of excellence in clinical performance) or performance on objective structured clinical examinations (OSCE).(22; 52; 79)

Other research that explores which personal characteristics may affect performance in medical school has focused on the perceptions of faculty, clerkship directors, and post graduate medical residents. These are the individuals with whom medical students spend the majority of their time during clinical rotations and who often write the end of rotation assessments. In one study that interviewed medical school faculty, the authors found that faculty viewed good clinical students as enthusiastic, motivated, proactive, confident, team players, and good communicators.(45) Another study constructed a list of the top ten characteristics surgery clerkship directors considered as most important in students receiving an honors grade during their surgical

clerkship. The noncognitive characteristics in the top ten included communication skills, professionalism, being proactive, outstanding work ethic, enthusiasm, and teamwork.(64) Other studies assessing faculty descriptions of performance of both high performing third year medical students and those considered to be the best pediatric residents found similar results.(49; 73) The most comprehensive research, however, was performed by Koenig et al. This research involved a review of the literature, surveys of U.S and Canadian medical school admission officers, and solicited input from the admission community.(57) His team identified nine personal competencies considered important for success in medical school (Table 1). These competencies were subsequently adopted by the Association of American Medical Colleges (AAMC), creating a standard of core personal competencies considered to be essential for success in medical school.(7)

However, success in and of itself is arguably socially constructed, and in terms of medical school, it is often defined by an ability to meet the requirements for medical school graduation: passing pre-clerkship courses, clinical assessments (OSCE), third and fourth year clerkships, and standardized medical examinations (National Board of Medical Examiners exams, USMLE). While the studies discussed so far provide us insight into what it takes to be successful in medical school, it provides less insight into what it is required to excel. For this, it is helpful to review a theoretical framework of exceptional performance.

THEORY OF EXCEPTIONAL PERFORMANCE

Deliberate practice theory, developed by Anders Ericsson, explains the acquisition of expert (exceptional) performance. Within this theory, innate abilities, such as intelligence, are not essential for high performance. Instead, deliberate practice argues

that expert performance is the result of deliberate (i.e. effortful) practice to change or improve a particular aspect of an activity. The theory emphasizes quality over quantity of experiences and values the ability to process and integrate improvements in targeted skills.(40) Essential features of deliberate practice related to medical students include: motivated learners with good concentration; receiving active coaching (teaching); engagement in learning activities with focused repetitive practice; and conscious refinement in performance.(26) Key characteristics of individuals that engage in deliberate practice are the ability for task analysis, goal setting, strategy development, self-monitoring, self-evaluation, self-challenge, and adaptation.(40) While long term participation in activities is necessary, extensive experience does not invariably lead to exceptional levels of achievement. Instead, activities need to be specifically designed to improve performance and deliberate effort made to change and improve specific aspects of performance.(40) For medical students, deliberate practice theory suggests that expert performance is not simply the result of high pre-measures such as top scores on the MCAT and high undergraduate GPAs; rather, it is the result of engagement of deliberate practice within study habits,(67; 70) clinical reasoning,(37) and acquisition of clinical skills.(38)

APPLICABILITY TO MEDICAL SCHOOL ADMISSIONS

Features associated with both deliberate practice and success in medical school can therefore inform us on what makes an exceptional performing medical student. Yet, knowing this information, how do medical school admission committees incorporate an assessment for these features into their decision processes? When it comes to accepting and rejecting medical school applicants, there is little research that provides insight. A

single qualitative study of ninety-four admission committee members at a London based medical school suggests that, when considering applicants to interview, admission committee members highly valued medically related work experience and commitment; and that their 'ideal' candidate possesses the positive attributes of enthusiasm, motivation, and academic ability.(84) On the other hand, when it comes to a final decision of acceptance, another study shows that less 6% of comments by admission committee members address personal traits, maturity, leadership, or service/volunteerism; instead, there was a higher focus on test scores, academics, and motivation for medicine.(44) So although there is some consensus on the personal competencies that medical students should demonstrate,(7) there appears to be a lack of consensus on how to incorporate them into the admission committee decision process.(59) Further, it is unknown if these characteristics are actually displayed by medical student applicants at the time of admission, and if displayed, whether they are associated with exceptional performance in medical school.

In order to determine an answer, we first need to attempt to define an exceptional performing medical student. There is no agreed upon frame of reference for defining top performing medical students and studies vary widely on how they defined top performing residents.(11; 17; 83) However, medical student acceptance into the Alpha Omega Alpha (AΩA) Honor Medical Society and Gold Humanism Honor Society (GHHS) could capture a cohort of students that can be considered to have performed above their peers. Membership to both means that students display scholastic achievement, professionalism, leadership, compassion, excellence in humanistic clinical care, and dedicated service.(1; 3) AΩA and GHHS selection is restricted to the top fifteen percent of the medical school

class and research shows that election to AΩA and/or GHHS can correlate with successful performance in residency.(11; 17; 28; 48; 74) Therefore, AΩA and GHHS election may serve as an adequate proxy definition for exceptional performance in medical school.

Second, there must be screening and selection methods that supplement the MCAT and uGPA and affords admission committee members to assess for key personal characteristics. The most common methods across medical schools in the United States to assess for noncognitive characteristics include the American Medical College Application Service (AMCAS) application, letters of recommendations (LOR), and personal interviews.(80) Interviews have been studied the most; and of the various formats, the multiple mini interview has shown the most promise to identify noncognitive attributes.(69; 71; 81) However, issues with reliability and validity, as well as variations in the design of the interviews, limit the ability to generalize findings across all medical schools.(60; 69) Several studies have also looked at letters of recommendation;(76) and while admission committee members may consider information about personal characteristics in these letters helpful,(53) they have not been shown to predict performance in medical school.(29; 69; 76)

No studies have assessed the use of the AMCAS application for its use in identifying noncognitive characteristics in applicants applying for medical school. Several studies have assessed the predictive ability of the self-described AMCAS medical student essay, clinical experiences, and research experiences, but found no positive correlations with PGY-1 performance in the realm of professionalism.(15; 30; 31; 68) Despite this, the AMCAS application does hold promise as it reveals applicants' life

experiences, accomplishments, motivation, and other personal attributes that bear on their likelihood of success in medical school and as a practicing physician. In addition, it provides a standard format that all medical schools in the United States use.

Third, while the literature offers insights into qualities that have been assessed to be relevant to medical school success, there is clearly room for research into what are the most salient qualities present in exceptional performing medical students. A set of identifiable personal qualities might usefully contribute to the dialogue about the most salient personal characteristics to assess during the medical school selection process.

RESEARCH QUESTION

In studying the application packets of exceptional performers, we can start constructing a knowledge base of personal characteristics that may be exhibited by exceptional performing medical students at the time they apply to medical school. The premise that admissions committees have to rely on traditional measures to ensure success in medical school continues to be challenged. Finding applicants that display characteristics of top performing medical students throughout a broad range of MCAT scores and uGPAs can offer an opportunity for admission committees to select applicants not only with potential for high performance, but also maintain a diverse and holistic medical school class.(82) Therefore, the purpose of this thesis is to begin building a shared understanding of the characteristics of exceptional performing medical students at the time of medical school admission. We start by asking the following research question: What personal characteristics in the AMCAS application are associated with exceptional performing medical students?

