Are They Prepared? Comparing Intern Milestone Performance of Accelerated 3-Year and 4-Year Medical Graduates

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Abstract

Purpose

Accelerated 3-year programs (A3YPs) at medical schools were developed to address student debt and mitigate workforce shortage issues. This study investigated whether medical school length (3 vs 4 years) was associated with early residency performance. The primary research question was as follows: Are the Accreditation Council for Graduate Medical Education Milestones (MS) attained by A3YP graduates comparable to graduates of traditional 4-year programs (T4YPs) at 6 and 12 months into internship?

Method

The MS data from students entering U.S. medical schools in 2021 and 2022 from the 6 largest specialties were used: emergency medicine, family medicine, internal medicine, general surgery, psychiatry, and pediatrics. Three-year and 4-year graduates were matched for analysis (2,899 matched learners: 182 in A3YPs and 2,717 in T4YPs). The study used a noninferiority study design to examine data trends between the study cohort (A3YP) and control cohort (T4YP). To account for medical school and residency program effects, the authors used cross-classified random-effects regression to account for clustering and estimate group differences.

Results

The mean Harmonized MS ratings for the midyear and end-year reporting periods showed no significant differences between the A3YP and T4YP groups (mean [SE] cross-classified coefficient = 0.01 [0.02], $P = .77$). Mean MS ratings across internal medicine MS for the midyear and end-year reporting periods showed no significant differences between the A3YP and T4YP groups (mean [SE] cross-classified coefficient = −0.03 [0.03], $P = .31$). Similarly, for family medicine, there were no statistically significant differences between the A3YP and T4YP groups (mean [SE] cross-classified coefficient = 0.01 [0.02], $P = .96$).

Conclusions

For the specialties studied, there were no significant differences in MS performance between 3-year and 4-year graduates at 6 and 12 months into internship. These results support comparable efficacy of A3YPs in preparing medical students for residency.

Medical education is increasingly embracing competency-based education, with a number of U.S. schools developing curricular models that enable learners to complete medical school within 3 years rather than spending 4 years or more in undergraduate medical education (UME). Competency frameworks have driven an evidence-based examination of learner outcomes, creating the potential to empirically map medical school programs to subsequent residency performance of their graduates.[1,2] The dominant structure of medical schools since the 1910 Flexner report has been a 4-year program.[3] Although some schools transitioned to 3-year MD curricula in the 1970s to alleviate physician shortages, most of those programs ceased to exist as physician workforce shortages eased and federal funding incentives were discontinued.[4–9]

Interest in accelerated 3-year programs (A3YPs) has exploded in the last decade, expanding from 8 programs in 2015[10] to 32 programs in 2023.[11] In 2015, NYU Grossman School of Medicine launched the Consortium of Accelerated Medical Pathway Programs through a grant from the Josiah Macy Jr. Foundation. These programs address the rising cost of medical education and subsequent student debt and are designed to provide individualized education pathways into specific specialties. Many A3YPs have delineated missions to alleviate physician workforce shortages in rural and underserved areas. Accelerated programs challenge the structure and efficiency of traditional 4-year programs (T4YPs), particularly the nonclinical activities of the fourth year,[12–16] and, through the option of directed pathways to residency at home institutions, seek to mitigate the intense stress of the residency application process.

In terms of the structure and process of A3YPs, all programs meet the 130-week instructional requirement of the Liaison Committee on Medical Education for an MD degree. They vary in their number of

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Table 1
Participating Medical Schools in A3YPs

Medical school	Year of first class	Pathway or school or campus	Specialties included	No. of students	Admissions	Mission
Cooper Medical School of Rowan University	2016	Program	IM, pediatrics	8	Students are admitted to the 4YP. The review is holistic, and the same metrics are applied. After acceptance, then students can apply to the A3YP. They write additional essays and interview with primary care faculty.	Prepare the next generation of primary care physicians who will be providing patient-centered, humanistic, and culturally sensitive care for patients and families in New Jersey and beyond.
Hackensack Meridian School of Medicine	2018	Program	Anesthesiology, child neurology, EM, FM, general surgery, IM, neurology, OBGYN, pediatrics, physical medicine and rehabilitation	37	Students must be accepted to the 4YP then apply to the accelerated pathway; thus, admissions criteria do not differ.	Expand the physician workforce in New Jersey. Reduce student debt. Provide a seamless transition between UME and GME. Individualize the UME experience to student goals and competency level.
MCW–Central Wisconsin and Green Bay	2016 and 2015	Regional campus	IM, psychiatry	39	Students specifically admitted to a regional campus as an accelerated student. They can opt to be reassigned to 4YP for specialty choice, academic or personal reasons.	Community-based primary care and psychiatry focused to address physician workforce shortages in Wisconsin and surrounding areas. Reduce student debt.
Medical University of South Carolina	2017	Program	EM, FM, IM, pediatrics, psychiatry	< 5	Students must be accepted to the 4YP before application to the accelerated pathway; thus, admissions criteria do not differ.	Expand the physician workforce in South Carolina. Reduce student debt.
NYU Grossman School of Medicine	2013	Program	EM, IM, pediatrics, psychiatry, surgery	11	Students must be accepted to the 4YP before application to the accelerated pathway; thus, admissions criteria do not differ.	Individualize medical education to allow those who are certain of their career choice to graduate early. Track learners across the UME-GME continuum. Reduce student debt.
NYU Grossman Long Island School of Medicine	2019	Entire school	IM, pediatrics, surgery	15	Students admitted to A3YP, then complete secondary application defining primary care interest, including interview with department faculty.	Increase the workforce in primary care to serve the needs of the Long Island, New York, community. Train physicians in health system science. Reduce student debt.
The Ohio State University College of Medicine	2017	Program	FM	< 5	Students specifically admitted to the A3YP. They write additional essays and interview with family medicine residents and residency faculty. Can decelerate to 4YP for specialty choice, academic, or personal reasons.	Graduating more Ohio primary care physicians faster and addressing national and Ohio shortages of primary care physicians. Reduce student debt.
Penn State College of Medicine	2014	Program	EM, FM, IM, psychiatry	9	Students must first be admitted to the 4YP. Then, applicants submit additional essays and interview with the department faculty and residents associated with the specialty of the pathway.	Individualize and accelerate medical education. Increase workforce, especially in primary care and train patient-centered physicians. Reduce student debt.

