

Time-variable medical education innovation in context

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Background: Medical education is undergoing robust curricular reform with several innovative models emerging. In this study, we examined current trends in 3-year Doctor of Medicine (MD) education and place these programs in context.

Methods: A survey was conducted among Deans of U.S. allopathic medical schools using structured phone interview regarding current availability of a 3-year MD pathway, and/or other variations in curricular innovation, within their institution. Those with 3-year programs answered additional questions.

Results: Data from 107 institutions were obtained (75% survey response rate). The most common variation in length of medical education today is the accelerated 3-year pathway. Since 2010, 9 medical schools have introduced parallel 3-year MD programs and another 4 are actively developing such programs. However, the total number of students in 3-year MD tracks remains small (n=199 students, or 0.2% total medical students). Family medicine and general internal medicine are the most common residency programs selected. Benefits of 3-year MD programs generally include reduction in student debt, stability of guaranteed residency positions, and potential for increasing physician numbers in rural/underserved areas. Drawbacks include concern about fatigue/burnout, difficulty in providing guaranteed residency positions, and additional expense in teaching 2 parallel curricula. Four vignettes of alternative innovative and relevant curricular initiatives are also presented in order to place 3-year MD programs in a broader context of medical education reform in the U.S.

Conclusion: Three-year MD pathways are the most common accelerated alternative available at a small number of medical schools for highly selected students. Long-term evaluation of these programs will be essential to determine if these programs are meeting their goals (e.g., increasing the number of physicians in rural/underserved areas). Benefits and shortcomings of such programs should be carefully examined when considering this approach, or others described, as part of MD curricular options designed to individualize medical education.

Keywords: pedagogy, curriculum, 3-year MD, medical students, medical school, reform

Introduction

Medical education is undergoing an unprecedented period of innovation. Inventive new curricula and pilot projects are being introduced in almost every medical school, including movement toward competency-based curricula.¹⁻³ In most medical schools, there is now integration of basic science and clinical experience across all 4 years.^{4,5} Incorporation of contemporary topics (e.g., health care delivery science, clinical informatics, business and management principles, public health, health policy, patient-centered and team-based care, big data) are also becoming more common, which are

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designed to prepare physicians for a future where patient outcomes will be measured in increasingly sophisticated ways and over longer periods of time. In addition, traditional lectures are on the decline given that factual material is now expected to be mastered outside of class so that classroom time can be reserved for discussion, small group and/or problem-based learning, and case presentations.

Historical context of 3-year and other accelerated medical education programs in the U.S.

As part of this wave of innovation, several medical schools have recently developed options for parallel 3-year Doctor of Medicine (MD) curricula. It is important to note that since publication of the Flexner Report in 1910, configuration of U.S. medical school curricula (2 years of medical science education [post-university] followed by 2 years of clinical learning) remained largely unchanged until the last decade. Having said this, the concept of accelerated 3-year medical education is not new. With recurring issues of physician shortages and increasing student debt, 3-year MD curricula have been explored as a possible solution to these challenges dating all the way back to the 1940s.⁶ Indeed, there have been 3 distinct periods of increasing interest in accelerated medical education; WWII (1939–1945), the 1970s, and within the last decade. During the WWII era, 3-year programs were initiated as an innovative approach to address physician shortages both abroad and at home however, these programs waned with the decreasing need for physicians after the war. The number of 3-year medical school programs increased again in the 1970s with 33 medical schools (almost one-third of all U.S. medical schools at that time) offering 3-year MD pathways for approximately 2,600 medical students.^{7,8} However, by the end of the 1970s, the proportion of medical schools offering 3-year curricula decreased from 27% to 6%.⁹ A recent 2014 survey showed resurgence of interest in accelerated 3-year programs,¹⁰ with now 9 schools having such programs. In 2017, Cangiarella et al described how 8 U.S. and Canadian medical schools with parallel 3-year curricula formed a Consortium of Accelerated Medical Pathway Programs to share ideas.¹¹

Other accelerated pathways to the MD degree such as combined Bachelor of Arts (BA)/MD are also not a new phenomenon, with first attempts dating back to the 1950s.¹² In the early 1960s, 2 medical schools matriculated 60 medical students into accelerated 6-year BA/MD programs.¹³ By 1976, this had grown to 11 medical schools with approximately 400 students.¹³ By 1991, 28 medical schools had formal accelerated BA/MD pathways accounting for approximately 900

students.¹⁴ Interestingly, the number of medical schools offering accelerated BA/MD programs decreased between 1990 and 2011, with 7-year formal BA/MD programs decreasing from 32% to 13% and 6-year BA/MD programs decreasing from 23% to 7%.¹² A 2011 survey identified 81 accelerated BA/MD programs for highly selected students.¹⁵

Recent time-variable medical education programs

Re-emergence of 3-year MD programs began in 2010. Given recent burgeoning interest, in 2015 Raymond et al suggested it was time for an evidenced-based discussion of accelerated medical programs.¹⁶ He pointed out that 3-year versus 4-year medical training in and of itself may be a misnomer since the U.S. Liaison Committee on Medical Education (LCME) requires 130 weeks of curriculum without mandating a time frame; consequently 3-year schools often meet this requirement by including summers and restricting time for residency interviews and vacations.