Table 1. AAMC’s Core Personal Competencies for Entering Medical Students

Competency	Definition
Ethical responsibility to self and others	Behaves in an honest manner; cultivates personal and academic integrity; adheres to principles; follows rules and procedures; resists peer pressure to engage in unethical behavior and encourages others to behave in honest and ethical ways; develops and demonstrates ethical and moral reasoning.
Reliability and dependability	Consistently fulfills obligations in a timely and satisfactory manner; takes responsibility for personal actions and performance.
Service orientation	Demonstrates a desire to help others and sensitivity to others’ needs and feelings; demonstrates a desire to alleviate others’ distress; recognizes and acts on his/her responsibilities to society, locally, nationally, and globally.
Social skills	Demonstrates an awareness of others’ needs, goals, feelings, and the ways that social and behavioral cues affect people’s interactions and behaviors; adjusts behaviors appropriately in response to these cues; treats others with respect.
Capacity for improvement	Sets goals for continuous improvement and for learning new concepts and skills; engages in reflective practice for improvement; solicits and responds appropriately to feedback.
Resilience and adaptability	Demonstrates tolerance of stressful or changing environments or situations and adapts effectively to them; is persistent, even under difficult situations; recovers from setbacks.
Cultural competence	Demonstrates knowledge of social and cultural factors that affect interactions and behaviors; shows an appreciation and respect for multiple dimensions of diversity; recognizes and acts on the obligation to inform one’s own judgment; engages diverse and competing perspectives as a

	resource for learning, citizenship, and work; recognizes and appropriately addresses bias in self and others; interacts effectively with people from diverse backgrounds.
Oral communication	Effectively conveys information to others using spoken words and sentences; listens effectively; recognizes potential communication barriers and adjusts approach or clarifies information as needed.
Teamwork	Works collaboratively with others to achieve shared goals; shares information and knowledge with others and provides feedback; puts team goals ahead of individual goals.

**CHAPTER 2: Beyond Grade Point Averages and Medical College
Admission Test Scores: A Thematic Analysis of Exceptional Performing
Medical Student Applications**

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Under review (*MedEd Publish*)

ABSTRACT

Phenomenon: Medical school admissions committees are tasked with selecting the best students for their institution and historically rely on grade point averages and Medical College Admission Test (MCAT) scores as measures for academic success. Yet research and expertise theory suggest that personal characteristics play a critical role in exceptional performance. Understanding the characteristics of exceptional performing medical students upon application to medical school could contribute to the holistic review process and selection decisions of medical universities. *Approach:* The purpose of this study was to identify themes in the American Medical College Application Service (AMCAS) application that reflect the characteristics of exceptional performing medical students when they applied to medical school. The authors completed an inductive thematic analysis of the primary AMCAS application of exceptional performing medical students attending the Uniformed Services University of the Health Sciences (USU). Selection to both Alpha Omega Alpha Honor Medical Society and the Gold Humanism Honor Society defined exceptional performance. *Findings:* Of the 485 medical school graduates between 2017 and 2019 at the USU, 22 (4.5%) met the criteria as exceptional performers. The authors identified seven themes from the AMCAS applications: success in a practiced activity, altruism, entrepreneurship, passion, perseverance, teamwork, and wisdom. *Insights:* The seven identified themes were consistent with the personal characteristics associated with both expertise theory and the AAMC's core personal competencies for medical student success. By constructing an understanding of the personal characteristics exceptional student performers display in their applications to medical school, these themes offer an additional lens for medical

school admission committees to assess a student's potential to be successful in medical school.

Keywords: medical school; student selection; academic performance

INTRODUCTION

Medical schools have often used prior academic performance as a proxy for future exceptional performance in medical school through a reliance on undergraduate grade point average (uGPA) and Medical College Admission Test (MCAT) scores.(66) Yet, while MCAT scores and uGPA have been shown to predict success in the pre-clinical years of medical school,(25; 32) they correlate less well with performance in the clinical years and beyond.(47; 75; 86) Instead, personal qualities become valued during these clinical years and likely play a significant role in the ability of clerkship students and residents to perform successfully.(47; 50; 63) Developing a better understanding of what qualities exceptional performing medical students possess upon entrance to medical school is necessary if we seek to optimize the recruitment of students with the best potential to be exceptional performing physicians.

As physicians progress through their training, research suggests that clinical performance increasingly depends on intra-personal and inter-personal competencies.(47; 63) As a medical student, top characteristics that faculty consider when assigning an honors clerkship grade are curiosity, dependability, taking ownership, and high ethical standards;(49) while a prior study argues that the top competencies valued in first year residents are responsibility, teamwork, empathy, and prioritization.(42) Other research demonstrates that certain personal characteristics (conscientiousness, extraversion, grit) are likely associated with successful clinical performance.(27; 47; 65) The Association of American Medical Colleges (AAMC) also recognizes the value of non-cognitive traits and describes nine core personal competencies for entering medical school students to be successful.(7; 57)

Deliberate practice is a theory that also explains the acquisition of expert performance. Within this theory, innate abilities, such as intelligence, are not essential for exceptional performance. Rather, expert performance is the result of deliberate (or effortful) practice.(39) In relation to medical student applicants, the theory would suggest that expert performance in academics and medicine is not rooted simply in measures of intelligence, but instead, is the result of engagement of deliberate practice within study habits.(38; 67; 70) Thus, deliberate practice argues that exceptional performance in medical school depends on more than uGPAs and MCAT scores and can provide a lens through which to frame our research.

While previous research does enlighten us to the personal qualities of medical students that are likely to perform well, research to date has not determined what characteristics are actually exhibited by exceptional performing medical students when they applied to medical school. Koenig et al. advocate for future study of potential tools to evaluate personal competencies for entering medical students and suggest accomplishment records as a tool for further research.(57) The American Medical College Application Service (AMCAS) application offers such a tool by allowing applicants to describe up to 15 work and activity experiences. Three of these experiences can be designated as most meaningful, where applicants can reflect and contemplate on “the personal growth [they] experienced as a result of [their] participation.”(6) Understanding what characteristics exceptional performing medical students exhibit when applying could help admission committees optimize their decisions regarding matriculation and challenges the premise that admissions committees must continue to

heavily weigh the traditional measures of uGPAs and MCAT scores to ensure academic success in medical school.

This is the first qualitative study to our knowledge that explores the characteristics of exceptional performing medical students within primary medical school applications using applicants' own words to capture findings. The purpose of this study is to understand these characteristics by answering the following research question: Which themes in medical student AMCAS applications are associated with exceptional performing medical students when they applied to medical school?

METHODS

Design

Every medical school applicant submits an AMCAS application for medical school admission within the United States (US). The AMCAS application provides a consistent standard that can be generalized to all US medical schools and allows for interpretation of data derived directly from the information provided by the applicant. We did not include application elements such as letters of recommendation (LOR), interview comments, and admission committee member comments. While these supplementary documents can provide additional information on the characteristics of the applicants, they either give us a secondary interpretation of the applicant through another person's viewpoint (LORs, interviews, and admission committee comments) or the formats may not be consistent across medical school admissions offices (interviews).

We explored these applications from a constructivist paradigm using thematic analysis methodology. Thematic analysis is a robust method to use when seeking to understand a set of experiences across a data set.(20; 23; 55) The multidisciplinary

nature of our research team provided a variety of perspectives to approach our research question. The first author (MP) is an accomplished clinician educator with firsthand experience in leadership roles in the military and medical education. The other two co-authors (SD, DT) have extensive experience both serving on medical school admission committees and performing research on medical student performance. The study was approved by the Uniformed Services University of the Health Sciences (USU) Institutional Review Board.

Subjects

Our unit of analysis was exceptional performing medical students from three consecutive graduating classes (2017-2019) at the USU. We defined exceptional performing medical students as students elected to both the Alpha Omega Alpha Honor Medical Society (AΩA) and the Gold Humanism Honor Society (GHHS). The mission of the GHHS is “to recognize individuals who are exemplars of humanistic patient care and who will serve as role models, mentors, and leaders in medicine”(3)^(p2), while the mission of AΩA is to “improve care for all by recognizing high educational achievement, encouraging the development of academic and community leaders, and promoting service to others.”(1)^{p4} To be elected to both, students would be expected to display not only high scholastic achievement, but also professionalism, leadership, community service, compassion and humanistic clinical care.

At the USU, the top 25% of academic performers are invited to submit an application for AΩA; while consideration for GHHS is through a peer nominated process solicited during the students’ core clerkship year. The selection process for each society is distinct and separate,(1; 3) and induction for each is restricted to 15% of the medical

school class. With 160 chapters for either AΩA or GHHS,(1; 2) using election to both societies serves as a feasible proxy of exceptional performance at other medical schools in the United States.