(Table continues)

Table 1
(Continued)

Medical school	Year of first class	Pathway or school or campus	Specialties included	No. of students	Admissions	Mission
Renaissance School of Medicine at Stony Brook University	2018	Program	EM, FM, IM, pediatrics, psychiatry, surgery	< 5	There are 2 points of entry. Students may apply after being admitted to the 4YP track. Once matriculated, students may also apply to the 3-year program in their first year of medical school.	Allow students who are certain of their career choice to graduate early. Reduce student debt. Afford enhanced opportunity for institutional specialty mentorship.
Rutgers New Jersey Medical School	2019	Program	IM, pediatrics	< 5	Students must be accepted to the 4YP before application to the accelerated pathway. Students must commit to one of the primary care specialties at the time of application to the 3-year track. Students are not permitted to apply after matriculation.	Address the national shortage of primary care physicians and the needs of the New Jersey Community of Newark. Reduce student debt.
Texas Tech University Health Sciences Center School of Medicine	2010	Program	FM, IM	26	Students may be accepted during the usual admissions cycle or may apply during the fall of their second year. Admission metrics are consistent with fourth-year metrics with the addition of strong and demonstrated interest in primary care.	Expand the primary care workforce in Texas. Reduce student debt.
UC Davis School of Medicine	2014	Program	FM, IM	13	Students must be accepted into the 4YP before being considered for the A3YP. Admission metrics are consistent with 4YP metrics.	Increase the primary care workforce to practice in underserved areas. Reduce student debt
University of Louisville School of Medicine (Trover Campus)	2011	Program	FM	< 5	Students accepted into the 4YP. The A3YP decision is made after students have demonstrated solid academic progress in the first 3 semesters of medical school and outstanding performance during the rural medicine accelerated track sessions completed after the first year.	Increase the family medicine workforce to practice in rural areas. Reduce student debt.
University of North Carolina at Chapel Hill School of Medicine	2015	Program	FM, IM, pediatrics, psychiatry, surgery	6–12	Students accepted into the 4YP. Admission to the 3-year program occurs in spring of the first year.	Increase the workforce to practice in rural or underserved settings in North Carolina. Reduce student debt.
University of Tennessee Health Science Center College of Medicine	2021	Program	FM, IM, pediatrics, medicine-pediatrics, psychiatry, neurology	26	Students accepted into 4YP. Applicants submit a secondary written application for the A3YP. There is a second entry point in the spring of the first year.	Address the physician and primary care workforce shortage in Tennessee. Allow students who are certain of their career choice to graduate early. Attract and retain high-caliber applicants as students, residents, and practicing physicians in Tennessee. Reduce student debt.
Virginia Commonwealth University School of Medicine	2019	Program	EM, FM, IM, OBGYN, pediatrics, psychiatry	6	Students enter A3YP during their second year. They are selected based on academic performance to date.	Address the physician workforce shortage in Virginia. Retain students. Reduce student debt.

Abbreviations: 4YP, 4-year program; A3YP, accelerated 3-year program; EM, emergency medicine; GME, graduate medical education; FM, family medicine; IM, internal medicine; OBGYN, obstetrics-gynecology; UME, undergraduate medical education.

students, structure, curriculum, and residency match process.[10,11,17,18] Medical students enter an A3YP either at matriculation or during the first or second year of medical school, depending on the program. Some programs include curricular activities in the summer before medical school, and many have curriculum in the summer between the first and second years. The most common form of A3YP is a track of students in parallel with an existing 4-year program, which allows for shared resources but creates logistic complexities of delivering 2 distinct programs. Whole cohorts of a regional campus or a school may be a solely A3YP.[19] Coe et al[11] articulated both the return on investment and potential limitations of A3YPs. Most A3YPs provide medical students the option of a directed pathway into a residency program sponsored by, or affiliated with, their institution. With only a handful of programs having an all-in policy exception to the National Resident Matching Program, most A3YP students enroll in and participate in the National Resident Matching Program in their third year, earn the MD degree in 3 years, and then proceed to residency training, entering internships with graduates of 4-year programs from their own school as well as other schools. As of the graduating class of 2022, there are more than 500 graduates of A3YPs nationally.