Current study

The purpose of this study was to establish the current extent of 3-year programs in the U.S. and to place these programs in a broader context of overall medical education curricular reform. In order to confirm previous reports, as well as extending new information, we completed a set of one-on-one structured phone interviews with the majority of allopathic medical school Deans in order to determine the overall number of medical schools currently offering 3-year programs (or other variations on length of medical education), number of students in each program, and outcome measures being used to determine success. In addition, we explored reasons given for offering (or not) such a 3-year program and what other innovative pathways to graduation might exist. Our results provide both a current snapshot and broad perspective on time-variable MD pathways and place them in context of other curricular innovations in the U.S. today. We defined characteristics of such programs, as well as pros and cons as viewed through the eyes of the leaders of today's U.S. allopathic medical schools.

Methods

In February 2017, Deans from all U.S.-based allopathic medical schools were invited to participate in a phone interview designed to obtain the Dean's perspective on accelerated medical education and explore a variety of elements of medical schools with a 3-year MD program. The University of Iowa IRB determined that this survey did not constitute

human subjects research, and so IRB approval was not required. Contact information for the Deans was obtained from the Association of American Medical Colleges (AAMC) Council of Deans directory. Between March and July 2017, structured phone interviews were conducted one-on-one with each Dean (or Dean designated delegate in 7 cases) by the senior author (DAS) and their answers were documented on the survey form. Phone interviews were conducted to allow for consistent definitions and for rapid follow-up to responses. Each Dean or Dean's delegate completed the entire survey to the best of her or his ability. If an interviewee was not able to answer a question, follow-up was completed by an appropriate person in their respective office by phone or email. Each completed survey form was scanned and data were entered into a spreadsheet. In July 2017, Deans who had not responded were contacted a second time and invited to participate. Interviews were halted at the end of July and medical schools not responding were excluded from any further analysis.

We initially asked "Does your medical school offer a shortened track to graduation? If so, what does it look like?" While focusing predominantly on 3-year MD programs, starting with these questions allowed us to identify other configurations for accelerated undergraduate/MD potential pathways. We asked the Deans of medical schools that did not have an accelerated track to graduation to describe their institution's decision to focus on a 4-year curriculum or other configurations. For the medical schools with a 3-year parallel curriculum currently in place, we explored specific elements in order to characterize the structure of these programs.

Specific elements included goals of the program, financial implications, mechanism for residency matching and medical sub-specialties involved, student debt, student and institution satisfaction, and future plans. Data on Bachelor of Science (BS)/MD potential pathways were confirmed using the Medical School Admissions Requirements online database and verified again on the respective medical schools' website.¹⁷ Open-ended questions were grouped categorically and the relative frequencies of responses were calculated.

Results

General overview and 3-year medical program summary

A total of 107 U.S. Deans responded to the survey invitation (see Supplementary material for a list of responding medical schools), 95 upon first request and 12 upon second request, with an overall survey response rate of 75% (107/143). Confirming previous studies,^{10,11,16} and adding new schools, 9 schools identified as having a 3-year MD pathway program currently. Table 1 provides an overview of these schools and the year they began accepting their first class of 3-year students (as early as 2010). Many outcome elements were excluded from analysis as students had not yet graduated from medical school and/or residency, and so most of these 3-year MD programs have not yet generated the requested data or metrics. Of the schools without a 3-year program, a total of 38.8% (38/98) stated they were leaving this option as a possibility for the future. Of these 38 schools, 76% (29/38) were open to the idea but not seriously considering,

Table 1 Overview of 3-year MD programs as of 2016–2017 academic year

U.S. Medical School	Year program began	Total # students in program ^a	% Students at medical school	When students begin program	Regional campus	Residency position offered?
Duke University	2014	2	0.4%	End of 2nd year	No	Yes
Medical College of Wisconsin	2015	56	6.1%	Upon admission	Yes	No ^b
Mercer University	2012	16	3.6%	End of 1st year	Yes	Yes
New York University	2013	50	7.7%	Upon admission, can opt in until 2nd year	No	Yes
Pennsylvania State University	2015	16	2.7%	Spring of 1st year	Yes	Yes
Texas Tech University	2010	36	8.9%	End of 1st year	Yes	Yes
University of California, Davis	2014	18	4.0%	8 weeks prior to traditional start	Yes	Yes
University of Louisville	2011	2	0.3%	End of 1st year	Yes	Yes
University of North Carolina, Chapel Hill	2016	3	0.4%	End of 1st year	Yes	Yes

Notes: This table not only confirms and updates current literature (gray columns),¹¹ it provides new and additional updated information including 2 new schools (Duke and University of North Carolina), total number and % of students, and presence of regional campus (white columns). ^an=199 total students in U.S. enrolled in 3-year MD programs (Note: Student numbers for each school were extrapolated from the survey. The percentage for each school was calculated by dividing the students in the program by the total enrollment of the respective school.) ^bThe Medical College of Wisconsin is in the process of creating regional residency programs for all students; currently psychiatry, family medicine, and rural general surgery residencies are offered.

13% (5/38) were seriously considering, and 11% (4/38) were actively pursuing developing and/or implementing such accelerated MD programs. Interestingly, a minority of students at institutions offering a 3-year MD pathway elect this option. As seen in Table 1, 199 total medical students participate in 3-year MD programs, with total numbers ranging from 2 to 56 students per program. This represents 3.7% (199/5,374)¹⁷ of total students in the medical schools with a 3-year program, or for broader context, 0.2% (199/88,304) of all allopathic medical students in the U.S.