Data Collection

We obtained demographic data, MCAT scores, and uGPAs from each student's AMCAS application. These data describe the composition of the exceptional performing medical students in our sample via traditional admission measures.

The unit of coding for our thematic analysis were student statements within the work/activities and personal essay sections of each AMCAS application. The work and activity section provides up to fifteen experiences across the domains of teaching, community service, research, employment, recognition, extracurricular activities, and athletics. The three most meaningful experiences offered additional narrative on the “transformative nature of the experience” and “the impact [the applicant] made while engaging in the activity”.(6) We focused on these sections because we could best capture themes within the rich descriptions written directly by the matriculate.

Data analysis

We performed descriptive analysis on demographic variables, MCAT scores, and uGPA using Excel 2016 for Windows (Microsoft, Redmond, Washington). For our thematic analysis, we took an inductive approach and performed iterative cycles of investigation by year group. Following the methods described by Boyatzis(20) and outlined in a 6 step process by Braun and Clarke(23), one researcher (MP) generated initial codes after familiarizing himself with the data from the 2017 year group. These initial codes were analyzed and compared to search for themes that describe the

characteristics of the students and then shared with the other two researchers (SD, DT) who reviewed the data, codes, and initial themes. Through an active and interpretive process, all three researchers discussed, analyzed, compared, and mapped relationships among the data and codes to reach complete consensus on the definition and naming of all constructed themes. One researcher (MP) continued to code the applications from the 2018 and 2019 year groups, applying the initially constructed themes and generating new codes until the following criteria were fulfilled: the data no longer yielded any further themes, the constructed themes managed the new data without requiring further modifications (theoretical sufficiency)(85), and all applications had been reviewed. These final data, codes, and themes were also independently reviewed and analyzed by SD and DT until we reached complete consensus on all constructed themes. All AMCAS applications were coded within NVIVO 12.0 for macOS (QSR International, Burlington, Massachusetts).

RESULTS

Students inducted into both AΩA and GHHS represented 4.5% (n = 22) of all medical school graduates (n = 485) from 2017 to 2019 at the Uniformed Services University. The average age at matriculation was 26 (SD 4.5, range 22-40) and 40% (n = 9) were female gender. One third (n = 7) had prior military experience either on Active Duty, in the Reserves, or in the National Guard. Approximately half (n = 10) took the MCAT more than once and the average of their highest MCAT score was 31.45 (SD 2.3, range 27-36). The mean cumulative grade point average was 3.59 (SD 0.31, range 2.71-4.0).

We coded statements within each experience and personal essay of all 22 exceptional performer's AMCAS applications, representing 175 pages of examined text. Each statement could be coded in more than one theme. Theoretical sufficiency was reached after reviewing 15 applications. Seven themes were constructed from the data: success in a practiced activity, altruism, entrepreneurship, passion, perseverance, teamwork, and wisdom (Table 1).

Success in a practiced activity

This theme was characterized by demonstrating ongoing practice and dedicated engagement in an activity which led to an improvement in one's ability or resulted in success. The types of activities varied and included training, participation in internships, formal practice, and work. Success was mostly displayed through either high achievement in competition, recognition for performance, or a promotion to a higher position. When not associated with a concrete measure of success, dedication to the activity resulted in significant improvement in an ability or skill. Commitment to and/or extended practice of the skill was evident across this theme, often with the individual dedicating numerous hours to the activity.

I participated in an intensive summer training program to develop the skills and knowledge needed to achieve significant gains in student achievement while teaching... I completed my two year [Teach For America] commitment teaching biology... I was awarded the [annual] Outstanding Educator of the Year award by the student body. (006)

Altruism

This theme was characterized by a genuine desire to selflessly help an individual or community and reflects an internal reward the student feels from their experience. Characteristics demonstrated within altruism were selfless service, compassion, and

generosity. Most exceptional performing medical students committed to participating in activities that directly impacted, served, assisted, or improved others, often benefiting disadvantaged, underserved, or those with disabilities. Often the experience gave a feeling of deep satisfaction and personal fulfillment.

Each week I meet and interact with children with developmental disabilities and various nervous system traumas, and I am able to see the progress and improvements that they make each week... It also brings me immense joy to make the children laugh and smile, and for a few brief moments, forget about their ailments. (008)

This theme also includes activities such as mentoring, teaching, or coaching other groups of individuals, reflecting a desire to help others improve.

Whether it is through training others, explaining the insulin-glucagon axis, or teaching the biomechanics of knee position in a squat, I find a deep satisfaction in breaking down complex concepts in a meaningful way for others and helping them to achieve a healthy and fulfilling life. (022)

A simple statement of volunteering or engaging in an activity by itself did not meet the definition of this theme: “[I] mentored four freshman students through the challenges of Plebe Year.” (019) Instead, there must be an understood desire and commitment by the student to help that is associated with evidence of a direct impact on others.

Entrepreneurship

This theme was defined as taking initiative to accomplish or create something. There was often a motivation by a personal desire or concern for doing something innovative. Engagement in the activity was either initiated on one’s own or collaboratively with another person.

A roommate of mine happened to work for someone washing windows, just as I had. We decided to start our own business and take out a loan for supplies. We paid off the loan in a matter of weeks and continue to wash together today... (018)

Entrepreneurship also involved initiative in developing a new process with an explicit goal to improve a system or fix a problem.

What I inherited with that office was a mess. While the organization was solid, its finances were not. In fact the chapter was in debt... I was able to resolve the debt, formulate a functional budget, and secure a reasonable financial future for the fraternity. (017)

Routine responsibilities of a leadership position were not considered as entrepreneurship as these responsibilities represent routine requirements of a position: "as the baseball representative for the program [I] was responsible for developing proactive strategies to increase awareness of substance abuse" (010) Entrepreneurship was also not established through being a follower or under the direct supervision of someone else: "As the student leader of the project, I began to help him [professor] with his efforts..." (006)

Perseverance

This theme was characterized by an ability to overcome hardship, adversity, difficulty, or setback through hard work, commitment, or determination. There was often a struggle or challenge that required resiliency, flexibility, or resourcefulness in order to adapt and endure.

If a patient requiring therapy had limited access because of an insurance company, I wrote letters demonstrating gains to justify continued care... When patients needed medical equipment, I called their physician to validate the need. (005)

Usually the end result of persevering was a positive outcome, although in some situations there was an increase in confidence in the individual.

Amidst doors slamming in my face and being made fun of, I pressed onward in a cause I believed in. I learned that my happiness stemmed from honest and dedicated hard work. As I worked through adversity I found confidence. (018)

Passion

This theme was characterized by an intense interest for an activity or pursuit. The theme was often identified at the latent level, reflecting that passion was likely an underlying phenomenon expressed across experiences; although it also would manifest through a commitment to a single experience. In both cases, there was a dedication and engagement that was exhibited consistently over time. Enthusiasm, enjoyment, aspiration, and intrigue were often expressed when describing the experiences.

My high school independent study (...) evolved into a passion and immersion into the Duchenne muscular dystrophy (DMD) community, including an appearance on Good Morning America, conferences, house calls, and disheartening deaths of friends with DMD... Throughout the academic years, I developed my thesis project (...) to elucidate post-transcriptional differences in DMD pathology. While volunteering as a counselor at Muscular Dystrophy Association summer camps for three years... (007)

A standalone statement about being passionate for something, such as “I am passionate about the work that I do, and I enjoy public speaking” (008) or “...a passion rather than a gift for the sciences led me to pursue a pre-medical neuroscience major” (006), did not rise to the level of meeting the definition of this theme.

Wisdom

This theme was described by gaining new insight, self-discovery, or awareness from an experience or activity, resulting in an examination of an internal thought process that leads to personal growth. Most exceptional performers reflected on a personal situation in which actions and feelings were analyzed or evaluated, leading to a transformative process where the student learned through and from their experience.