Medical schools aim to prepare both 3- and 4-year learners for effective transition to postgraduate education and to equip graduates with necessary competencies for residency training.[20] To facilitate these efforts, accrediting bodies and governing entities developed and promoted competency frameworks, including guidelines on specific processes and structures for implementation. The Accreditation Council for Graduate Medical Education (ACGME)[21] initiated the Next Accreditation System International and the Milestones (MS) assessment initiative to mandate formative developmental assessments of resident progress during training.[22–24] Critics of A3YPs cite concern about the preparedness of graduates of A3YPs compared with students who complete medical school in 4 or more years. Studies demonstrate that students reported equal educational attainment during medical school and perceived preparedness.[25,26]

This study aims to determine whether 3-year graduates and 4-year graduates have comparable residency performance outcomes. A unique opportunity is provided by the ACGME MS to systematically align medical school outcomes with residency performance.[27] The research questions are as follows: Does the length of medical school affect early residency performance? and Are the MS attained by A3YP graduates equivalent to the MS attained by 4-year graduates at 6 and 12 months into internship? We hypothesize no significant differences between A3YP and T4YP graduates in attainment of MS during internship.

Method

Participants

A3YP consortium. The MS data from students entering U.S. medical schools in 2021 and 2022 from the 6 largest specialties were used: emergency medicine, family medicine, internal medicine, general surgery, psychiatry, and pediatrics. The A3YP data for this study come from a consortium of 16 U.S. medical schools (529 medical students graduating between 2013 and 2022; Table 1): (1) Cooper Medical School of Rowan University, (2) Hackensack Meridian School of Medicine, (3) Medical College of Wisconsin (2 campuses: Central Wisconsin and Green Bay), (4) Medical University of South Carolina College of Medicine, (5) NYU Grossman School of Medicine, (6) NYU Grossman Long Island School of Medicine, (7) Northeast Ohio Medical University, (8) Penn State College of Medicine, (9) Renaissance School of Medicine at Stony Brook University, (10) Rutgers New Jersey Medical School, (11) Texas Tech University Health Sciences Center School of Medicine, (12) The Ohio State University College of Medicine, (13) UC Davis School of Medicine, (14) University of North Carolina at Chapel Hill School of Medicine, (15) University of Louisville School of Medicine (Trover Campus), and (16) Virginia Commonwealth University School of Medicine. Most schools have separate tracks of students in the A3YP alongside the T4YP, whereas at other schools, all students at the school or campus are in the A3YP Most A3YP graduates stay at the same or affiliated institution, but many go elsewhere for residency. To evaluate residency performance of A3YP graduates relative to the performance of T2YP graduates, we used the ACGME MS 2.0 as outcomes for graduates in 2021 and 2022 matching into the 6 largest specialties (emergency medicine, family medicine, internal medicine, pediatrics, psychiatry, and general surgery).

Matched cohort sample: A3YP and T4YP graduates. We used learner information (graduating medical school, matched residency and specialty, learner name, graduating year) to match graduating medical students with the ACGME database, resulting in a matched cohort sample of 182 learners from the A3YP (95.3% match rate from eligible sample with the ACGME database) and 2,717 learners graduating from T4YPs among A3YP consortium schools.

Study design

Noninferiority study design. We used a noninferiority study design, hypothesizing that graduates from A3YPs are noninferior (i.e., comparable) to T4YP graduates from similar UME programs in attainment of intern MS. The purpose of the noninferiority study design in this context is to evaluate whether an educational program is as effective in graduating learners into residency compared with standard education practice (graduates from T4YPs). As such, we used graduates from A3YPs and graduates from T4YPs among A3YP consortium schools as study and control groups, respectively. Noninferiority study designs differ from standard superiority study designs in that our goal was to establish nonsignificance of any differences between study (A3YP graduates) and control (T4YP graduates) groups.

Power, sample size, and margin for noninferiority. We established a ±0.50-point difference threshold as the margin for noninferiority (i.e., half of 1 MS level). This difference threshold translates to a standardized effect size of 0.59 (applying the 0.50 MS rating difference and 0.85 MS SD), resulting in a sample size of 46 learners in the treatment group for 80% power. Our cohort data sample size of 2,899 (182 A3YP graduates and 2,717 T4YP graduates) is sufficiently sensitive to detect the margin for noninferiority at 99% power. Our cohort sample size is robust enough to allow sensitivity even up to a 0.22 standardized effect size at 80% power, yielding

sufficient power to test the hypotheses of noninferiority in our study design.

ACGME MS

The ACGME MS consist of subcompetencies with associated developmental levels of performance, articulated through developmentally based MS anchors.[28] For the Harmonized MS, trainees are assessed on MS levels using a 9-point scale, with ordinal levels ranging from level 1 (resident demonstrates MS expected of an incoming resident) to level 5 (advanced performance demonstrating "aspirational" goals beyond graduation target) with 0.5 intervals between the levels. Level 4 is designated as the target for residents by the time of graduation (labeled as proficiency). In addition to the MS levels, programs also have the option to indicate that the resident "has not achieved level 1," indicating that the individual has not met requirements for the first level, potentially signifying significant deficiencies in the subcompetency. Programs can also indicate the residents were "not assessed." Programs assign MS levels for all subcompetencies in the specialty for each 6-month reporting period (midyear reporting period in December and end-year reporting period in June). Decisions and processes associated with MS ratings are within the purview of the residency program and its leadership based on consensus of the clinical competency committee and the program director.[29]

From 2019 to 2021, the ACGME worked with specialty boards to revise the subcompetencies and MS. For patient care and medical knowledge, each specialty revised the MS according to the field. For systems-based practice, practice-based learning and improvement, professionalism, and interpersonal and communication skills, the ACGME worked with experts to propose Harmonized MS, which represent the competencies across all programs. The Harmonized MS allow us to compare MS performance of graduates of A3YPs and T4YPs across specialties. In the A3YPs, a large proportion of graduates enter internal medicine and family medicine, allowing comparison of patient care and medical knowledge within these specialties. A few A3YPs have begun to use specialty-specific MS to assess medical students' readiness for transition to residency.

