

Chapter 14

The Premedical Years

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ABSTRACT

The premedical baccalaureate period is critical to shaping a high-achieving, diverse, and service-oriented medical school applicant pool. The focus on achieving superior academic performance in premedical coursework captures the attention of most premedical students, but equal attention must be paid to developing the personal qualities and experiences that will form the foundation of their future capacity to understand and communicate with patients. Premedical students are best served to major in a field for authentic intellectual reasons regardless of the field's immediate connection to the health care field. There is a growing trend for applicants to have a gap year or more between the undergraduate period and medical school. The authors discuss the role of letters of evaluation and the premedical committee in the application process. The authors have more than 40 years of combined experience in premedical academic and career advising at a large, research-focused public institution.

INTRODUCTION

The demands, competition, and anxiety of the premedical college experience shape the formative years in the lives of thousands of students. Some remember these years as stressful, consuming, and disappointing. Others remember an awakening of fascination with science, ambition to help individuals in need, and determination to make a societal impact. The difference in the premedical experience may prove critical, not only for individual happiness and fulfillment, but for the future wellbeing of countless patients who benefit the most when their physicians feel professionally satisfied, helpful, and capable rather than burned out.

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This chapter will consider the landscape of the premedical period encompassing the entirety of the college experience in the setting of a large research-focused public institution. The authors will address premedical students' choice of major, prerequisite coursework, MCAT preparation, how students engage in meaningful exploratory healthcare experiences, letters of evaluation, and the application stage. It is the authors' intent that medical school educators will find this perspective valuable for the enhancement of their ability to interpret applications to their programs. Insight they will gain from this review could improve their understanding of the particular challenges and unique opportunities that exist in the contemporary undergraduate premedical experience.

BACKGROUND

The roots of the modern American medical education model can be traced to the late nineteenth century when medical educators first called for a premedical education period leading to a baccalaureate degree or its equivalent in preparation for medical training. These recommendations were established to ensure that medical trainees were properly prepared in the sciences and classics such that they would possess the academic fitness to complete a medical doctor degree that was becoming increasingly based on scientific practice (Fishbein, 2001). Decades later in 1910, in his comprehensive review of the American and Canadian medical education system, Abraham Flexner of the Carnegie Foundation concluded that "a two-year college training, in which the sciences are featured is the minimum basis upon which modern medicine can be successfully taught" and advocated further for medical departments to adopt a stricter standard of a prerequisite baccalaureate degree (Flexner, 1910). The 1920s saw the development of the the Moss Test, a forerunner of the Medical College Admission Test (MCAT), a tool designed to objectively assess an applicant's intellectual qualities with the aim of reducing the medical school attrition rate which had climbed to as high as 50% in that period (McGaghie, 2002). In the postwar period, under the direction of the Association of American Medical Colleges (AAMC), the exam evolved into a multiple-choice test of verbal, quantitative, and science ability and knowledge of "modern society." The MCAT has undergone numerous revisions and updates with the latest in 2015. The MCAT and the undergraduate record continue to be the key indicators of academic readiness in the medical school application process (Schwartzstein, Rosenfeld, Hilborn, Oyewole, & Mitchell, 2013).

This uniquely American rite of passage has played out for generations in elite liberal arts colleges and universities, the most prized recruiting grounds for medical schools. The decades that followed have witnessed considerable debate about the objectives of this premedical education period, and while such debates are still ongoing, a baccalaureate degree for the modern American premedical student is *de rigueur*. In an undergraduate experience characterized by competition, sacrifice and persistence (Richardson, Mulvihill, & Latz, 2014), the premedical student not only must demonstrate excellence in coursework, research, and service and achieve a high MCAT score, but also demonstrate mature personal development and obtain formal letters of support from several faculty. The numbers are not in the premedical student's favor with fewer than 50% of applicants each year gaining admission to U.S. MD-granting schools (*Applying to Medical School: 2018 AMCAS Medical School Applications by the Numbers*, 2019).

Like any large system, the U.S. medical school preparation and application process is susceptible to inequities. Institutionalized discrimination, endemic poverty, and poor educational opportunities focused in urban and rural environments are key drivers each year behind the underrepresentation of the poor in

general and specific populations among competitive applicants to medical schools in the United States; African Americans perhaps chief among these underrepresented-in-medicine (URiM) populations. This has resulted in a population of physicians that skews toward affluence which in turn has resulted in a scarcity of doctors and ongoing barriers to acceptable medical care in disadvantaged parts of the country (Smith, Rose, Schroeder, & Long, 2015). For premedical students from minority and disadvantaged backgrounds particularly, the competitive and complex undergraduate period can contribute to the “leaky pipeline” effect, or the decline in interest in a medical career (Barr, Gonzalez, & Wanat, 2008; Freeman, Trevino, Grande, Shea, & Shea, 2016). With the following, the authors offer their view of the fundamental features of the undergraduate premedical period and point attention to aspects that present particular vulnerabilities to the URiM population.