This experience taught me the importance of fully investing myself in whatever I am involved in. Genuine care for the kids brought me success, not the pursuit of success. (018)

Insight often derived from experiences that related to leadership, empathy, tolerance, or self-care. The following example demonstrates a reflection on cultural bias and an understanding of being tolerant of differences,

From this experience I learned the importance of avoiding cultural biases and being culturally aware. Integrating this lesson into my life has enriched my professional and personal relationships by allowing me to draw upon similarities, rather than differences (020)

while this applicant shows insight gained from a leadership experience.

The challenge has always been getting my Marines to want to accomplish what they wouldn't otherwise... The highs include... the benefits of truly influencing a young man for the better, whether professionally or personally. The lows have been more instructive as enforcing standards is rarely easy and the task of correcting someone in the best manner has only come with experience. (022)

There were statements about what it was like to be something or someone (“[I] began to appreciate the dedication demands and day-to-day responsibilities of a doctor” (010)), or a gaining of a better understanding about a process or system (“I learned much about national regulations that stipulate a doctors' care” (002)), or being inspired from an experience (“I realized that the personal side of medicine appealed to me” (016)), but these statements did not demonstrate the self-discovery or personal growth associated with this theme.

Teamwork

This theme was defined as an appreciation for or reflection of the value of teamwork, collaboration, interpersonal relationships and/or camaraderie. Exceptional

performers either demonstrated the value in working together with others to achieve goals and be successful,

Being part of the program allows me to spend the majority of my time outside of class with like-minded individuals, working together to help each other achieve our goals so that we may all become successful officers upon commissioning. (016)

or placed an emphasis on teamwork over individual effort or achievement.

While playing rugby, I have learned that a strong team effort can achieve far more than any individual can. (008)

When building camaraderie, there was a cultivation of relationships and a development of a bond with others, as in the following example:

Having led them and the others through almost 200 combat patrols, having eaten, slept, and fought with them for months, our unbreakable bond of brotherhood was one borne of the crucible of war. We were a family, and their injuries affected me no differently than if we were blood relatives. (019)

DISCUSSION

The AAMC advocates for a greater emphasis on personal characteristics within a holistic approach to selection of medical students,(5) yet challenges facing medical schools to rely more on personal characteristics and less on uGPAs and MCAT scores for admission include self-interest, inertia, and philosophical factors.(12) This study demonstrates that the AMCAS application could be utilized as a tool for identifying personal characteristics that are associated with both medical school success and exceptional performance. We identified seven such characteristics using qualitative methods to assess actual student statements of exceptional performers when they applied to medical school: success in a practiced activity, altruism, entrepreneurship, perseverance, passion, wisdom and teamwork. These themes are consistent with

expertise theory and support the AAMC's core personal competencies to be successful in medical school.(7)

Deliberate practice theory describes certain features which are required to achieve expertise: persistent desire to do better, goal oriented, full concentration and effort, seeking out challenge, and reflective feedback.(14) Expert performers refine their knowledge and skills by seeking out training situations that exceed their current level of reliable performance and allow them to attain desired goals.(14) The concept of pursuing continuous improvement, taking initiative, and seeking innovation (features of our theme of entrepreneurship) are attributes that lead one to take deliberate efforts to change aspects of performance for the purpose to get better. Demonstrating one's ability to engage in practice which results in improvement and success (success in a practiced activity) suggests that such applicants may stick with the rigors of medical school and excel. Further, the ability for personal growth through self-discovery and awareness (wisdom) opens one up to reflective feedback. Reflective feedback is a core element of deliberate practice that involves self-monitoring and self-evaluation in order to effectively improve performance. Of note, our exceptional performers did not have exceptional MCAT scores or uGPAs with several taking the MCAT more than once.(8)

Other research into exceptional performance associates the personality characteristics of passion and perseverance, when combined with the pursuit of a long term goal, with successful outcomes.(34) Defined as grit, research found that individuals with more grit have higher educational attainment(34) and better medical school performance.(65) Because medical education entails maintaining long term effort and interest in the face of adversity (long hours, intense study, burnout), it makes sense that

those who possess the ability to persevere and maintain passion would be less susceptible to burnout(54) and that these themes manifest as personal characteristics displayed by exceptional performers in medical school.

The AAMC also reports nine core personal competencies that they consider significant to be successful in medical school.(7; 57) We found that several of our themes relate to these competencies. For example, the theme of altruism aligns with the competency of service orientation, both defined as “a desire to help others” and “to alleviate other’s distress”. Meanwhile, the competency of resilience and adaptability aligns with theme of perseverance - persistence under difficult situations and the ability to recover from setbacks. Our theme of entrepreneurship refers to taking initiative to create new concepts and engage in continuous improvement, similar to the competency of capacity for improvement. Lastly, both our findings and the AAMC competencies acknowledge the value of teamwork.

A core principle of the AAMCs holistic review is that selection criteria is “supported by student performance data that show that certain experiences or characteristics are linked to that individual’s likelihood of success as a student and/or physician.”(5) Given the above relationships, our themes provide empirical support that several of the AAMC’s personal competencies are not only related to a student’s likelihood of success, but are also associated with exceptional performing medical students. Knowing that one can identify early in the admission’s process personal competencies that may be related to medical student success can help medical school admission committees to select who to interview and can build a strong and talented medical school class. Detecting and recruiting medical student applicants with these

characteristics is especially important to residency programs that attempt to recruit the best medical students.(11; 13; 17; 19; 21; 83) A focus on such personal characteristics not only supports a holistic approach to selection, but has the potential to shape a physician workforce that provides society the best that medicine has to offer.

Our study has several limitations. First, the data come from a single institution. Because the USU is a school for physicians that will enter military or public health service, prior military service is weighted favorably during the admission process. In fact, a third of our exceptional performers had prior military experience, consistent with the 37% of prior military students that matriculate to the USU. Although we attempted to generalize our findings by using honor societies (AΩA and GHHS) that represent national commonly used standards for identifying exceptional performance, we do acknowledge selection to these societies at USU and elsewhere may be impacted by bias.(18; 89) Second, applicants may have had help in writing their statements and those statements may not reflect the applicant's voice. Further, the AAMC promotes applicants to demonstrate the core AAMC competencies within their applications,(34) which could persuade the applicants written responses and result in applications that reflect their ability to write convincing narratives. However, students are unlikely to possess all core competencies and those competencies they do possess are more likely to be emphasized within the application, which is true for all matriculates that applied to medical school. A third limitation of this study is that we have a lack of a comparison group (average or low performers) and therefore cannot conclude that our themes are unique to exceptional performers. However, causation was not the intent of the current study. Instead, we were interested to understand what themes, if any, were present within the AMCAS

applications of exceptional performers. Future research should explore whether these or different themes are present in average or low performing medical student applications to further elucidate the significance of our research.

Recruiting medical school applicants that have the best potential for exceptional performance is especially important in medicine because of the rigor required to complete medical training. Indeed, building a cohort of exceptional performers in medicine ultimately benefits society through enhancing the physician workforce. While empirical data clarifying what leads to exceptional performing students is lacking, this study does contribute to the literature by constructing an understanding of the personal characteristics of exceptional student performers at the entrance to medical school. These characteristics further align with both features of well-established theory on exceptional performance (deliberate practice) and competencies deemed necessary to be successful in medical school. Our research also illustrates that it appears possible to use the AMCAS application as a tool for admission committees to assess for these personal qualities. Future research should seek to replicate these seven characteristics across a cohort of applicants at other institutions and compare themes between exceptional performers and either average or low performers. Although such future research is needed to determine the utility of incorporating these characteristics into the medical school admissions process, our findings offer a starting point for consideration.