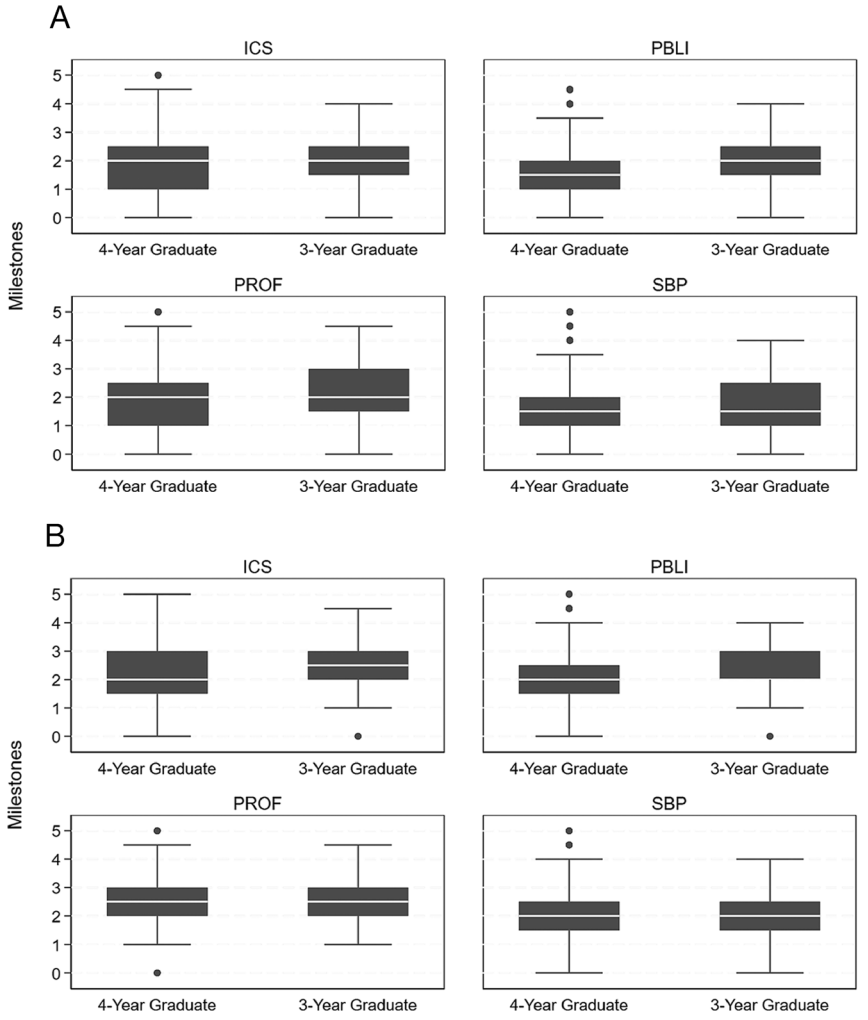

Figure 1 Box plots of Harmonized Milestone ratings across emergency medicine, family medicine, internal medicine, pediatrics, psychiatry, and surgery between traditional 4-year programs graduates (n = 2,717) and accelerated 3-year program graduates (n = 182) for (panel A) midyear and (panel B) end-year. Midyear reporting period is first 6 months, and end-year reporting period is last 6 months of postgraduate year 1. Each plot corresponds to a different Accreditation Council for Graduate Medical Education competency domain. Abbreviations: ICS, interpersonal communication skills; PBLI, practice-based learning and improvement; PROF, professionalism; SBP, system-based practice.

Analysis

We calculated the mean MS rating for each competency domain. We used descriptive statistics and box plots to examine data trends between treatment (A3YP) and control (T4YP). To account for medical school and residency program effects, we used cross-classified random-effects regression to account for clustering and to estimate group differences. We examined MS differences aggregated at the competency level for Harmonized MS for interpersonal and communication skills, practice-based learning and improvement, professionalism, and systems-based practice. For internal medicine and family medicine, which have sufficient sample sizes to detect noninferiority margin effects, we examine group differences for patient care, medical knowledge, and the Harmonized MS. Data compilation and analyses were conducted using Stata software, version 18/MP (StataCorp, College Station, Texas). A 2-sided $P < .05$ was considered to be statistically significant. The institutional review board of the University of Illinois at Chicago approved this study.

Results

Harmonized MS: across 6 specialties

We used data from 2,899 matched learners (182 in A3YPs and 2,717 in T4YPs), representing graduates of consortium medical schools in emergency medicine, family medicine, internal medicine, pediatrics, psychiatry, and surgery. Figure 1 shows descriptive statistics (box plots) of learners between groups for the Harmonized MS.

Mean MS ratings across Harmonized MS for the midyear reporting period (A3YP: mean [SD], 1.95 [0.80]; T4YP: mean [SD], 1.83 [0.84]) and end-year reporting period (A3YP: mean [SD], 2.33 [0.78]; T4YP: mean [SD], 2.22 [0.84]) showed no significant differences between the A3YP and T4YP groups (mean [SE] cross-classified coefficient = 0.01 [0.02], $P = .77$). Table 2 compares Harmonized MS competency-level results and shows no significant differences between the A3YP and T4YP groups.