ROLE OF THE BACCALAUREATE MAJOR

The selection of a major field of study is perhaps the most significant act of self-definition that a premedical student confronts. In this act, a student formally joins a community of like-minded scholars and adopts a new layer of identity distinct from the “premed” label. The authors underscore that from the standpoint of the goals of a liberal arts and sciences education, the premedical student is best served to pursue a major that is most personally meaningful, regardless of any immediate connection of the major to the health care or biomedical field. The reasons for this recommendation are twofold: 1) a diversity of academic specialization brings richness to the practice of medicine, and 2) for the many freshmen who embark on the premedical path and choose a life-science major reflexively, some may abandon a premedical path entirely or ultimately may not gain admittance to a medical program and are then burdened with an academic preparation they chose for arbitrary reasons rather than intrinsic interest.

Concerning the latter case, consider a student who listlessly pursues a cellular biology major without an authentic interest in the field and under the misguided impression that such a choice will “look good” to a medical school admissions committee. This student finds herself in a precarious position should she arrive at graduation with no medical school acceptances (a fate shared by over 50% of the MD applicant pool) and with a degree that she did not enjoy nor thrive in. Had this student declared a major that truly reflected her intellectual interest, a viable plan B would be in place. More significantly, her college journey would have been an authentic one, not an instrumental one.

An examination of the premedical student population at the authors’ institution¹ shows that the majority of premedical students applying majored in a life-science related field in recent years (Table 1). The American Association of Colleges of Osteopathic Medicine reports a similar trend wherein 70% of the DO applicant pool majored in a life science (*Data Reports in Osteopathic Medical Education* 2017). Among the MD applicant pool, a small majority (56%) specialized in the biological sciences with a broader distribution among the physical sciences, social sciences, humanities and other fields (*MCAT and GPAs for Applicants and Matriculants to U.S. Medical Schools by Primary Undergraduate Major, 2018-2019*, 2019). The dominance of life-science majors among the premedical population is not surprising given that a commitment to a future career in health care might incline a student toward a major that draws a linear connection to human medicine. Undoubtedly for some in this group, the choice of a life science major was informed not by an intrinsic interest for the field but by the notion that medical schools admissions committees prefer life science majors or that these majors are efficient routes toward completing medical school-specific prerequisites. A closer examination of this institution’s applicant

cohort reveals that dozens of non-science majors are represented – from English to history to business – and students who major in these subjects experience similar medical school acceptance outcomes to traditional life-science majors.²

In the modern era, countless medical journal commentaries have called for increased intellectual diversity among the medical school applicant pool with considerable interest in supporting premedical students with an academic focus in the humanities (e.g. English, cultural studies, religion, philosophy). Thirty years ago, the Mount Sinai School of Medicine Humanities and Medicine Program opened a new pathway to obtaining a medical degree that encouraged premedical students to engage in a truly broad liberal arts education by way of guaranteeing medical school admittance to select humanities students in the sophomore year (Rifkin, Smith, Stimmel, Stagnaro-Green, & Kase, 2000). The Mount Sinai program is joined by a growing number of formal undergraduate programs in medical humanities built upon the idea that the study of empathy, communication, and ethical reasoning prepares premedical students to serve as expertly-skilled, patient-centered physicians (Lamb, Berry, & Jones, 2019). Investigations of undergraduate humanities and social science majors have substantiated that as physicians, they have a greater tendency to choose primary care specialties (Hall, Woods, & Hanson, 2014), have superior interpersonal competencies, and are more informed of the factors that lead to health disparities than their science-major prepared colleagues (Metzel, Petty, & Olowojoba, 2018).

PREREQUISITE COURSEWORK AND ACADEMIC COMPETENCIES

As the American medical education model evolved over the last century, a broad consensus emerged that applicants to medical school should be required to show a mastery in biology, chemistry, physics, and

Table 1. Undergraduate majors of University of Michigan students who entered the MD application pool in the period of 2014-2018. Students with double majors are included in both major cohorts, respectively. Majors with fewer than 25 students are not shown. S. Chervin (author) collected these data.

Undergraduate Major	Number
Neuroscience	1233
Biology-related	1102
Psychology/Biopsychology	946
Biochemistry	491
Engineering-related	285
Kinesiology	201
Foreign language	179
Anthropology	105
History/Political Science	98
Economics/Business	97
Sociology-related	41
English	30
Mathematics	26

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mathematics coursework at the undergraduate level as evidence of readiness to engage in the medical school curriculum (Alpern, Belitsky, & Long, 2011). At its most general, the modern prerequisite list continues to emphasize coursework in the sciences: one year each of general chemistry, organic chemistry, and physics; two years of biology; and a semester of biochemistry. Beyond these sciences, particular medical schools may require additional coursework in math or statistics (a requirement for calculus has become rare), an English composition, or social science (*Medical School Admission Requirements™*, 2019; *Student Guide to Osteopathic Medical Colleges*, 2019). Over the course of a baccalaureate degree, the medical school-specific courses amount to roughly half of all the academic courses a student will take. For some students, the prerequisite coursework will align efficiently with their chosen major, and for others, these courses will be completed alongside a major in a non-science field.