Table 2. Themes and Representative Quotes from Exceptional Performing Medical Students, USU 2017-2019

Theme	Representative Quotes
Success in a practiced activity	<p><i>“I began at [Company X] as a full-time summer intern. In my first clinically relevant position, I took my experience seriously and wanted to soak up as much as possible... [Company X] provided me the necessary foundation for understanding clinical trials and their greater role in medicine. After my internship was complete, my supervisor offered me a position working remotely as a Safety Coordinator in the Drug and Device Safety Compliance and Coding Department. At only 20 years of age, I was the youngest Safety Coordinator in their history of the company” (001)</i></p> <p><i>“Because of my interest in physical fitness and the human body, I enrolled in a 6 week personal training program. Each week consisted of a classroom lecture followed by a practical lab in the local gym. After passing both the written and practical exams, I completed a 30-hour internship...where I shadowed a personal trainer, witnessed multiple fitness assessments, and began designing workout programs for clients. Now as a certified trainer, I have two clients whom I instruct several times a week.” (010)</i></p> <p><i>“Working with children of all ages, genders, personalities, and abilities allowed me to finely tune perhaps dozens of coaching and mentoring techniques. The extraordinary number of hours spent coaching and planning team events refined my time management and organization skills.” (016)</i></p>

Altruism

“... I was shocked by the amount of homeless individuals wandering the streets. I was quickly inspired to help out at one of the shelters downtown and still serve meals there whenever I can, on weekends or in the morning before classes.” (011)

“...use special equipment and continual assistance to allow clients with various physical and mental impairments to ski for a half-day... there are few things as rewarding as making someone else's day, particularly when that someone has significantly harder days than I can begin to imagine.” (016)

“After his mission, the Jamaican team would not take him back; poverty left him with little future... He needed somewhere to stay and someone to guide him through his schooling. I volunteered and have taken classes with him, tutored him, corrected his papers, taught him grammar, given rides, and managed finances between him and his benefactor.” (018)

Entrepreneurship

“This year I cofounded an organization...which links refugees and recent immigrants in the... area with undergraduate students in order to decrease healthcare disparities for limited-English speaking populations.” (006)

“I developed an English curriculum focused on real-life conversational skills that non-native speakers need to have in order to confidently communicate... I have taught around 15 students and am currently in the process of expanding. By the end of the summer I plan to hire two other teachers and have 30 active students.” (014)

“My number one goal was to modernize legacy processes, equipment and production. Although quite capable, the squadron had become stagnant and

institutionally resistant to change. I knew [I] needed to empower each of the stake holders in the change process if I were to have any chance of success... By the end of my tenure, we had jointly accomplished about 90 percent of the items on that list. The improvement was palpable.” (013)

Perseverance *“I was placed on academic probation and academic suspension... I was 17 years old, thousands of miles from home and unprepared to attend college. I withdrew from college after one more semester. I would go on to earn four degrees and ultimately a doctorate degree from [another prestigious university] with a 3.82 cumulative GPA.” (009)*

“A challenging but rewarding aspect of research is the importance of persistence. I struggled for six months to sequence a difficult portion of the hepatitis C genome and ultimately found a method to replicate and uncover the sequence.” (015)

Passion *“My EMS career, which had begun with a gut feeling and a friend's recommendation, quickly grew into a passion and a sense of identity for me. By my senior year I was my college squad's equipment officer, and was also responsible for organizing training exercises. As for that simple invitation to ride on an ambulance, well that blossomed into two part-time jobs in EMS.” (017)*

“For the past year I have been building a 1965 Shelby Cobra kit car that I purchased ... The process has been laborious but highly rewarding and is a dream come true. I first heard about the company in 2004 and saved money for years to be able to purchase my own kit.” (009)

Wisdom *“In food preparation, I developed the ability to take ownership of my mistakes. Work ethic and trustworthiness are very important to employers as well as patients.*

Working in food service for four years taught me a lot about patience and empathy.”
(003)

“I learned a valuable lesson from the camp participants, which was patience... Working with these youngsters not only allowed the opportunity to pass my knowledge onto future baseball players, but also it taught me how to effectively communicate with a less than receptive audience.” (010)

“Work at [Company Y] has increased my ability to handle stressful situations. Building off of this skill, I have developed more personal methods that allow me to learn from stress in a healthy manner rather than just coping with it. In other words, I try to turn distress into eustress.” (017)

Teamwork

“...this experience has emphasized the importance of discipline, teamwork, and adaptability. I have learned that personal accountability allows for cooperation among members that facilitates effective patient care.” (015)

“Teachers are a part of a larger education system and have to adapt to playing various roles, so acquiring teamwork and leadership skills has been vital to my teaching career.” (021)

“I coordinated training between the [military’s] ships and west-coast [special forces] teams. With limited finances, this job has taught me to be resourceful... The job necessitates the cultivation of work relationships with a wide array of professionals.” (012)

CHAPTER 3: Discussion

A movement toward competency-based admissions implies an increasing recognition that high grades and test scores are only part of what predicts a good physician. To widen the lens through which to assess medical student applicants, the AAMC advocates for consideration of experiences and attributes that create “a richly diverse interview and selection pool and student body”; and they recommend this selection strategy be “supported by student performance data that show certain characteristics are linked to that individual’s likelihood of success as a student and/or physician”.(5) To achieve such a strategy, admission committees could benefit from our study findings in so far as we have constructed competency based themes that are displayed by exceptional performing medical students upon admission to medical school.

We discussed the relationship of deliberate practice and grit with our findings in Chapter Two. However, there is other research that supports our themes as it relates to student success and performance. In 1978, Warren Willingham directed the Personal Qualities Project to determine what factors (personal qualities) contribute to success in young adulthood. He discovered that follow-through, defined as purposeful and continuous commitment to (extracurricular) activities, was the one factor that stood out above the rest.(91) Higher levels of follow-through predicted graduating college with academic honors, holding an appointed or elected leadership position in young adulthood, and achieving a notable accomplishment in any domain. Later research further tested the concepts of follow through by awarding points for those who participated in a multiyear activity, advanced (were promoted), and achieved a high level of success. They found that high school students who met all three criteria were twice as likely to earn a college

degree and volunteer in their communities,(33; 43) while teachers meeting the criteria were more effective in their teaching.(72) In relation to performance in medical education, anecdotal studies have shown a correlation between participation in varsity athletics during college with selection to chief resident, as well as having a notable achievement or skill outside of academia or medicine with clinical and academic residency performance.(13; 77)

Interestingly, there is a similarity of follow through with grit and deliberate practice which demonstrates how several of our themes are complementary of each other for achieving exceptional performance. One can imagine that sticking with an activity over several years requires intense interest and dedication (passion). Those that go on to advance to higher levels within the activity are likely to learn to overcome difficulties and setbacks (perseverance) and to develop techniques for self- improvement (entrepreneurship). For those that achieve the highest level of success (success in a practiced activity), it is implied that long term practice and commitment results in a significant enhancement in their skills. Taken together with the theory of deliberate practice, the frameworks of follow through and grit provide some validity evidence for our study themes' relevance to exceptional performance.

Although the characteristics of teamwork and altruism do not directly support the theories related to exceptional performance, they do support the notion that learning is a social activity and that medicine is a “team sport”. Given that medicine represents a community of practice, these qualities would be expected to support the performance of medical students throughout their training. Because the practice of medicine relies on inter-professional collaboration to provide the best patient outcomes, medical students

must be able to effectively communicate, problem solve, and cooperate as part of team. Further, learning in medical school often involves building a social network with peers who share the development of a common knowledge base, values, and experiences around medicine. The desire to selflessly help others (altruism) through mentorship or coaching further supports a community of practice by the transfer of skills, knowledge, and attitudes that one has acquired. To be able to teach others, one must have first acquired the ability first.