Curricular details of 3-year MD programs have been presented elsewhere¹¹ and so are not reviewed here. In terms of overall structural elements, however, time of entry into the 3-year program varies among schools, ranging from 8 weeks before traditional MD start through the end of the 2nd year of medical school (see Table 1 for details). Of note, 7 of 9 schools utilize a regional campus as nidus for their 3-year programs. One of their stated rationales was that completing medical school and residency in an underserved location, particularly if students originate from that community and have completed both medical school and residency training locally, should entice these new physicians to stay and practice in their “home” community.

Little time is built into most 3-year MD curricula for residency interviews and 8 of 9 schools offer guaranteed residency positions for all 3-year students; the 9th school is currently developing new regional residency programs

for this purpose. Figure 1 shows the number of residency programs offered as of July 2017 by 3-year MD programs. Family medicine and general internal medicine are the most frequent residency programs chosen by 3-year students. This is followed by obstetrics/gynecology, pediatrics, general surgery, psychiatry, orthopedic surgery, and other specialties.

Other alternative accelerated medical education pathways

In addition to 3-year MD curricula, various other configurations of accelerated pathways to completion of medical school also exist today. One of these programs is entitled “Education in Pediatrics Across the Continuum” (EPAC). This competency-based program, recently described in an AAMC newsletter,¹⁹ involves 4 medical schools (University of California at San Francisco, University of Colorado, University of Minnesota, and University of Utah [note the University of Maryland started such a program and then withdrew from EPAC]). While each program has a slightly different “flavor”, EPAC essentially enables students who know they want to be pediatricians early in medical school to focus on pediatric aspects of core clerkships (e.g., pediatric surgery during their surgery core clerkship or pediatric neurology) and then begin their pediatric residency after 3.5 years of medical school (January of medical school year 4, although the University of Minnesota has achieved even more flexibility in its start of residency date).

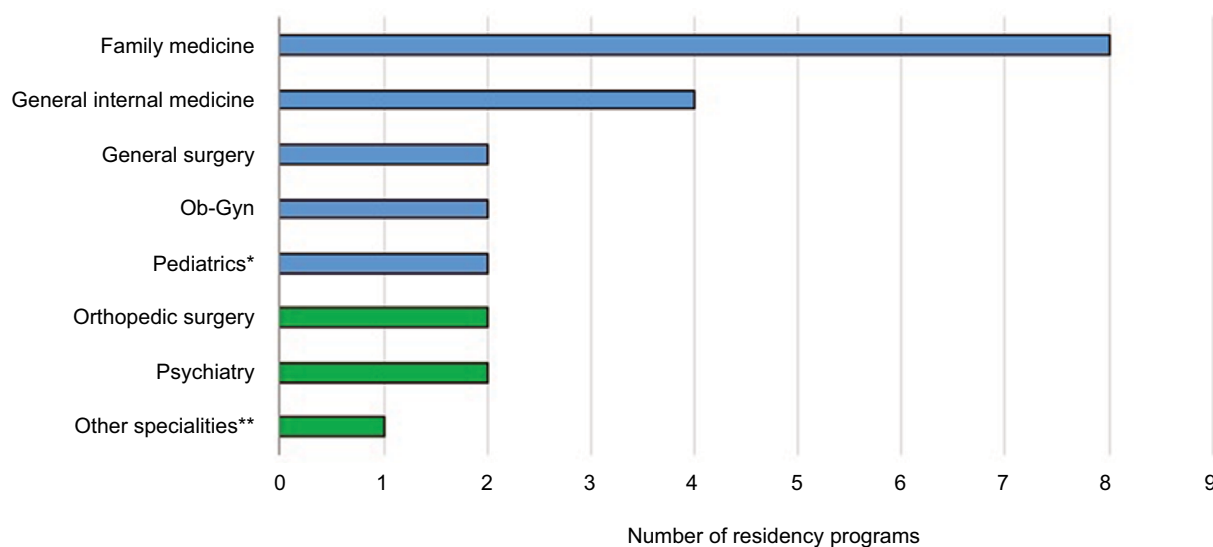


Figure 1 Number of residency programs offered to 3-year MD program graduates.

Notes: *There are 4 additional medical schools (University of California at San Francisco, University of Colorado at Denver, University of Minnesota, and University of Utah) that participate in EPAC as another form of accelerated MD/residency programs for pediatrics (see text). **Other residency specialties offered by 3-year MD programs include the following: anesthesiology, dermatology, emergency medicine, neurology, neurosurgery, ophthalmology, otolaryngology, pathology, physical medicine and rehabilitation, plastic surgery, podiatry, radiation oncology, radiology (diagnostic and interventional), thoracic surgery, urology, and vascular surgery.^{18,19}

Abbreviation: EPAC, Education in Pediatrics Across the Continuum; Ob-Gyn, Obstetrics and Gynecology.

Another method of decreasing the overall years required for medical education is to shorten the Bachelor's degree (e.g., BA, BS) years. As shown in Figure 2, many schools ($n=36/107$) matriculate selected students after 3 years of undergraduate education (3+4: undergraduate + medical school) for total of 7 years of post-secondary education. Additional 4 ($n=4/107$) medical schools offer an integrated 6-year (2+4) BA/MD program; one of these is described in more detail in the following vignette section.