Where a premedical student completes these prerequisite courses appears to influence admissions outcomes. Students who begin their undergraduate experience at a two-year community college experience lower admission rates than students who matriculate at four-year undergraduate institutions even when controlling for MCAT scores and GPA (Talamantes et al., 2014). This finding is particularly concerning because a higher proportion of underrepresented minority and first-generation college students attend community colleges and thus complete much of the introductory premedical science coursework in these less-competitive settings (Saguil & Kellermann, 2014). In a recent commentary (2018), Amanda Kost speaks about the broken promise of a community college pipeline to medical school and challenges medical schools to “take a hard look at how we think about medical school admissions and the value we assign community college education versus a traditional 4-year degree. Community college should not be a barrier for medical school admission. On the contrary, it should be valued for not only the education it provides, the spaces it builds and offers disadvantaged students, but also for the pipeline it creates for those who otherwise could not apply to medical school.”

Theoretically, once community college students arrive as transfer students to a four-year college or university, they have the opportunity to demonstrate academic prowess equivalent to that of the students who have been at such institutions from the beginning by performing well in upper-level science courses. However, it is the authors’ (admittedly anecdotal) observation that the factors that initially led those students to begin at community colleges follow them to the four-year school and exacerbate what was likely to have been a challenging transition to begin with. Low SES status still requires them to work and sets them apart from an otherwise affluent student population. Lack of familiarity with the intensity and academic cultures associated with the new school’s science courses may be an impediment to immediate success. The fact that they arrive with only two years to finish can force the transfer student to make an expedient curricular choice rather than a scholarly one. All of these factors can militate against the transfer student’s academic success, even as they imbue in precisely the breadth of perspective, resilience, and empathy for the struggle of others that medical schools are looking for.

In 1988, the University of Pennsylvania School of Medicine moved away from the traditional model requiring a particular amount of credit hours in target coursework and toward a competency model. This model has slowly been adopted³ by a small number of other programs (Burg, Croll, Ruff, & Stemmler, 1988). At its core, the competency model defines a benchmark set of knowledge and skills deemed essential for the study of human medicine (e.g., demonstrated skills in laboratory-based problem solving, knowledge of eukaryotic cell function, knowledge of the molecular underpinnings of life). Under this model, the premedical student is given freedom to master these competencies through a range of curricula and experiential options; they may demonstrate mastery by coursework, certainly, but also by extensive research in the content area, completing low-cost online courses or by other kinds of focused

experiences. The underlying goals of the competency model were to provide medical schools with a greater degree of flexibility when it comes to identifying acceptable applicants and to encourage broad intellectual exploration at the undergraduate level. The developers of this model hoped that in freeing premedical students from the credit-hour economy, the competency model would have a liberating effect on the undergraduate premedical experience and support the development of innovative interdisciplinary leaders in the field. The Association of American Medical Colleges, in partnership with numerous consulting committees, developed a list of core personal and academic competencies to guide students both in their preparation for medical school and undergraduate institutions in their efforts toward curriculum reform (*Core Competencies for Entering Medical Students*, 2019). These core competencies encompass four areas of personal development and knowledge:

- Interpersonal:
 - Service orientation.
 - Social skills.
 - Cultural competence.
 - Teamwork.
 - Oral communication.
- Intrapersonal:
 - Ethical responsibility to self and others.
 - Reliability and dependability.
 - Resilience and adaptability.
 - Capacity for improvement.
- Thinking and Reasoning:
 - Critical thinking.
 - Quantitative reasoning.
 - Scientific inquiry.
 - Written communication.
- Science:
 - Living systems.
 - Human behavior.

The existence of the competency model poses the dilemma that unless a vast majority of medical schools adopt similarly liberal admission standards, the premedical student will forever be confined to complete the traditional prerequisite course list. Consider that on average applicant applies to sixteen medical programs in hopes of landing an interview at a handful of these schools (*FACTS: Applicants, Matriculants, Enrollment, Graduates, MD-PhD, and Residency Applicants Data*, 2018). In casting such a sizeable net, the applicant is beholden to complete the most particular coursework requirements among the set regardless of the existence of a more flexible plan among them. Thus, the traditional coursework model continues to hold sway over the lives of the modern premedical student.