Across the cohort, 13% and 5% of learners had at least 1 subcompetency rated not ready for supervised practice (level 1: not achieved) during the mid- and end-year reporting periods, respectively. Between groups, there were no significant differences in level 1: not achieved ratings at midyear (A3YP: 13%; T4YP: 8%, $P = .09$) and end year (A3YP: 5%; T4YP: 2%, $P = .07$).

Internal medicine

Internal medicine included 1,032 matched learners (64 in A3YPs and 968 in T4YPs). Figure 2 shows descriptive statistics (box plots) of learners between groups for internal medicine residents.

Mean MS rating for the midyear reporting period (A3YP: mean [SD], 2.26 [0.87]; T4YP: mean [SD], 2.04 [0.91]) and end-year reporting period (A3YP: mean [SD], 2.46 [0.93]; T4YP: mean [SD], 2.36 [0.94]) showed no significant differences between the A3YP and T4YP groups (mean [SE] cross-classified coefficient = −0.03 [0.03], $P = .31$). Table 2 compares internal medicine competency-level results and shows no significant differences between the A3YP and T4YP groups.

Across the internal medicine cohort, 14% and 7% of learners had at least 1 subcompetency rated not ready for supervised practice (level 1: not achieved) during the mid- and end-year reporting periods, respectively. Between groups, there were differences in level 1: not achieved ratings at midyear (A3YP: 5%; T4YP: 14%, $P = .03$) and end year (A3YP: 2%; T4YP: 7%, $P = .12$), but these findings were not statistically significant.

Family medicine

Family medicine included 442 matched learners (57 in A3YPs and 385 in T4YPs). Figure 3 shows descriptive statistics (box plots) of learners between groups for family medicine residents.

Mean MS ratings for the midyear reporting period (A3YP: mean [SD], 1.95 [0.80]; T4YP: mean [SD], 1.83 [0.84]) and end-year reporting period (A3YP: mean [SD], 2.33 [0.78]; T4YP: mean [SD], 2.22 [0.84]) showed no statistically significant differences between the A3YP and T4YP groups (mean [SE] cross-classified coefficient = 0.01 [0.02], $P = .96$). Table 2 compares family medicine competency-level results and shows no significant differences between the A3YP and T4YP groups.

Across the family medicine cohort, 15% and 3% of learners had at least 1 subcompetency with a level 1: not achieved (not ready for supervised practice) rating during the mid- and end-year reporting periods, respectively. Between groups, there were no significant differences in level 1: not achieved ratings at midyear (A3YP: 7%; T4YP: 16%,

Table 2
Differences in A3YP and T4YP: Cross-Classified Random-Effects Regression[a,b,c]

Competency	Midyear reporting		End-year reporting	
	Coefficient (SE)[b]	*P* value[c]	Coefficient (SE)[b]	*P* value[c]
All specialties[d] (A3YP: n = 182; T4YP: n = 2,717)				
ICS	0.06 (0.04)	.17	0.03 (0.04)	.51
PBLI	0.05 (0.05)	.27	0.09 (0.05)	.06
PROF	0.03 (0.04)	.49	0.03 (0.04)	.44
SBP	0.05 (0.04)	.17	0.05 (0.04)	.23
Internal medicine[e] (A3YP: n = 64; T4YP: n = 968)				
ICS	0.06 (0.08)	.45	0.01 (0.08)	.95
MK	0.02 (0.07)	.80	–0.02 (0.07)	.83
PBLI	0.08 (0.08)	.28	0.03 (0.08)	.67
PC	–0.03 (0.06)	.63	–0.03 (0.06)	.59
PROF	–0.01 (0.07)	.84	–0.05 (0.07)	.51
SBP	0.12 (0.07)	.12	0.04 (0.07)	.58
Family medicine[e] (A3YP: n = 57; T4YP: n = 385)				
ICS	0.06 (0.04)	.14	–0.02 (0.04)	.68
MK	0.05 (0.05)	.34	–0.01 (0.05)	.87
PBLI	0.04 (0.05)	.50	0.04 (0.06)	.45
PC	0.04 (0.04)	.32	–0.03 (0.03)	.42
PROF	0.08 (0.05)	.06	–0.01 (0.05)	.81
SBP	0.06 (0.04)	.16	0.01 (0.04)	.86

Abbreviations: A3YP, accelerated 3-year program; ICS, interpersonal communication skills; MK, medical knowledge; PBLI, practice-based learning and improvement; PC, patient care; PROF, professionalism; SBP, system-based practice; T4YP, traditional 4-year program.

[a]Analyses take into account clustering among medical school, residency program, competencies, and specialty, as appropriate, using cross-classified random-effects regression models.

[b]Coefficients (SEs) indicate group Milestone differences between A3YP and T4YP.

[c]*P* values are associated with cross-classified random-effects regression estimates.

[d]All specialties include emergency medicine, family medicine, internal medicine, pediatrics, psychiatry, and surgery, restricted to Harmonized Milestones.

[e]Internal medicine and family medicine include MK and PC.