Decelerated medical education pathways

Decelerated medical education can be defined as medical education that lasts longer than the traditional 4 years. Many medical schools, particularly those associated with research intensive academic medical centers, offer an additional year (or more) of research training. This can take the form of supervised laboratory or clinical/translational research, or master's (or other terminal) degree programs (e.g., MD/Master of Public Health, MD/Master of Science, MD/Doctor of Jurisprudence, MD/Master of Business Administration). The most codified combined program is the MD/

PhD (often in the form of a NIH-funded Medical Scientist Training Program). However, what may be more novel from a pedagogical perspective is a decelerated medical education curriculum without additional research or combined degrees. Such programs enable a new type of student (e.g., those who remain active in the military and/or who need to work in order to afford medical school even with scholarship support) to complete medical school part-time over longer than 4 years. One such program, which lasts 6 years, will begin taking students starting in 2018; this program is described in the following vignette section.

Benefits and drawbacks of 3-year MD programs

Medical Deans were asked to list reasons they believe 3-year MD programs have benefits or drawbacks. Table 2 summarizes general categories of comments elicited from these leaders. Major benefits include reduction in student debt (primarily by entering the workforce 1 year early), guaranteed residency positions for selected students (e.g., keeping students in region/state for residency), and the potential of

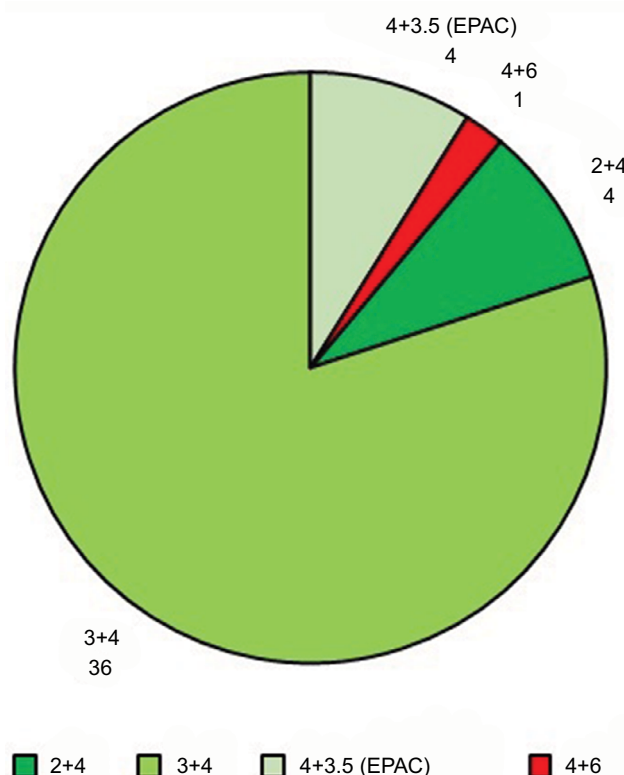


Figure 2 Alternative accelerated and decelerated medical education programs by medical school.*

Notes: *Numbers shown represent years for undergraduate degree + MD degree. Two medical schools have both 2+4 and 3+4 programs and are counted twice. Medical schools with multiple 3+4 programs were only counted once.

Abbreviation: EPAC, Education in Pediatrics Across the Continuum.

Table 2 Benefits and drawbacks of 3-year medical school curricula and programs cited by medical school Deans*

Student benefits		Student drawback	
5.4%	Alternative pathway facilitating additional academic training (e.g., physician-scientist research, dual degrees, etc.)	8.6%	Student burnout and fatigue
11.8%	Guaranteed residency provided for 3-year medical students	4.3%	Decreased vacation time
20.4%	Reduction of medical school debt (mainly due to entering workforce 1 year earlier)	2.2%	Missed curricular opportunities (focus solely on clinical medicine, no dual degree options)
		10.8%	Perceived lack of maturity or readiness (less competitive) for residency versus 4-year students
Institutional benefits		Institutional drawbacks	
4.3%	Facilitates partnerships with residency programs and enhanced public relations in region/state	4.3%	Guaranteed residency positions needed (must be arranged and sustained)
14.0%	Potential to increase MDs in rural/underserved areas of state	3.2%	Faculty burnout and fatigue
3.2%	Pathway may leave room for enhanced academic training of students	7.5%	Substantial initial development costs and ongoing expense

Note: *Percentages represent relative frequencies of comments cited by Deans surveyed.

increasing physician numbers in rural or underserved areas and/or underserved specialties (e.g., psychiatry or family/rural medicine).

In parallel, major drawbacks, according to the Deans, include concerns about student fatigue/burnout (similar number of hours of training over a shorter time period without many breaks), additional institutional expense involved in teaching 2 parallel curricula, and the need to provide guaranteed residency positions for all 3-year track students. In general, most Deans are concerned that more needs to be taught to medical students today than clinical medicine as historically defined. Topics such as team-base care experience/skills, leadership, nutrition, health-care delivery science, population health, business and management, clinical informatics, quality and safety science, public health, clinical genetics, and self-care were mentioned as additional topics believed important for 21st century physicians; a majority of leaders believe delivering this material, in addition to training strong clinical physicians, requires 4 full years of medical school. Finally, ongoing current major curricular reform is a practical current reality that precludes many schools from being able to consider additional novel programs for the next

3–5 years. Figure 3 summarizes in more detail the reasons many medical schools have chosen to have a 4-year course.