PREPARING FOR THE MCAT

A superior performance on the Medical College Admission Test (MCAT) is essential to an applicant's competitiveness and accordingly the test is a dominant feature of the undergraduate premedical experience. With a substantial reform in 2015 (Schwartzstein et al., 2013), the MCAT shed its previous final exam-like quality and shifted to a format that emphasizes the foundational nature of the natural and behavioral sciences to the practice of human medicine. The seven-hour multiple-choice exam measures knowledge of the natural and behavioral sciences and assesses problem solving and critical reasoning skills. With the 2015 update, the AAMC introduced a variety of free and low-cost test preparation materials, including a comprehensive set of online tutorial videos produced in partnership with the Khan Academy, low-cost question packs, flashcards, and practice tests. While these AAMC resources are key to providing access to quality test prep for all applicants, many students nevertheless are compelled to invest in expensive commercial test preparation services, leaving low-income students vulnerable. From the authors' vantage, it appears that formal undergraduate institutional MCAT support is uneven and largely dependent upon the institution's philosophy. Does the institution consider pre-professional education core to its mission or does it prioritize intellectual development over "teaching to the test"?

With the mean MCAT score of an MD program matriculant at the eighty-third percentile (511.2) (*FACTS: Applicants, Matriculants, Enrollment, Graduates, MD-PhD, and Residency Applicants Data*, 2018) and sixtieth percentile (503.8) for a DO program matriculant (*AACOMAS Applicant and Matriculant Profile Summary Report*, 2018), students are aware of the high-stakes nature of the exam. The worry about outscoring the majority of other test takers contributes to the tendency for students to adopt a competitive mindset when it comes to learning and preparing for the exam (Lin et al., 2014). In the authors' view, the MCAT is an exam best taken once and after the student has completed the entirety of the premedical coursework. Students who take the exam before they are ready with the idea that they will sit for multiple times, find themselves on a continual loop of exam preparation which takes away from the effort that they could be devoting to other worthwhile experiential and educational opportunities. Within the framework of this high-stakes competition, those who advise and teach undergraduates must work to ensure that premedical students have a learning experience that is not solely focused on completing an academic checklist based on prerequisites and the MCAT, but one that sparks fascination and fosters life-long learning.

EXPERIENCES IN HEALTHCARE AND SERVICE

While the focus on achieving superior academic metrics captures the attention of most premedical students, equal attention must be paid to developing the personal qualities and experiences that will form the fabric of their future bedside manner. Strong GPAs and MCAT scores will often grant an applicant a review, but without meaningful exposure to the health care setting and related service-oriented experience, students have little chance of landing an in-person interview. These non-academic factors grow in importance as admissions committees move toward a final decision post interview (Dunleavy, Sondheimer, Castillo-Page, & Beer Bletzinger, 2011). It is now commonplace for premedical students to have spent hundreds of hours volunteering in clinical environments, nursing homes, hospice centers, or similar contexts during their undergraduate years (*Applying to Medical School: 2018 AMCAS Medical School Applications by the Numbers*, 2019). In addition to providing evidence to medical schools of an

applicant's capacity to become a humane (and not just technically competent) physician, the interaction with patients helps premedical students find their decision to pursue a career in medicine on a realistic understanding of what this career can entail. Beyond patient interaction, medical schools also place enormous emphasis on the value of volunteer work of all kinds. This emphasis comes from the philosophical position that medicine is a service profession, and thus substantive involvement in some volunteer service in local, national, or international contexts is indicative of an applicant's ability to thrive in medical service.

Often, access to shadowing opportunities and high-profile internships favors students with the social capital to arrange for these opportunities. A student who is the first in their family to attend college, for example, cannot rely on a well-connected family member to offer her easy entry into a clinic or hospital. Premedical students who are underrepresented-in-medicine cite that difficulties connecting to a physician mentor was a contributing factor to their decision to leave the premedical track (Freeman et al., 2016). To address this disparity in access with an aim to promote diversity in the future physician workforce, several innovative partnerships between medical schools and undergraduate institutions have been developed. In 2001 at the University of Michigan, the Health Science Scholars Program (HSSP) was launched to connect low-income and first-generation college students to structured clinical observation and mentorship by health professionals in the setting of a first-year living-learning community (Morgan, Haggins, Lyson, & Ross, 2016). Dr. Helen K. Morgan, a clinical associate professor of obstetrics and gynecology at the University of Michigan and former faculty director of HSSP puts forth that medical schools have a responsibility to support premedical education in such direct ways. Morgan states (2016), "leaders in academic medicine should be involved in 'matching' underprepared, underrepresented students with concrete college experiences that promote their success. The HSSP is one example of how developing innovative collaborations can help to nurture and sustain interest in these promising students."