Recruiting medical school applicants that have the potential for exceptional performance is of particular interest to residency training programs. Indicators that reflect excellence in clinical performance are valued across the specialties by residency program directors regardless of competitiveness within the specialty.(17; 19; 24; 46; 78; 92) Interpersonal skills, professionalism, and ethics are top rated factors in terms of importance by program directors in applicant ranking; placing higher than cognitive factors such as clerkship grades and USMLE scores.(9) Furthermore, residency directors prefer to avoid applicants at risk of difficulty,(9) as these residents often require significant time-consuming resources to meet the minimum clinical and professional standards. Surgical residencies in particular have an interest in selecting top performing medical students due to the rigors of surgical training and the surgical specialty's high attrition rates.(13; 92)

The better we are at recruiting candidates with characteristics that may be associated with exceptional performance, the better the pool of candidates residencies will have to select for their programs. To achieve such a goal, however, requires the ability to integrate our themes into the admission process. In particular, admission

committees would need to establish a process with reliability and validity evidence to assess for the themes within the AMCAS application.(16; 58; 59) This can be difficult due to the nature of human judgement and is a primary reason that MCAT scores and uGPA continue to appeal to admissions committees: they allow for reliable, valid, and easy comparison of applicants across the board.(16) Yet, prior research does provide encouragement that it is feasible to establish such a process. Through the use of multiple mini interviews, Terregino et al implemented a standardize method to assess for the AAMC personal competencies.(81) Using the scoring outcomes from this assessment in their final phase for decision on acceptance to medical school, they showed a positive correlation between those student applicants demonstrating higher levels of the core personal competencies and the following: higher clerkship competency ratings for patient care skills, intellectual curiosity, self-reflection skills, cultural competence, effective communication, and number of GHHS nominations.

Further research is needed to establish whether a similar process, utilizing our themes identified within the AMCAS application's written activities and experiences, can impact medical school's acceptance decisions and the performance of students, residents, and physicians. Such an assessment process would need to have reliability and validity evidence to ensure it meets the standards of good assessment (Table 3)(51) ^{p.116} before implementation. If successful, such research could help admission's committees incorporate more easily such personal characteristics into the admission process.

LIMITATIONS

Personal written statements, which led to the findings in our study, are subject to multiple limitations that may affect their implementation in a high stakes' decision process. In such a selection process, medical students are driven by a need to stand out and sell themselves in order to be competitive.(87; 88) This could lead to pressure to portray themselves in a falsely positive light, which in turn, could lead applicants to exaggerate or embellish when recounting their activities.(61; 87) In addition, applicants may receive input from others when crafting their application, either from friends and family or through professional services.(12; 61) While it may not be necessary to assume that all applicants will respond honestly and without help or embellishment, it is important to be aware that these influences may render an account of their experiences that is not fully accurate.

Furthermore, medical school applicants often present themselves in ways that they believe are expected of candidates.(87) Because applicants are highly motivated to reflect positively on themselves, whichever attributes are assumed to be targeted in the application process are more likely to be exhibited by them. For example, when asked to provide community service and teaching experiences on the AMCAS application, a theme of helping others is likely to emerge simply by the nature and expectation of the activity. The same phenomenon may occur with honors/awards/recognitions or intercollegiate athletics, experiences likely to display success in a practiced activity. Because of this phenomenon, there may actually be very few degrees of separation within the AMCAS application themes between the average medical school student and those that are identified as exceptional performers. Notably, without comparing the themes found in our study against applications of either average or low performing medical

students, one cannot conclude that our themes are unique to exceptional performers. Future research that applies our themes to a comparison group (e.g. typical or even low performers), would help elucidate any differences. In addition, future research can either study other parts of the medical school application for our themes, such as letters of reference, or test our themes through the use of mini medical interviews. Such research may provide additional validity evidence for our findings and represents logical potential next steps to explore in our program of research.

MILITARY RELEVANCE

Making accurate predictions regarding personal qualities of admitted students is critical to intentionally formulating class composition and will impact long-term physician representation in the United States Armed Forces. Medical school admissions officers carry the burden of deciding who will constitute the next generation of military physicians and have a considerable role in determining those who will be given the opportunity represent military medicine. The Uniformed Services University is unique to all other medical schools in so far as that admission to the school equates to employment into military service. USU medical students commit to seven years of post-residency employment in the military. Therefore, the USU admissions committee has a vested interest in selecting high quality medical school candidates that will not only be top performers in medical school, but exceptional performers in their professional military career. For example, some past graduates of the USU have become General Officers and a few have even been the Surgeon General for their respective service. Further, a majority of USU graduates will lead clinics, hospital departments, residency programs, and medical Brigades. To successfully accomplish these tasks will require the capability

of admissions committee members to identify and recruit those applicants with the personal characteristics to meet the values of our Armed Services. The ability to maximize potential within the USU medical student body should reap benefits to the United States military in the future.

CONCLUSION

MCAT scores and uGPA appeal to admissions committees because they allow for easy comparison of applicants from different undergraduate schools. Although academic credentials have an important place in medical school admissions, there is increasing recognition that overreliance on measures of academic performance may eliminate some applicants who could become excellent future physicians. Our themes of top performers in medical school provides the groundwork to develop future research into performance outcomes based on our findings, as well as, how to best devise methods to incorporate such characteristics within the AMCAS application into the admission decision process. Creating a pipeline of exceptional performing medical students will pay dividends down the road for residency programs, medicine, and society. The medical students we are selecting now are those who will help navigate the future of medicine and ensure continued growth and successful delivery of care.

Table 3. Criteria for Good Assessment

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1. Validity or coherence: There is a body of evidence that is coherent (“hangs together”) and that supports the use of the results of an assessment for a particular purpose.

 2. Reproducibility or consistency: The results of the assessment would be the same if repeated under similar circumstances.

 3. Equivalence: The same assessment yields equivalent scores or decisions when administered across different institutions or cycles of testing.

 4. Feasibility: The assessment is practical, realistic, and sensible, given the circumstances and context.

 5. Acceptability: Stakeholders find the assessment process and results to be credible.

Modified from Holmboe ES, Hawkins RE. *Practical guide to the evaluation of clinical competence*. Philadelphia, PA: Mosby/Elsevier; 2008. p.113, Box 6.2.

REFERENCES

1. *Alpha Omega Alpha Honor Medical Society. Constitution.*
<https://alphaomegalpha.org/pdfs/2020revConstitution.pdf>
2. *Arnold P. Gold Foundation. Gold Humanism Honor Society Chapter List.*
<https://www.gold-foundation.org/programs/ghhs/chapter-list/>
3. *Arnold P. Gold Foundation. Gold Humanism Honor Society Chapter Toolkit.*
<https://s3.amazonaws.com/gold-foundation/wp-content/uploads/2019/02/2019-Toolkit-FINAL.pdf>
4. *Association of American Medical Colleges. Graduation Rates and Attrition Rates of U.S. Medical Students.*
<https://www.aamc.org/system/files/reports/1/graduationratesandattritionratesofu.s.medicalstudents.pdf>
5. *Association of American Medical Colleges. Holistic Review: Core Principles.*
<https://www.aamc.org/services/member-capacity-building/holistic-review>
6. *Association of American Medical Colleges. How to Apply to Medical School with AMCAS: Section 5 of the AMCAS Application: Work and Activities.*
<https://students-residents.aamc.org/applying-medical-school/article/section-5-work-and-activities>
7. *Association of American Medical Colleges. The Core Competencies for Entering Medical Students.* <https://students-residents.aamc.org/applying-medical-school/article/core-competencies/>
8. FACTS Table A-16: MCAT Scores and GPAs for Applicants and Matriculants to U.S. Medical Schools, 2006-2007 through 2015-2016, Association of American Medical Colleges. Available at datarequest@aamc.org
9. *National Resident Matching Program, Data Release and Research Committee. Results of the 2020 NRMP program director survey. Washington: National Resident Matching Program.* <https://mk0nrmp3oyqui6wqfm.kinstacdn.com/wp-content/uploads/2020/08/2020-PD-Survey.pdf>
10. 2010. Oxford Dictionary of English. In *Oxford Dictionary of English* ed. A Stevenson. Online: Oxford University Press
11. Agarwal V, Bump GM, Heller MT, Chen LW, Branstetter B Ft, et al. 2018. Do Residency Selection Factors Predict Radiology Resident Performance? *Acad. Radiol.* 25:397-402