Innovative vignettes

During our structured interviews, many new curricular initiatives were discovered related to the length and content of medical education. Four innovative vignettes are presented below as examples.

Vignette 1 – specialized 4th year medical school training for students choosing family medicine (University of Washington)

The University of Washington (UW) in Seattle has a long history of an outstanding (and top-rated) Department of Family Medicine. Students who wish to practice in remote areas are trained in numerous settings across 5 states (Washington, Wyoming, Alaska, Montana, Idaho [WWAMI]) for both medical school and residency. Recognizing that many locations within the WWAMI region can become isolated for days to weeks due to bad weather, interfering with the

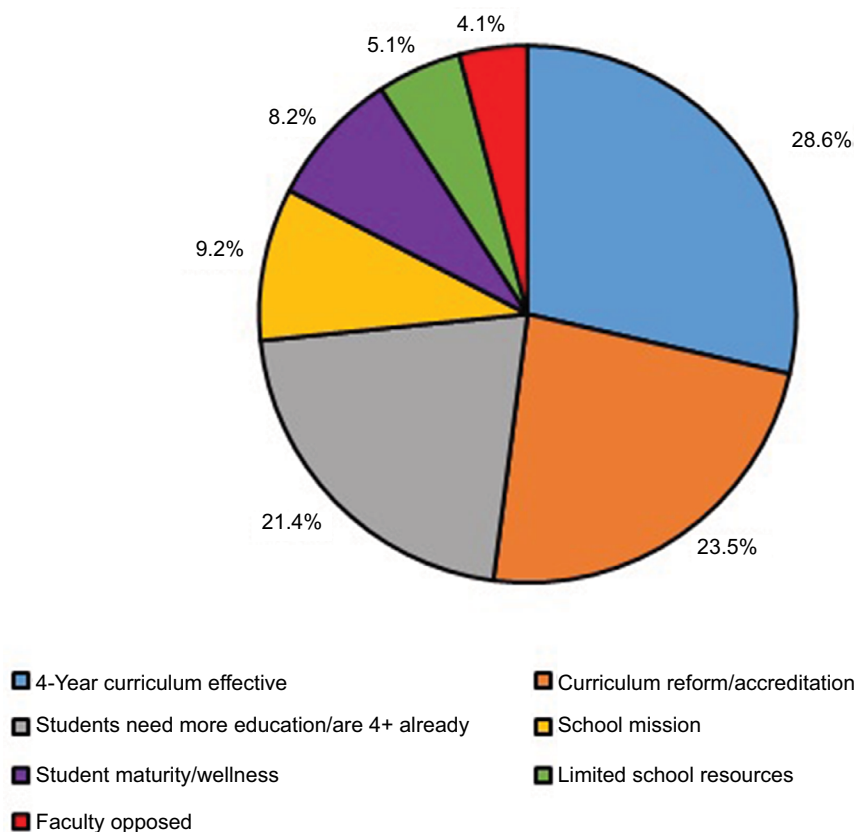


Figure 3 Reason given by Deans for their medical schools focusing on 4-year curriculum.

ability to transport patients to larger medical centers, it is important that physicians in these remote regions be able to treat critically ill patients for extended periods of time. To accommodate this need, the UW School of Medicine provides the option of intensive 4th year “Advanced Clerkships” at Harborview Medical Center (regional trauma center) in the emergency room and intensive care unit(s) for students planning on rural practice; this is particularly helpful since such intensive training is less available in residency programs affiliated with smaller hospitals across the region. Essentially, rather than shortening medical school for students entering specialties like family medicine, a more intense 4th year has been planned in order to prepare students to ultimately practice family medicine in the WWAMI region as the most senior medical care provider in large rural areas.

Vignette 2 – regional campus for 3-year MD program to meet state need for physicians (Medical College of Wisconsin)

The Medical College of Wisconsin (MCW), based in Milwaukee, is a private medical school committed to serving the entire state of Wisconsin. As part of that mission, MCW created two regional campuses dedicated to educating students who will practice in underserved and rural areas of Wisconsin. MCW has developed one of the largest parallel 3-year medical school programs in the country located on these two campuses; one centered around the community of Green Bay in northeast Wisconsin and another around the community of Wausau in central Wisconsin. Nearly all of the students admitted to these campuses are Wisconsin residents with clear ties to the region including many who have attended secondary and university education in close proximity to the campuses. Integral in these regional campuses has been the simultaneous creation of residency programs to support the next phase of medical education for these students in these regions, which are medically underserved. MCW has worked closely with regional hospitals and health systems to start 2 new psychiatry residencies (since this is the most underserved specialty in the state and local region), worked with local family medicine residencies, and also has a track for rural surgical residency training. The overall goal of these regional campuses is to ultimately enrich the number of physicians practicing in currently underserved northern Wisconsin.

Vignette 3 – decelerated 6-year medical school (Florida International University)

The Florida International Wertheim College of Medicine is launching a new parallel medical education program in

2018 designed to spread the first 2 years of pre-clinical (science) medical education over 4 years, while retaining the traditional 2 years of clinical education. This decelerated approach allows students to work while taking pre-clinical medical school courses, ultimately facilitating entry of more non-traditional students into medicine. Florida International University believes this curriculum may also facilitate transition to a competency-based curriculum since students with prior educational experiences may be able to enter the curriculum at various points based on their knowledge level.