There is little doubt that learning communities providing formalized access to opportunities such as shadowing and courses designed to develop a deep understanding of healthcare help the students in profoundly valuable ways. The question remains, however, as to whether such programs can contain enough students to provide sufficient opportunity to address the current inequities of access to resources at a scale that matches the need. The resources, typically in the form of low faculty/staff to student ratios and specialized courses that such programs provide typically come at a high cost and therefore the programs serve only a small subset of the students who would benefit. For example, HSSP enrolls 120 students each year, while the entering class at the University of Michigan regularly includes approximately 6000 students. Among these students, about 2000 declare some interest in a healthcare career. Advisors who work with students who are part of the general population (rather than those in small learning communities) engage in a different strategy, one that requires the collaboration of medical school admissions personnel. Specifically, those students who do not have access to formal exploratory opportunities are forced to find such experiences on their own and in the process develop the reflective practice that allows them to learn well from the work they are doing. For example, advisors commonly spend a great deal of time helping students see the connection between the experiences they develop in activities ranging from research, to tutoring, to tending bar at home to help pay for school to the competencies expected by medical school admissions committees. By the same token, advisors are frequently a medium for conveying explanatory context about the idiosyncrasies of the institution's sprawling curricula and programs to the medical schools frequently targeted for application by their students.

A specific instance of this kind of work has to do with the opportunities offered by third party commercial organizations who look to profit from zeal found in the large populations of premedical students

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at public schools. It is not uncommon to encounter a premedical student who is eager to demonstrate his or her capacity to engage in hands-on medical care under the mistaken notion that admissions committees will be impressed by their capacity to diagnose, assist with surgery, or otherwise practice medicine with no official training. Such opportunities are thankfully rare in the United States, but for a hefty fee, some less-than-reputable medical “voluntourism” junkets will provide students the ability to act as a health care provider under local supervision in a short-term “medical mission” trip abroad. On the surface, these trips appear laudable for providing students a mechanism to learn about the challenges of healthcare delivery in a developing country, but they create a situation that has the potential to put patients at real risk for harm. Reports of undergraduates engaging in activities that would never be allowed stateside (e.g., extracting teeth and performing physical examinations) led the AAMC to develop guidelines for students participating in medical experiences abroad (*Guidelines for Premedical and Medical Students Providing Patient Care During Clinical Experiences Abroad*, 2011). This statement emphasizes the importance of ethical decision-making concerning the welfare of the patient and provide cautionary statement about the risks to the applicant when ethics aren’t foremost. Premedical advisors commonly take responsibility for conveying this information to student organizations that focus on work abroad, usually in the form of direct outreach.

EXPERIENCES IN RESEARCH

Premedical students generally articulate their motivation to pursue a career in medicine as stemming from a desire for a career that combines helping others and doing science (Pacifici & Thomson, 2011). However, much of their premedical science coursework centers on learning and applying long-established scientific principles that do not afford them the opportunity to actually engage in the scientific methods of research. Only through authentic research experiences can students truly practice the art of scientific inquiry and work to create a new understanding of natural phenomena. Scientific inquiry is among the fifteen core competencies for entering medical students, as outlined by the AAMC, and it is identified as a key experience leading to the development of the thinking and reasoning skills of the applicant. Medical school admissions committees, and particularly those affiliated with research universities, value substantial hypothesis-driven research experience as an indicator that the applicant is adept at the type of analytical thinking that will promote innovation in medical science and practice. A perusal of the Medical School Admission Requirements publication of the AAMC finds that all medical schools report that a vast majority of their matriculating students had research experience in the premedical period with an average of over 1,200 hours reported (*Applying to Medical School: 2018 AMCAS Medical School Applications by the Numbers*, 2019). In this context, nearly all premedical students will seek to engage in a faculty-mentored research experience either at their home institution or through short-term summer research fellowships in external academic or industrial settings.

For students aiming for a career as a physician-scholar via the highly competitive MD-PhD dual degree pathway, research experiences dominate the undergraduate years. Although the majority of MD-PhD programs are intended to support those pursuing careers in translational biomedical research, MD-PhD training has grown to encompass academic inquiry from across the natural sciences, social sciences, and humanities. Regardless of their intended academic focus, undergraduates pursuing an academic path need a strong, intrinsic motivation for research and demonstrated independence, creativity, and productivity in the research setting.

APPLICATION TIMING AND GAP YEARS

Depending on the institution's ability to provide dedicated premedical advisors on staff or faculty, applicants can benefit from expert guidance through the medical school application process. Such advisors provide a wealth of knowledge about navigating the primary and secondary applications, assist students in crafting a target medical school list appropriate for their philosophy and goals, and provide critical feedback about essays and written material. For underrepresented students and those with little social capital in the professional community in particular, such guidance is critical to their success.

Considering the present landscape, there are about 180 medical degree programs in the United States with thirty-five of these leading to the osteopathic degree (DO) and the remainder leading to the allopathic degree (MD). The authors have observed strong interest in both degree paths among their institution's premedical population.⁴ Applications to both MD and DO programs are robust, with nearly 7,000 applications to DO programs annually with the top feeder institutions being the University of Florida, Michigan State University, and the University of California-Los Angeles (*Data Reports in Osteopathic Medical Education*, 2017). MD programs receive approximately 50,000 applications annually with the top feeder schools being the University of California-Los Angeles, University of Florida, and the University of Michigan (*FACTS: Applicants, Matriculants, Enrollment, Graduates, MD-PhD, and Residency Applicants Data*, 2018).