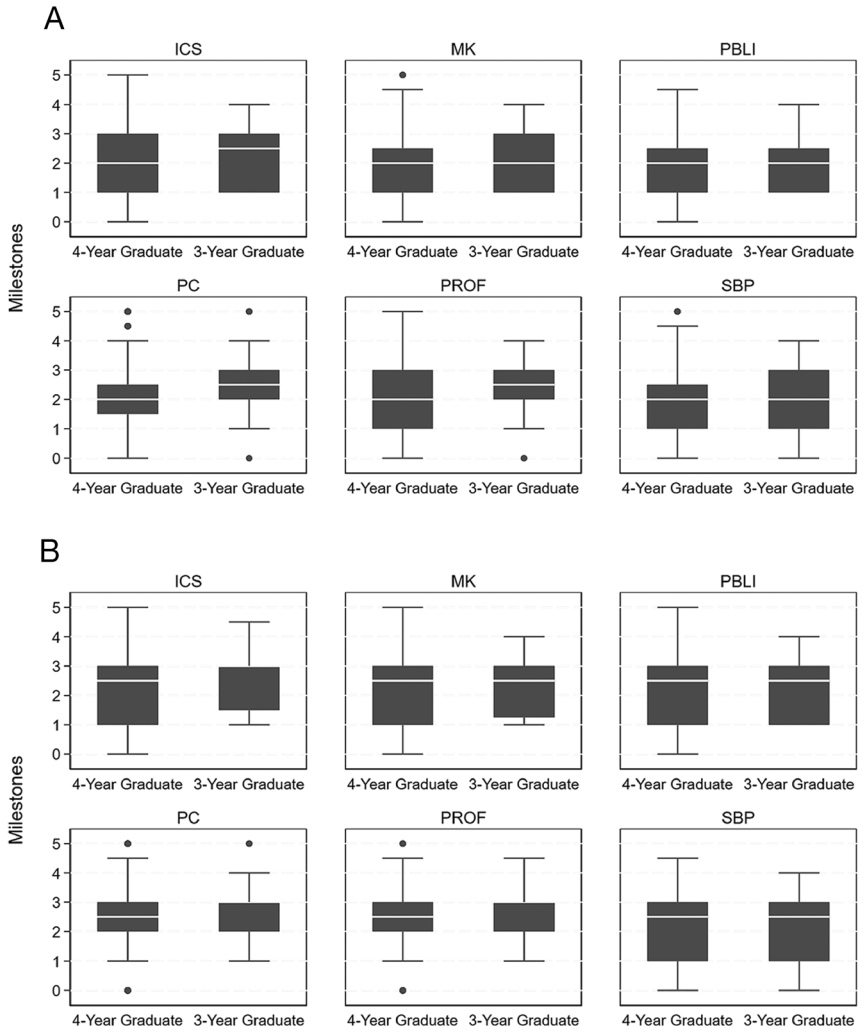

Figure 2 Box plots of Harmonized Milestone ratings between traditional 4-year programs graduates (n = 968) and accelerated 3-year program graduates (n = 64) in internal medicine for (panel A) midyear and (panel B) end-year. Midyear reporting period is first 6 months, and end-year reporting period is last 6 months of postgraduate year 1. Each plot corresponds to a different Accreditation Council for Graduate Medical Education competency domain. Abbreviations: ICS, interpersonal communication skills; MK, medical knowledge; PBLI, practice-based learning and improvement; PC, patient care; PROF, professionalism; SBP, system-based practice.

P = .08) and end year (A3YP: 0%; T4YP: 4%, P = .24).

Discussion

This study tested the hypothesis that the length of medical school training (3 vs 4 years) is not associated with performance in the intern year of residency as assessed by the MS. We analyzed the performance of graduates of A3YPs and graduates of T4YPs in their intern year of residency as assessed by ACGME Harmonized MS competencies. Our analysis supports the conclusion that intern performance for the 2 groups of graduates was similar at 6 months and 1 year. Comparability of performance for the 2 groups of interns was evidenced in aggregate across 6 specialties (emergency medicine, family medicine, internal medicine, pediatrics, psychiatry, and surgery) as well as within internal medicine and family medicine individually.

These results are supportive evidence for the comparable efficacy of A3YPs in preparing medical students for residency, particularly for primary care residencies. This study is unique in 2 aspects. First, this is one of the first times that performance on MS has been used as an outcome for UME programs in a national study. Often UME and graduate medical education (GME) are siloed with little feedback to UME programs about their graduates.[30,31] Second, the study was designed to assess noninferiority of the performance of graduates of A3YPs compared with the performance of graduates of T4YPs and had a robust sample size with sufficient statistical power to draw the conclusion that performance of the 2 cohorts was comparable. This study contributes to medical education research through demonstrating the methods of a noninferiority study. In addition, it adds to the corpus of work about transition from medical school to residency.

A3YPs to address workforce issues

This empirical evidence of the success of accelerated medical education programs is pivotal as medical schools pursue effective strategies for managing learners' educational debt and increasing the physician workforce more efficiently. Reducing the amount of time needed to complete the MD degree not only lowers overall tuition expenses but also condenses the total amount of educational time spent away from wage-earning roles. Reducing the cost of a medical education is key to deepening the potential pool of highly qualified medical school applicants and diversifying the workforce because students underrepresented in medicine tend to have higher levels of debt compared with non-underrepresented in medicine students.[32] Reducing debt also increases the likelihood that medical school graduates will pursue careers in sorely needed practice areas that solve long-standing workforce issues.