Vignette 4 – the British model: 6-year integrated undergraduate and medical school (University of Missouri, Kansas City)

The University of Missouri at Kansas City (UMKC) has a long-standing (45 year) history of a 6-year BA/MD pathway from high school to MD, quite similar to the British model of physician training. During the first 2 years of the program, three-fourths of the student's time is dedicated to the arts and sciences to fulfill baccalaureate degree requirements in liberal arts, chemistry, or biology; other degrees are possible depending on whether the student has college placement credits from high school. While the curriculum is highly integrated across all 6 years, years 3–6 essentially function as a 4-year medical school with some additional classes taken to complete the undergraduate degree. Both BA and MD degrees are awarded upon final graduation. The centerpiece of the program is the docent system (learning communities) where a physician (the docent) mentors a group of 12 students arranged into 6 junior and senior student pairings over 4 years. As described by Drees et al, scores of the graduates of the UMKC program are compared favorably with national averages for United States Medical Licensing Exam (USMLE) board scores and residency match rates; in addition, 45% of the students practice long-term in Missouri or in adjacent counties in Kansas and Illinois.²⁰ Also, Arnold et al recently reported that the docent system was one important factor identified by a large number of highly successful graduates as key to their development as leaders in patient care, research, education, government, military, and organized medicine.²¹

Discussion

Overview of current accelerated 3-year MD programs

Of the 9 U.S. medical schools with 3-year programs today, timing of entry, financial support, medical specialty focus, and the residency match process vary widely. There are key

similarities, with 80% of current accelerated 3-year programs having a primary care focus (e.g., students plan on careers in family medicine, general internal medicine, pediatrics, obstetrics-gynecology, etc.).^{11,22} However, some medical schools with 3-year programs allow students to choose from a multitude of specialties. Another similarity is that 70% of schools admit students into the 3-year MD pathway either at matriculation or by the end of the first year.¹¹ Many programs also offer additional financial support to students, most often coming from state appropriations and/or innovation grants.¹¹ In some states, state funding is offered in the form of student scholarships, which would be converted into loans if the student elects to leave the program or chooses a specialty outside of the program's mission. Given the limited time for students to interview for residency programs, the vast majority of current 3-year programs guarantee a local residency position.

Other current accelerated MD programs

Our survey indicates that many medical schools accept rare outstanding students who complete their BA degree in 3 years, although this should be considered distinct from having a specific formalized combined BA/MD program. Recently, some states (and a few private universities) have initiated programs whereby outstanding students can be accepted into medical school upon graduation from high school, often with scholarship support and/or the ability to enter medical school after 3 years of undergraduate training; these programs require the students to keep a specific grade point average in science and non-science courses to continue in the program, and are generally designed to keep high achieving students in state. Such programs, however, should not be confused with integrated BA/MD programs (e.g., see Vignette 4) since the medical education portion of training for these students is largely distinct from undergraduate years.

Analysis of pros and cons of 3-year medical education

One of the frequently mentioned benefits of 3-year medical school is that it decreases student debt. This is an important goal since the AAMC estimates that 75% of medical students have education debt with an average of \$190,694 per student.²³ Entering the work force a year earlier may add 1 year to overall lifetime employment, which can substantially reduce the burden of student debt. However, whether or not a year of medical school tuition is also saved (as is often presumed) depends on the structure of the program, as well

as the individual institution and its policies. As noted by Raymond et al,¹⁶ the LCME requires 130 weeks of curriculum without mandating a time frame. If the 130 hours of training is achieved by starting medical school 8 weeks early (as in one program) and adding summer sessions (as occurs in virtually all current 3-year programs), then cost savings to students depend on how medical tuition is incurred. If each quarter or semester requires distinct payment, then accomplishing 3-years by adding summers and decreasing vacation and residency interview time may not save tuition fees. On the other hand, when medical schools charge by the year, with no extra charge leveraged for the summer term, 3-year students might be able to save on tuition fees. As one considers this issue, it is important to be cognizant that costs of medical education are rising.²⁴ In addition to more faculty required to facilitate small group and problem-based learning in newly revised innovative medical education curricula across the country, distinct parallel 3-year and 4-year coursework often requires additional faculty since courses do not always overlap between programs. Combined, this makes it unlikely that medical schools will be able to offer additional teaching time without appropriately charging for summer tuition. This was mentioned as a specific issue by several Deans. Summarizing, 3-year medical schools accomplish entry into the work force 1 year earlier and this provides cumulative positive financial benefit over time; however, it may not decrease the overall cost of medical education as has been assumed by some.

Another desired benefit of 3-year medical school is the potential for increasing physician numbers in rural or underserved areas and/or underserved specialties. Studies have shown that physicians tend to practice in higher proportions in the state/region where they completed their terminal (residency/fellowship) training.²⁵ A practical reality for 3-year MD programs is that there is very little time for residency interview trips, and competitiveness of 3-year versus 4-year medical graduates in the broader residency match has yet to be determined. Given these realities, virtually all (n=8/9) current 3-year MD programs guarantee residency positions to all students. While sometimes challenging to arrange, guaranteed residency positions often result in students remaining in the region/state for residency training. As the number of medical school graduates increases nationally without parallel increases in graduate medical education positions, competitiveness for residencies has increased, and so having a guaranteed residency can be very positive for students and also eliminates the cost of traveling and interviewing across the country. Indeed, Benson et al, revealed that medical students are nowadays interviewed at approximately