When is a premedical student ready to apply to medical school? The answer to this question is unique to the individual, and is a measure of an applicant's academic preparedness, maturity, and experience. A generation ago, the premedical student could assume that he or she would apply to medical school early senior year and proceed from college graduation ceremony directly to white coat ceremony. In the present day, the straight-through path is not a given with the median age of a white-coat inductee at twenty-four and thus a few years post-college or after lengthy part-time undergraduate status (*FACTS: Applicants, Matriculants, Enrollment, Graduates, MD-PhD, and Residency Applicants Data*, 2017).

Recent trends at the authors' institution find that about one-third of premedical students who achieve a spot in a medical school do so directly out of undergraduate education, leaving two-thirds who have completed at least one gap year or are planning for a glide year.⁵ A postbaccalaureate gap period is a valuable detour for students with the motivation to expand their knowledge and experience into an area that is complementary to their professional and personal goals. The experiences students pursue in this period range from formal master's degree programs (e.g., MBA, MFA, MPH) to service opportunities (e.g., Peace Corps, City Year) to research experiences and beyond. A gap year experience, chosen thoughtfully and with an understanding of how the opportunity marries the premedical student's overall narrative, can bring unique perspectives and innovations to the practice of medicine.

POSTBACCALAUREATE PROGRAMS

The over two-hundred formal postbaccalaureate programs in the United States deserve consideration given their prominent position in the preparation of substantial numbers of medical school aspirants. These programs were developed over the last four decades to address the needs of two groups of premedical students: the career-changers who developed a late awareness of their desire to pursue a career in medicine; and the academic enhancers who in the face of lackluster performance in medical school prerequisites at the undergraduate level seek a mechanism to improve their academic record. The career-changer

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focused programs are typically administered by undergraduate colleges and provide the late-decider with an efficient route to fulfill all of the medical school prerequisites in twelve to eighteen months of study. In contrast, the academic enhancing-focused programs build upon the prerequisite coursework and challenge the student with up to two years of graduate level coursework in the applied life sciences and often lead to a master's degree. Both categories of programs frequently include personalized advising, professional development opportunities, and application support. Particularly advantageous are programs with linkage agreements to a medical school, which offers assurance that upon successful completion of the program, a student will earn an interview to at least one medical school.

A long-term study of medical practice outcomes of students who completed postbaccalaureate programs of any type prior to medical school matriculation (about 12% of the medical student pool) found that such participants had an increased likelihood of practicing medicine in an underserved area and that participants in career-changing-focused programs had a slight edge in gaining admissions to medical school over those who had completed an academic enhancing program (Andriole & Jeffe, 2011). Both types of programs, and particularly those with formal ties to a medical school, have been implicated as impactful methods to support minority and disadvantaged premedical students of promise (Blakely & Broussard, 2003). Typically these programs are small and selective, with cohorts of twenty to thirty students. Program candidates are evaluated on the basis of the candidate's potential to gain admittance to medical school or other health professional graduate programs and consider the student's overall undergraduate record, commitment to health care, and educationally disadvantaged status. The fees for these programs remain relatively high (into the range of 40K) and arranging financial aid can be a challenge especially for the career-changer programs, which do not lead to a terminal degree.

PREMEDICAL COMMITTEES AND LETTERS OF EVALUATION

In the high-volume and competitive world of medical school admissions, letters of evaluation can play a critical role in helping admissions committee differentiate their applicants. The unique insights that well-crafted letters can provide also support medical schools' efforts to engage in more holistic admission practices. However, the interests of a medical school committee, whose main charge is to admit the best-qualified and diverse applicants, do not align perfectly with the interests of premedical advisors, whose main charge is to support their students.

For the letters to help medical school admission committees discern the personal qualities and attributes among their applicants, they need to be relevant and more evaluative than descriptive. They should focus on information that either would not be otherwise available to the reader or that should help make sense of the information provided. The fact that medical schools insist on requiring multiple letters of evaluation also reinforces the importance of gathering *multiple* perspectives about an applicant.

However, the world of letters of evaluation is rife with unevenness. The guidelines for writing letters of evaluation developed by the AAMC have been a useful tool in clarifying expectations for such documents, while providing critical structure and, ideally consistency in addressing applicants' relevant personal attributes as well as skills and abilities (*Guidelines for Writing a Letter of Evaluation for a Medical School Applicant*, 2019). The fact, however, that these guidelines are optional and that writers may operate within different contexts and mechanisms (e.g., premedical committees, advising offices, commercial services) create great variances both in the process and the end-product.