Some A3YPs have been specifically developed to address workforce shortage, recruiting applicants who have shown commitment to specialties in high need, such as primary care. Previous work[33,34] found that high student debt has a negative relationship on choosing primary care as a career. A3YPs address this issue by lowering student debt and liberating students to pursue a specialty not necessarily based on debt and anticipated income. Some A3YPs with directed pathways progression from UME to GME strategically partner with GME programs that are placed in highly underserved areas to address geographic maldistribution of physicians by

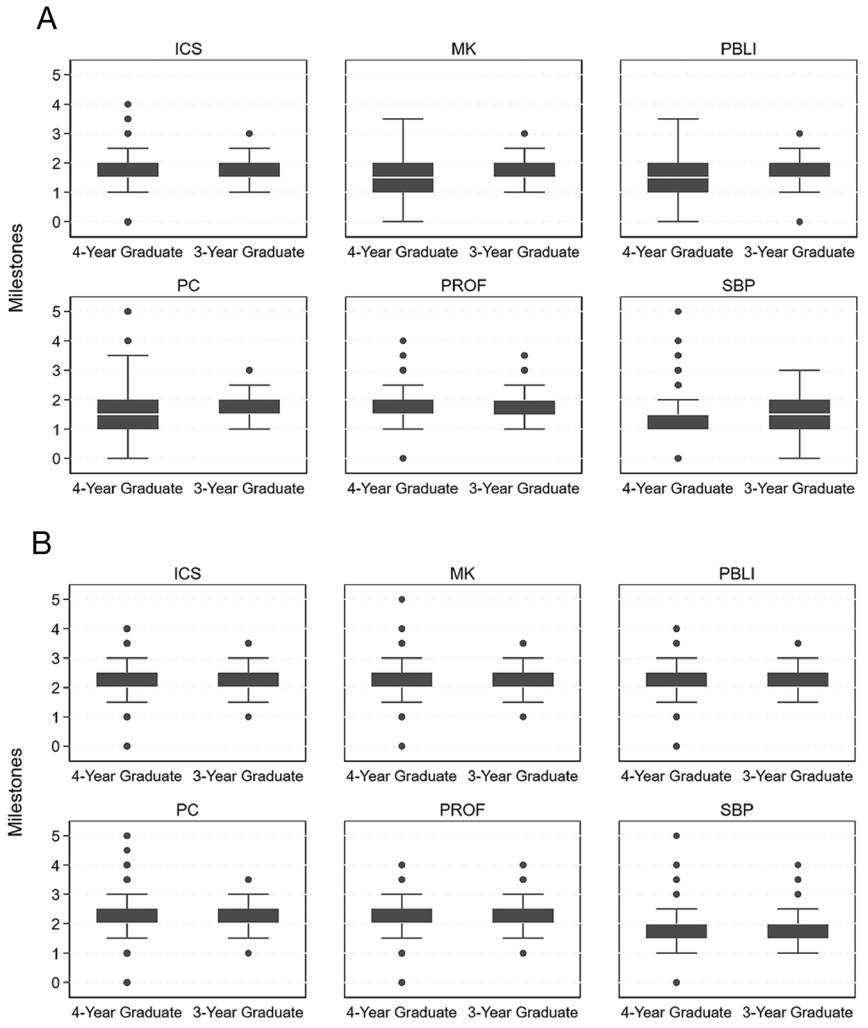

Figure 3 Box plots of Harmonized Milestone ratings between traditional 4-year programs graduates (n = 385) and accelerated 3-year program graduates (n = 57) in family medicine for (panel A) midyear and (panel B) end-year. Midyear reporting period is first 6 months, and end-year reporting period is last 6 months of postgraduate year 1. Each plot corresponds to a different Accreditation Council for Graduate Medical Education competency domain. Abbreviations: ICS, interpersonal communication skills; MK, medical knowledge; PBLI, practice-based learning and improvement; PC, patient care; PROF, professionalism; and SBP, system-based practice.

place-specific training. Additionally, many A3YPs fulfill an urgent workforce need by specifically recruiting applicants from underserved communities who are more likely to practice in those underserved communities. Thus, A3YPs contribute to addressing health inequities while not compromising the quality of training, as shown in this study.

Medical education programs: evolving concepts

The apparent success of accelerated programs calls into question the traditional structure and time frame of UME. Although the MD degree is described as a generalist degree, increased time has been committed in the UME years to ensure exploration of specialty experiences and to demonstrate specific skills that are focused on success in residency specialties. At the same time, the amount of information that medical educators expect students to be exposed to, demonstrate familiarity with, and understand continues to expand each year. Accelerated programs challenge us to revisit and perhaps redefine the expectations that the medical community has of UME. For example, time spent on preclerkship foundational medical knowledge has translated in the modern era into a need for earlier integration of basic science. In addition, the relative value and necessity of the fourth year of medical school for all matriculants have been under discussion for a number of years.[14]

Potential differences between students in A3YPs and T4YPs

Depending on a school's curricular structure, students can enter A3YPs at matriculation or during the preclerkship phase. Admissions practices and criteria for A3YPs may be different from those for T4YPs. These differences may include higher Medical College Admission Test score cutoffs; evidence of greater consistency of performance in premedical academics; commitment demonstrated in prior clinical experiences, including prior roles as clinical professionals; and stated commitment to a specific specialty. Therefore, there is an inherent self-selection and institutional selection bias for A3YP students that may affect later performance.

Because many of the accelerated programs have directed pathways to residencies within their own institutions, graduates of accelerated programs are more likely to complete residency at the same institution, creating continuity and stability from UME to GME that in many cases started in the first year of medical school. Three-year graduates who stay at the same institution for residency are more likely to have a head start on well-established relationships within their chosen department and a better understanding of the department's structure and workflow than interns coming from other institutions. These benefits may lead to higher MS ratings early in training either because performance is superior or because faculty have more familiarity with their institution's graduates. In addition, graduates of accelerated programs are less likely to have experienced the decay in clinical skills that is often seen during the traditional fourth year of medical school. These are some reasons that 3-year graduates may perform well in internship despite 1 less year of training. The counterpoint to A3YPs is that T4YP graduates have increased time in clinical training, may have time to develop additional expertise in areas of their choice, and may have more choices of residency programs balanced with the increased stress of applications and cost of the fourth year.