12 residency programs, and the majority of students spend between \$1,000 and \$5,000 for associated travel expenses.²⁶ While guaranteeing local residency positions to 3-year MD graduates will likely enhance physicians practicing in the region/state, one should remember there is no guarantee since physicians are free to practice anywhere in the U.S. A Canadian study suggests that family medicine physicians leave rural areas at a faster rate than more populated areas, although there is compensatory influx of physicians from other regions.²⁷

Some have also suggested that 3-year MD programs will increase the number of physicians available to practice in a given state since it takes less time to train. As pointed out by one Dean during the survey, this is a misnomer. After year 1 of a new 3-year program, when the first group of 3-year MDs graduates at the same time as the traditional 4-year MD class, there is no further “bump” in graduating physician numbers. This is because a steady state is reached immediately the next year when the same number of students graduate every year thereafter unless overall medical school class size is increased.

Another less intuitive positive aspect of 3-year MD programs is enhanced flexibility within the standard 4-year curriculum, a fact that can be used to deepen academic endeavors. For example, the possibility of pairing a 3-year MD pathway with master’s degree programs (e.g., MBA, MPH, MHA, MS) would allow students to pursue additional academic endeavors without increasing the overall time spent in medical school. With curriculum reform, integration of in-depth study in the form of numerous MS degrees makes graduation with MD/MS in 4 years very attractive as an alternative to entering residency 1 year early.

Some of the drawbacks of current 3-year programs are not new and were reasons these programs waned in prior iterations. As already stated, most 3-year MD programs have reduced vacation and residency interview time, and schedule classes through summer sessions, all of which may lead to increased stress and burnout amongst medical students. Indeed, dating back to the 1970s, some medical students found 3-year programs to be an unsatisfactory education experience, mentioning issues such as quality of life stresses, inadequate time for test preparation, academic difficulties, and resultant health problems.^{12,28} This resulted in approximately one-third of students extending the duration of medical school beyond their originally planned 3 years.²⁸ These are serious concerns, particularly given depression, suicide, and burnout rates are increasing problems for medical professionals (students, residents, and practicing clinicians) today.^{29–31} Therefore, having some degree of overlap

between a 3-year and 4-year MD curricula allows a conduit for struggling 3-year MD program students to transition to a traditional 4-year curriculum if needed. Careful screening and selection of medical students for 3-year programs, who are both motivated and resilient, might reduce the incidence of these issues as well.

Accelerated 3-year MD program outcomes

There are several potential outcome measures, identified from the survey, that could be used to evaluate how well 3-year MD programs meet their stated objectives. Classical metrics include USMLE Step 1 and Step 2 scores, comparing the number of matriculants to the number of graduates, comparison of 3-year versus 4-year MDs on in-training and residency board exams, and ultimately (where appropriate) if these programs increase physicians in rural and underserved areas and/or direct more physicians into underserved specialties. Because many of the 3-year programs have small numbers of students each year, and programs only began accepting students within the last 3–7 years, most current 3-year programs have been utilizing mainly USMLE Step 1 scores of students in accelerated tracks to compare them with traditional 4-year medical students. When reported, 3-year programs state that USMLE Step 1 scores are comparable between the 2 groups; given the small numbers, however, even this outcome is likely not yet statistically significant. It will take 3–5 more years, at a minimum, before enough students from the most recent wave of 3-year MD programs graduate from residency to determine how they compare as new independent physicians. Thoughtful consideration should be given to how to evaluate and measure students in a 3-year curriculum since measures of wellness, resilience, problem-solving skills, team-based partnership abilities, etc. may be important end points in addition to test scores. Finally, evaluation of where these medical students practice long-term would be valuable to determine if these programs are actually increasing the number of physicians in rural or underserved areas.

Limitations

Our study has some limitations. First and foremost, our results only provide a snapshot in time and are not able to capture a longitudinal view, although our findings update (with more recent data) what is currently available in the literature. There may have been a participation bias in which schools with an accelerated medical school curricula were

more likely to respond, which would create an overrepresentation of those schools in our data; AAMC data for total U.S. medical students were used to cross-reference programs (3-year and total number of U.S. allopathic medical students) to avoid this pitfall. Furthermore, although we had a 75% response rate, we studied only U.S. schools, which omitted foreign medical schools with a 3-year MD program (e.g., some Canadian programs). There could also be an interviewer bias that may have influenced the subjects' responses, although all interviews were performed by one individual (senior author) using a structured interview format to minimize this possibility.

Conclusion

Medical education is in the midst of a time of robust curricular reform, providing an opportunity to rethink fundamentals of MD training. Within this context, several examples of both accelerated and decelerated medical education curricula have recently emerged. With regard to accelerated 3-year MD programs, reintroduction of 3-year MD programs have occurred in 9 medical schools since 2010 and 4 more are in the process of implementing such a track, although overall the total number of students in 3-year MD programs remains small. Family medicine and general internal medicine are the most common residency programs these students choose (or are tracked into). In our study cohort, there are 4 medical schools that offer 2+4 programs, 36 schools with 3+4 programs, 4 schools with 4+3.5 programs, and 1 school with a 4+6 program (undergraduate + medical school, respectively). The major benefits of accelerated (predominantly 3-year MD programs) include reduction in student debt (primarily by entering the work force 1 year early), guaranteed residency positions for graduating medical students, and the potential of increasing physician numbers in rural or underserved areas and/or underserved specialties by utilizing regional campuses for these programs. Major drawbacks identified from the survey, as well as gleaned from the literature, include concern about student fatigue/burnout, additional expense involved by the medical school in teaching 2 parallel curricula, and the necessity for institutions to provide guaranteed residency positions for all 3-year track students. Since recently initiated accelerated programs are still quite new, consistent outcome measures (post-residency) are not yet available. Ultimately, long-term evaluation of these programs will be essential to determine if these programs are increasing the number of physicians in rural or underserved areas and/or tracking students into important underserved specialties.