Admissions committees are challenged to understand this very complex landscape in which letters are generated and place letters in the appropriate context. For example, when it comes to format, they review committee letters, letter packets, and individual letters. Although some medical schools prefer committee letters, not all do. Regardless, applicants must support their application with letters generated via whatever mechanism their primary undergraduate institution or post-baccalaureate program provides. In fact, some undergraduate schools have the resources *and* applicant pools small enough to make committee letters possible, but that is not the reality of larger undergraduate institutions or under-resourced premedical advising offices.

The presence or absence of rankings adopted by certain undergraduate institutions; cryptic code words to express overall support of an applicant; different philosophies around rating scales and even the professional responsibility to ensure that the “right” individuals enter the medical profession (vs. succumbing to the pressure of ensuring a better medical school “placement” rate for their school). Each of these factors can negatively impact how a letter is written and perceived. More examples of unevenness include the internal institutional criteria that an applicant has to meet to be able to avail themselves to the services of their premedical committee; the “gate keeping” role that some premedical committees take on; and different undergraduate schools’ policies around disclosure of disciplinary action in letters of evaluation.

Premedical advisors at institutions with a premedical committee often painfully feel the pull between the time devoted to writing letters versus advising their students. Advisors at large institutions without a premedical committee struggle to educate all their students’ letter writers – especially those external to the school. While they may lament the generic endorsements that may come out of faculty teaching large science introductory courses, they cannot help being sympathetic to their plight of being bombarded with requests (often in a short period of time) or even more basically the fact that they are not receiving any institutional recognition or support for the enormous investment in time and resources to write these letters.

In addition, a changing landscape in the world of employment and graduate school admissions (with increasing reliance on phone references for the former and the required use of centralized application services for the latter) has gradually but inexorably inhibited the ability of university-based reference letter services to continue to handle the files of their students and alumni, forcing them to outsource their operation to external commercial services. This new reality has put even more distance and potential disconnect between the letter writers, the advisors, and the applicants in the absence of a committee or university-based letter service. For example, “unmonitored” delays in submitting letters can have dire effects on the timely review of an applicant’s file. Similarly, with the protection of the waived right to access a letter and the lack of an internal review for the fitness of individual letters, sometimes unsubstantiated or ill-spirited comments can greatly hinder an applicant’s viability. Moreover, the disclosure of information around protected categories and unwanted impact of such disclosures presents another tricky area.

In light of the issues stemming from different letters of evaluation mechanisms at various undergraduate institutions and the unique challenges that non-traditional and under-represented applicants may encounter, it is clear that flexibility and context are essential to review letters of evaluation in the appropriate light.

CONCLUSION

Much of this discussion has been grounded by the experience and observations of the authors, who acknowledge and lament the sparse formal research about the premedical years in general. This observation has been made by others calling for the need for “up-to-date, high quality empirical research on the premedical period.” (Lin et al., 2013) The authors can only speculate as to why the premedical period has been largely neglected, but proffer the observation that the mission of liberal arts and sciences institutions are sometimes at odds with the goals of a pre-professional focused education. There is much focus for example, on understanding Science, Technology, Engineering, and Math (STEM) curriculum pathways as routes to STEM careers and professorships, but medicine has decidedly been excluded from the STEM focus (Granovski, 2018). Furthermore, the liberal arts and sciences philosophy calls for faculty to teach to their area of expertise— be it molecular biology or organic chemistry— as content relevant for further disciplinary focus, not as stepping stones to the applied medical school curriculum. In this environment, the premedical student is at risk for marginalization as a student whose career-focused directive is counter to the liberal arts philosophy.

The challenge at hand is to craft a college experience that preserves and cultivates humanism along with both intellectual and experiential diversity among the premedical ranks. In doing so, colleges will prepare applicants who can withstand the rigors of medical training and form the foundations for an effective, empathic, and well-balanced professional career. Likewise, colleges with the help of medical schools need to ensure that students from all backgrounds are invited to consider a career in medicine and are mentored and supported throughout their preparatory years. The success of those premedical years should not be judged solely by a college’s ability to place students into competitive medical programs, but ultimately by the well-being of the medical profession itself and the premedical students’ future patients.

The authors leave the reader with the following considerations:

Will The Goals of the Competency Prerequisite Model Be Met?

The competency model was introduced with the notion that it would free the premedical student from a lock-step credit hour economy and thereby encourage individualized and diverse curricular paths. The model has been slow to be adopted by the majority of medical schools. Given that the average student applies to over a dozen medical schools, unless the majority of medical schools adopt the competency model, the student still is bound to complete the standard credit hours of premedical science and math coursework. Undergraduate institutions are unsure how, or even if, to respond to the competency model in their curricular planning. What is the future for the competency model? Furthermore, should the majority of schools eventually adopt it, will the MCAT ascend as the primary academic metric by which knowledge of the premedical content is judged?

Is There a Downside to The Rise in the Average Age of a Medical School Matriculant?