12. Albanese MA, Snow MH, Skochelak SE, Huggett KN, Farrell PM. 2003. Assessing personal qualities in medical school admissions. *Acad. Med.* 78:313-21
13. Alterman DM, Jones TM, Heidel RE, Daley BJ, Goldman MH. 2011. The predictive value of general surgery application data for future resident performance. *J. Surg. Educ.* 68:513-8
14. Anders Ericsson K. 2008. Deliberate Practice and Acquisition of Expert Performance: A General Overview. *Acad. Emerg. Med.* 15:988-94
15. Artino AR, Jr., Gilliland WR, Waechter DM, Cruess D, Calloway M, Durning SJ. 2012. Does self-reported clinical experience predict performance in medical school and internship? *Med. Educ.* 46:172-8
16. Benbassat J, Baumal R. 2007. Uncertainties in the selection of applicants for medical school. *Adv Health Sci Educ Theory Pract* 12:509-21
17. Bhat R, Takenaka K, Levine B, Goyal N, Garg M, et al. 2015. Predictors of a Top Performer During Emergency Medicine Residency. *J. Emerg. Med.* 49:505-12
18. Boatright D, Ross D, O'Connor P, Moore E, Nunez-Smith M. 2017. Racial Disparities in Medical Student Membership in the Alpha Omega Alpha Honor Society. *JAMA internal medicine* 177:659-65
19. Bowe SN, Laury AM, Gray ST. 2017. Associations between Otolaryngology Applicant Characteristics and Future Performance in Residency or Practice: A Systematic Review. *Otolaryngol. Head Neck Surg.* 156:1011-7
20. Boyatzis RE. 1998. *Transforming qualitative information: Thematic analysis and code development*. Thousand Oaks, CA, US: Sage Publications, Inc. xvi, 184-xvi, pp.
21. Boyse TD, Patterson SK, Cohan RH, Korobkin M, Fitzgerald JT, et al. 2002. Does medical school performance predict radiology resident performance? *Acad. Radiol.* 9:437-45
22. Brannick MT, Grichanik M, Nazian SJ, Wahi M, Goldin SB. 2013. Emotional Intelligence and Medical School Performance: A Prospective Multivariate Study. *Medical science educator* 23:628-36
23. Braun V, Clarke V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology* 3:77-101
24. Burish MJ, Fredericks CA, Engstrom JW, Tateo VL, Josephson SA. 2015. Predicting success: What medical student measures predict resident performance in neurology? *Clin. Neurol. Neurosurg.* 135:69-72

25. Busche K, Elks ML, Hanson JT, Jackson-Williams L, Manuel RS, et al. 2020. The Validity of Scores From the New MCAT Exam in Predicting Student Performance: Results From a Multisite Study. *Acad. Med.* 95:387-95
26. Cleland JA, Durning SJ. 2015. Researching medical education.
27. Cortez AR, Winer LK, Kim Y, Hanseman DJ, Athota KP, Quillin RC, 3rd. 2019. Predictors of medical student success on the surgery clerkship. *Am. J. Surg.* 217:169-74
28. Daly KA, Levine SC, Adams GL. 2006. Predictors for resident success in otolaryngology. *J. Am. Coll. Surg.* 202:649-54
29. DeZee KJ, Magee CD, Rickards G, Artino AR, Jr., Gilliland WR, et al. 2014. What aspects of letters of recommendation predict performance in medical school? Findings from one institution. *Acad. Med.* 89:1408-15
30. Dong T, Durning SJ, Gilliland WR, Waechter DM, Cruess DF, et al. 2012. Exploring the relationship between self-reported research experience and performance in medical school and internship. *Mil. Med.* 177:11-5
31. Dong T, Kay A, Artino AR, Jr., Gilliland WR, Waechter DM, et al. 2013. Application essays and future performance in medical school: are they related? *Teach. Learn. Med.* 25:55-8
32. Donnon T, Paolucci EO, Violato C. 2007. The predictive validity of the MCAT for medical school performance and medical board licensing examinations: a meta-analysis of the published research. *Acad. Med.* 82:100-6
33. Duckworth A. 2016. *Grit: The power of passion and perseverance*. New York, NY, US: Scribner/Simon & Schuster. xv, 335-xv, pp.
34. Duckworth AL, Peterson C, Matthews MD, Kelly DR. 2007. Grit: Perseverance and Passion for Long-Term Goals. *J. Pers. Soc. Psychol.* 92:1087-101
35. Duckworth AL, Yeager DS. 2015. Measurement Matters: Assessing Personal Qualities Other Than Cognitive Ability for Educational Purposes. *Educational researcher* 44:237-51
36. Dunleavy DM, Kroopnick MH, Dowd KW, Searcy CA, Zhao X. 2013. The predictive validity of the MCAT exam in relation to academic performance through medical school: a national cohort study of 2001-2004 matriculants. *Acad. Med.* 88:666-71
37. Durning SJ, Ratcliffe T, Artino AR, Jr., van der Vleuten C, Beckman TJ, et al. 2013. How is clinical reasoning developed, maintained, and objectively assessed? Views from expert internists and internal medicine interns. *J. Contin. Educ. Health Prof.* 33:215-23

38. Duvivier RJ, van Dalen J, Muijtjens AM, Moulaert VR, van der Vleuten CP, Scherpbier AJ. 2011. The role of deliberate practice in the acquisition of clinical skills. *BMC Med. Educ.* 11:101
39. Ericsson KA. 2015. Acquisition and Maintenance of Medical Expertise: A Perspective From the Expert-Performance Approach With Deliberate Practice. *Acad. Med.* 90:1471-86
40. Ericsson KA, Hoffman RR, Kozbelt A, Williams MA. 2018. *The Cambridge handbook of expertise and expert performance.*
41. Ferguson E, James D, Madeley L. 2002. Factors associated with success in medical school: systematic review of the literature. *BMJ* 324:952-7
42. Furstenberg S, Harendza S. 2017. Differences between medical student and faculty perceptions of the competencies needed for the first year of residency. *BMC Med. Educ.* 17:198
43. Gardner M, Roth J, Brooks-Gunn J. 2008. Adolescents' Participation in Organized Activities and Developmental Success 2 and 8 Years After High School: Do Sponsorship, Duration, and Intensity Matter? *Dev. Psychol.* 44:814-30
44. Gilliland WR, Artino AR, Jr., Waechter DM, McManigle JE, Cruess DF, et al. 2012. Identifying themes within a medical school admission committee's reviews of applicants. *Mil. Med.* 177:16-20
45. Goldie J, Dowie A, Goldie A, Cotton P, Morrison J. 2015. What makes a good clinical student and teacher? An exploratory study. *BMC Med. Educ.* 15:40-
46. Gross C, O'Halloran C, Winn AS, Lux SE, Michelson CD, et al. 2020. Application Factors Associated With Clinical Performance During Pediatric Internship. *Acad. Pediatr.* 20:1007-12
47. Haight SJ, Chibnall JT, Schindler DL, Slavin SJ. 2012. Associations of medical student personality and health/wellness characteristics with their medical school performance across the curriculum. *Acad. Med.* 87:476-85
48. Harfmann KL, Zirwas MJ. 2011. Can performance in medical school predict performance in residency? A compilation and review of correlative studies. *J. Am. Acad. Dermatol.* 65:1010-22.e2
49. Herrera LN, Khodadadi R, Schmit E, Willig J, Hoellein A, et al. 2019. Which Student Characteristics Are Most Important in Determining Clinical Honors in Clerkships? A Teaching Ward Attending Perspective. *Acad. Med.*
50. Hojat M, Erdmann JB, Gonnella JS. 2013. Personality assessments and outcomes in medical education and the practice of medicine: AMEE Guide No. 79. *Med. Teach.* 35:e1267-301