Acknowledgments

The authors would like to thank Jean Robillard, MD, Emeritus Vice President for Medical Affairs & Dean of the Carver College of Medicine at the University of Iowa for his helpful suggestions on the manuscript and support for the project overall. In addition, the authors would like to thank Amber Ryan for assistance with initial data entry and Jamie Holmes for help with data entry and interview scheduling.

Disclosure

The authors report no conflicts of interest in this work.

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Supplementary material

Responding U.S. Medical Schools

- Albert Einstein College of Medicine
- Baylor College of Medicine
- Boston University School of Medicine
- California Northstate University College of Medicine
- Case Western Reserve University School of Medicine
- Chicago Medical School at Rosalind Franklin University of Medicine and Science
- Columbia University Vagelos College of Physicians and Surgeons
- Dartmouth Geisel School of Medicine
- Drexel University College of Medicine
- Duke University School of Medicine
- East Carolina University Brody School of Medicine
- East Tennessee State University James H. Quillen College of Medicine
- Eastern Virginia Medical School
- Emory University School of Medicine
- Florida International University Herbert Wertheim College of Medicine
- Geisinger Commonwealth School of Medicine
- George Washington University School of Medicine and Health Sciences
- Harvard Medical School
- Hofstra/Northwell Donald and Barbara Zucker School of Medicine
- Howard University College of Medicine
- Indiana University School of Medicine
- Johns Hopkins University School of Medicine
- Loma Linda University School of Medicine
- Louisiana State University School of Medicine in New Orleans
- Marshall University Joan C. Edwards School of Medicine
- Mayo Clinic School of Medicine
- Medical College of Wisconsin
- Medical University of South Carolina College of Medicine
- Meharry Medical College School of Medicine
- Mercer University School of Medicine
- Michigan State University College of Human Medicine
- Mount Sinai Icahn School of Medicine
- New York University School of Medicine
- Northeast Ohio Medical University College of Medicine
- Northwestern University Feinberg School of Medicine
- Oakland University William Beaumont School of Medicine
- Oregon Health & Science University School of Medicine
- Pennsylvania State College of Medicine
- Quinnipiac University Frank H. Netter MD School/North Haven of Medicine
- Rush Medical College of Rush University Medical Center
- Rutgers New Jersey Medical School
- Rutgers Robert Wood Johnson Medical School
- Saint Louis University School of Medicine
- Southern Illinois University School of Medicine
- Stanford University School of Medicine
- Stony Brook University School of Medicine
- Temple University Lewis Katz School of Medicine
- Texas Tech University Health Sciences Center Paul L. Foster School of Medicine
- Texas Tech University Health Sciences Center School of Medicine
- Tufts University School of Medicine
- Tulane University School of Medicine
- University at Buffalo Jacobs School of Medicine and Biomedical Sciences
- University of Alabama School of Medicine
- University of Arizona College of Medicine – Tucson
- University of California, Davis School of Medicine
- University of California, Los Angeles David Geffen School of Medicine
- University of California, Riverside School of Medicine
- University of California, San Francisco School of Medicine
- University of Central Florida Orlando College of Medicine
- University of Chicago Division of the Biological Sciences, the Pritzker School of Medicine
- University of Cincinnati College of Medicine
- University of Colorado School of Medicine
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- University of Kansas School of Medicine
- University of Louisville School of Medicine
- University of Maryland School of Medicine
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- University of Miami Leonard M. Miller School of Medicine
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- University of Minnesota Medical School
- University of Mississippi School of Medicine
- University of Missouri-Columbia School of Medicine

- University of Missouri-Kansas City School of Medicine
- University of Nebraska College of Medicine
- University of Nevada Reno School of Medicine
- University of North Carolina School of Medicine
- University of North Dakota School of Medicine and Health Sciences
- University of Oklahoma College of Medicine
- University of Pennsylvania Raymond and Ruth Perelman School of Medicine
- University of Pittsburgh School of Medicine
- University of South Carolina School of Medicine, Columbia
- University of South Dakota Sanford School of Medicine
- University of South Florida Health Morsani College of Medicine
- University of Texas at Austin Dell Medical School
- University of Texas Health San Antonio Joe R. and Teresa Lozano Long School of Medicine
- University of Texas Health Science Center at Houston McGovern Medical School
- University of Texas Medical Branch at Galveston School of Medicine
- University of Texas Rio Grande Valley School of Medicine
- University of Texas Southwestern Medical Center
- University of Toledo College of Medicine and Life Sciences
- University of Utah School of Medicine
- University of Vermont Robert Larner, M.D. College of Medicine
- University of Virginia School of Medicine
- University of Washington School of Medicine
- University of Wisconsin School of Medicine and Public Health
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