With the average age of an incoming medical student approaching twenty-five in the United States, many future physicians are facing a training period that will extend well into their thirties. The anticipated effects of a lengthy premedical period can be heard in the anxieties expressed by undergraduates imagining their future. Potentially delaying a medical school application by even a year or two brings forth ques-

tions fundamental to the structuring of an adult life (e.g., *When can I have a child? When will I earn a real salary?*) and points to the personal sacrifice inherent to the arduous medical training process. While applicants with gap year experiences bring perspective and maturity to a medical school class, what is the personal cost to our future physician workforce when taking a gap year (or two) becomes the rule?

What is The Role of Physician Shadowing in Preparation for Medical School?

It has become increasingly difficult for undergraduates to obtain physician shadowing opportunities, a key experience especially for those students not socialized to a career in medicine. Those who do get substantive shadowing hours as undergraduates are typically either related to physicians or otherwise involved in a privileged relationship with someone in a clinical profession. Less well-connected applicants are faced with increasingly dense barriers to shadowing formed by references to HIPAA regulations and ignored requests. In the authors' experience, medical school representatives also seem to be less emphatic about the value of shadowing, citing its passive nature. Is shadowing experience valued by admissions committees and if so, how are barriers to finding it best addressed and by whom?

What is the Future for the Letter of Evaluation in the Application Process?

This report has described the inequities inherent to the current state of play embodied by letters of evaluation. Committee letters are common among private schools, where premedical programs provide a reliable process and an equally reliable product, but perhaps reproduce the privilege that feeds such institutions. Applicants from schools without premedical committees have a much harder time finding faculty evaluators who can and will write substantive letters. A tremendous amount of faculty time and effort is devoted to writing letters of evaluation, a task for which few are properly recognized. Consider the science professor tapped to produce letters by dozens of medical school applicants year after year; how can he or she not tire of a ritual that arguably provides little distinguishing insight into the non-academic characteristics of the applicant? The authors ask for clarity from medical school admissions committees about what information they most value from these recommendations and ask furthermore if letters are ultimately the most efficient vehicle to deliver that information. Are there alternatives? Perhaps the situational judgement tests (e.g., CASPer®) now part of several medical school evaluation processes, will fulfill their promise to provide a robust and objective characterization of an applicant's personal strengths. Eventually, will letters of evaluation and committee evaluations decrease in prominence for these more objective tools?

Are Relationships Between Premedical Advisors and Medical School Admissions Personnel as Effective as they Should Be?

The faculty and staff who teach and advise premedical students are uniquely positioned to encourage undergraduates of promise to seek a career in medicine and as such should be considered partners in the medical education process. In the authors' view, strong professional relationships with medical school admissions personnel are vital to their ability to effectively support students throughout the premedical education period. An open, regular exchange between admissions directors and premedical advisors about all matters that shape the applicant pool would help to identify areas for collaboration to promote

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a shared interest in supporting a more diverse applicant pool. Key areas of focus for such exchanges might include:

- Many medical schools are extraordinarily generous with information about and access to their program's mission, curriculum, and admissions procedures. This is immensely helpful to advisors. More formalized opportunities for advisors from the undergraduate institutions (e.g., those that provide high numbers of applicants for a given school) to return the favor by providing information about the educational and socioeconomic dynamics in the undergraduate school to medical school admissions personnel might provide similar benefits.
- More specifically, case studies, demographic data, and discussions of curricular particularities from the undergraduate institution might provide a foundation for more nuanced decisions involving students from disadvantaged backgrounds, with possible benefits for the effort to diversify the population entering medical school.
- Much of an advisor's ability to help a student negotiate the most challenging decisions about medical school preparation is based on accumulated anecdotal information: When is additional, costly record enhancing post-baccalaureate work a reasonable option? What constitutes a viable MCAT score in the context of holistic review? What criteria do medical schools think applicants should use when compiling a list of target schools?

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ENDNOTES

- ¹ The University of Michigan is a large, research-focused public institution with a total undergraduate population of about 30,000.
- ² Data not shown. S. Chervin.
- ³ Competency-based models have been adopted by University of California, Los Angeles David Geffen School of Medicine in 2018; University of Michigan Medical School in 2017, and Albert Einstein College of Medicine in 2014, among others.
- ⁴ In a given application cycle about 1,200 students from the University of Michigan will apply to MD and DO programs combined, with about 800 applying to MD programs and 300 applying to DO programs and a portion of these students applying to both.
- ⁵ Glide year vs. gap year: The timing of the application dictates that the application is submitted a full year prior to medical school matriculation. For an applicant who submits the summer immediately following college graduation, the *glide year* describes the year spent between college graduation and medical school matriculation. For the applicant who engages in a year-long experience prior to making an application, the term *gap year* applies. The gap year experience often features prominently in the application and for these applicants, actually a period of two years passes between college graduation and medical school matriculation.