51. Holmboe ES, Hawkins RE. 2008. *Practical guide to the evaluation of clinical competence*. Philadelphia, PA: Mosby/Elsevier
52. Humphrey-Murto S, Leddy JJ, Wood TJ, Puddester D, Moineau G. 2014. Does Emotional Intelligence at Medical School Admission Predict Future Academic Performance? *Acad. Med.* 89:638-43
53. Johnson M, Elam C, Edwards J, Taylor D, Heldberg C, et al. 1998. Medical school admission committee members' evaluations of and impressions from recommendation letters. *Acad. Med.* 73:S41-3
54. Jumat MR, Chow PK-H, Allen JC, Lai SH, Hwang N-C, et al. 2020. Grit protects medical students from burnout: a longitudinal study. *BMC Med. Educ.* 20:1-9
55. Kiger ME, Varpio L. 2020. Thematic analysis of qualitative data: AMEE Guide No. 131. *Med. Teach.*:1-9
56. Kim K-J, Kee C. 2012. Gifted Students' Academic Performance in Medical School: A Study of Olympiad Winners. *Teach. Learn. Med.* 24:128-32
57. Koenig TW, Parrish SK, Terregino CA, Williams JP, Dunleavy DM, Volsch JM. 2013. Core Personal Competencies Important to Entering Students' Success in Medical School: What Are They and How Could They Be Assessed Early in the Admission Process? *Acad. Med.* 88:603-13
58. Kreiter C, O'Shea M, Bruen C, Murphy P, Pawlikowska T. 2018. A meta-analytic perspective on the valid use of subjective human judgement to make medical school admission decisions. *Med. Educ. Online* 23:1522225
59. Kreiter CD. 2016. A research agenda for establishing the validity of non-academic assessments of medical school applicants. *Advances in health sciences education : theory and practice* 21:1081-5
60. Kreiter CD, Axelson RD. 2013. A perspective on medical school admission research and practice over the last 25 years. *Teach. Learn. Med.* 25 Suppl 1:S50-6
61. Kumwenda B, Dowell J, Husbands A. 2013. Is embellishing UCAS personal statements accepted practice in applications to medicine and dentistry? *Med. Teach.* 35:599-603
62. Libbrecht N, Lievens F, Carette B, Cote S. 2014. Emotional intelligence predicts success in medical school. *Emotion* 14:64-73
63. Lievens F, Ones DS, Dilchert S. 2009. Personality scale validities increase throughout medical school. *J. Appl. Psychol.* 94:1514-35
64. Lipman JMMDF, Schenarts KDP. 2016. Defining Honors in the Surgery Clerkship. *J. Am. Coll. Surg.* 223:665-9

65. Miller-Matero LR, Martinez S, MacLean L, Yaremchuk K, Ko AB. 2018. Grit: A predictor of medical student performance. *Educ Health (Abingdon)* 31:109-13
66. Monroe A, Quinn E, Samuelson W, Dunleavy DM, Dowd KW. 2013. An overview of the medical school admission process and use of applicant data in decision making: what has changed since the 1980s? *Acad. Med.* 88:672-81
67. Moulart V, Verwijnen MG, Rikers R, Scherpbier AJ. 2004. The effects of deliberate practice in undergraduate medical education. *Med. Educ.* 38:1044-52
68. Paolino ND, Artino AR, Jr., Saguil A, Dong T, Durning SJ, DeZee KJ. 2015. Predicting medical school and internship success: does the quality of the research and clinical experience matter? *Mil. Med.* 180:12-7
69. Patterson F, Knight A, Dowell J, Nicholson S, Cousans F, Cleland J. 2016. How effective are selection methods in medical education? A systematic review. *Med. Educ.* 50:36-60
70. Plant EA, Ericsson KA, Hill L, Asberg K. 2005. Why study time does not predict grade point average across college students: Implications of deliberate practice for academic performance. *Contemp. Educ. Psychol.* 30:96-116
71. Rees EL, Hawarden AW, Dent G, Hays R, Bates J, Hassell AB. 2016. Evidence regarding the utility of multiple mini-interview (MMI) for selection to undergraduate health programs: A BEME systematic review: BEME Guide No. 37. *Med. Teach.* 38:443-55
72. Robertson-Kraft C, Duckworth AL. 2014. True Grit: Trait-Level Perseverance and Passion for Long-Term Goals Predicts Effectiveness and Retention Among Novice Teachers. *TEACHERS COLLEGE RECORD* 116
73. Rosenbluth G, O'Brien B, Asher EM, Cho CS. 2014. The "zing factor"-how do faculty describe the best pediatrics residents? *J. Grad. Med. Educ.* 6:106
74. Rosenthal S, Howard B, Schlusser YR, Lazarus CJ, Wong JG, et al. 2009. Does medical student membership in the gold humanism honor society influence selection for residency? *J. Surg. Educ.* 66:308-13
75. Saguil A, Dong T, Gingerich RJ, Swygert K, LaRochelle JS, et al. 2015. Does the MCAT predict medical school and PGY-1 performance? *Mil. Med.* 180:4-11
76. Siu E, Reiter HI. 2009. Overview: what's worked and what hasn't as a guide towards predictive admissions tool development. *Advances in health sciences education : theory and practice* 14:759-75
77. Spitzer ABBA, Gage MJBA, Looze CABS, Walsh MP, Zuckerman JDMD, Egol KAMD. 2009. Factors Associated with Successful Performance in an Orthopaedic

- Surgery Residency. *Journal of bone and joint surgery. American volume* 91:2750-5
78. Stohl HE, Hueppchen NA, Bienstock JL. 2010. Can medical school performance predict residency performance? Resident selection and predictors of successful performance in obstetrics and gynecology. *J. Grad. Med. Educ.* 2:322-6
 79. Stratton TD, Elam CL. 2014. A holistic review of the medical school admission process: examining correlates of academic underperformance. *Med. Educ. Online* 19:22919
 80. T G, D D. 2013. Letters of evaluation: Current practices in the admission process. *Analysis in Brief* 13:1-2
 81. Terregino CA, Copeland HL, Laumbach SG, Mehan D, Dunleavy D, Geiger T. 2018. How good are we at selecting students that meet our mission? Outcomes of the 2011 and 2012 entering classes selected by a locally developed multiple mini interview. *Med. Teach.* 40:1300-5
 82. Terregino CA, Saguil A, Price-Johnson T, Anachebe NF, Goodell K. 2020. The Diversity and Success of Medical School Applicants With Scores in the Middle Third of the MCAT Score Scale. *Acad. Med.* 95:344-50
 83. Thompson RH, Lohse CM, Husmann DA, Leibovich BC, Gettman MT. 2017. Predictors of a Successful Urology Resident Using Medical Student Application Materials. *Urology* 108:22-8
 84. Turner R, Nicholson S. 2011. Reasons selectors give for accepting and rejecting medical applicants before interview. *Med. Educ.* 45:298-307
 85. Varpio L, Ajjawi R, Monrouxe LV, O'Brien BC, Rees CE. 2017. Shedding the cobra effect: problematising thematic emergence, triangulation, saturation and member checking. *Med. Educ.* 51:40-50
 86. White CB, Dey EL, Fantone JC. 2009. Analysis of factors that predict clinical performance in medical school. *Adv Health Sci Educ Theory Pract* 14:455-64
 87. White J, Brownell K, Lemay J-F, Lockyer JM. 2012. "What Do They Want Me To Say?" The hidden curriculum at work in the medical school selection process: a qualitative study. *BMC Med. Educ.* 12:17-
 88. White JS, Lemay J-F, Brownell K, Lockyer J. 2011. "A Chance To Show Yourself" - how do applicants approach medical school admission essays? *Med. Teach.* 33:e541-e8
 89. Wijesekera TP, Kim M, Moore EZ, Sorenson O, Ross DA. 2019. All Other Things Being Equal: Exploring Racial and Gender Disparities in Medical School Honor Society Induction. *Acad. Med.* 94:562-9

90. Wiley A, Koenig JA. 1996. The validity of the Medical College Admission Test for predicting performance in the first two years of medical school. *Acad. Med.* 71:S83-5
91. Willingham WW, Educational Testing Service PNJ, College Entrance Examination Board NYNY. 1985. *Success in College: The Role of Personal Qualities and Academic Ability*. College Board Publications, Box 886, New York, NY
92. Zuckerman SL, Kelly PD, Dewan MC, Morone PJ, Yengo-Kahn AM, et al. 2018. Predicting Resident Performance from Preresidency Factors: A Systematic Review and Applicability to Neurosurgical Training. *World Neurosurg.* 110:475-84.e10