We do not know whether there are other differences between the A3YP students and T4YP students. It is possible that because they are self-selecting for the A3YP, they are more motivated and directed. Moreover, 3AYP students may also be older, many seeking accelerated pathways toward second (or third) careers as physicians, and thus enter medical school more certain about specialty and residency choices and in need of less exploration. For some programs, the A3YP students may receive additional mentoring, tutoring if needed, and attention. Regardless, students decelerate in both programs with A3YP transitioning back to the T4YP or T4YP slowing their progression. From our team's work, it appears that the rate of deceleration is similar in both programs at approximately 16%.

Initially, our team had concern for decreased student well-being in accelerated programs; however, Leong et al[18] showed that burnout scores (exhaustion and disengagement) were similar between A3YP students and T4YP students on the Association of American Medical Colleges Graduation Questionnaire. Students in accelerated programs rated their learning environments (emotional climate and student-faculty interaction) statistically more positively than did the nonaccelerated students ($P < .001$).

Limitations

The retrospective design of the study introduces several limitations, including the potential for selection bias and the inability to establish causality between the number of years in medical school training and early residency performance. Residency program rating behavior and expectations may vary somewhat across programs and thus obscure performance differences between A3YP and T4YP graduates. Research into the Harmonized MS ratings has shown scoring variability across specialties, with some specialties demonstrating greater stringency or leniency. To account for specialty-specific effects in the analyses, we used cross-classified random-effects regression. Moreover, the total numbers of A3YP graduates and medical schools are relatively small; incorporating data across the 6 largest residency specialties represented among our A3YP sample enabled us to have 2 reasonably sized comparator groups. Nonetheless, generalizability of the findings, especially to those specialties with relatively few A3YP graduates moving into residency training, may be limited and will require further analysis as the number of such graduates increases. Finally, both the medical school education and transition to residency timeline from which this study drew data occurred in the shadow of the COVID-19 pandemic. Shifts away from in-person classroom learning and dramatic changes in hospital environments, for example, could have more strongly affected AY3P graduates, especially given that they had no fourth year to fill gaps or gain needed experience. Certainly, as the number of AY3P programs and graduates continues to increase, and in ways that involve additional specialties, additional review of graduates' performance in residency must be replicated and maintained.

Future work

Our study has provided valuable insights into the relationship between medical school length and early residency performance, but further research is needed to confirm and expand on these findings. Future studies may include a larger and more diverse sample of medical schools and specialties as well as longitudinal follow-up to assess long-term residency performance outcomes. In addition, qualitative research methods could be used to gain a deeper understanding of the factors that contribute to successful residency performance.

This study's results point to next steps in examining A3YP and T4YP graduates' performance further into residency training to (1) determine if the comparability of ACGME MS persists beyond the intern year and (2) to explore patterns of A3YP and T4YP graduates' choice of specialties and practice locations related to workforce gaps. Future areas of inquiry will require quantification of (1) tendency of A3YP graduates to remain in their institution through directed pathways into GME, (2) deceleration rates in 3-year and 4-year programs, (3) differences in the admissions processes and characteristics of applicants to A3YPs and T4YPs, and (4) differences in performance of A3YP and T4YP graduates on Step 3 of the United States Medical Licensing Examination.

Conclusions

Length of medical school training (3 vs 4 years) is not associated with residency performance as assessed by the MS in the first year of training, for the Harmonized MS across specialties, and in internal medicine and family medicine. Our analysis supports the conclusion that intern performance for the 2 groups of graduates was similar at 6 months and 1 year. Because there are increasing numbers of A3YPs, these results demonstrate supportive evidence for the comparable efficacy of A3YPs in preparing medical students for residency.

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Teaching and Learning Moments
A Patient Who Changed My Practice

Coming to Cambridge for a sabbatical years ago, I had the good fortune to meet Anthea, a widow who rented me a jolly upper floor room overlooking the garden. I came to her chiefly because she was not only close to the hospital but also on the list of a few homeowners who donated a sizeable amount of the rent revenue to charity. It was a very good match.

Anthea was an utterly nice person who doted on her daughter and lovely 3-year-old granddaughter, Emily. Each morning we chatted away while eating breakfast together in her kitchen. I met her family and played with little Emily, and we became good friends. After I returned home, we kept writing to each other.

Then I received an unexpected, upsetting letter. Anthea told me she had a blood workup at the hospital for anemia, recently discovered when she found it harder to cycle uphill. At her next appointment with the hematologist, expecting to hear what tablets she needed to take for her anemia, he told her suddenly and quite bluntly that she had myeloid leukemia, and there was no treatment to offer.

The enormity of the blow she was dealt resounded from the letter. Her serious illness was still almost asymptomatic at that stage, but she became morose and miserable since learning about it. In particular, she could not forgive that she was totally unprepared and all alone at this crucial moment, without her daughter to support her and without any prior hint that anything serious was amiss.

Years have passed but I still remember how sorry I was to learn of her predicament. I felt for her and was angry with the physician. Surely this gentle, noble woman deserved better … but don't we all? It seemed a betrayal and left a deep impression. Could it be that I was inadvertently guilty of the same behavior sometimes?

Gradually, I stopped treating diseases in patients. I started giving as much volume to each patient's unique personal identity as to the collecting of biological data—the focus of my medical school training. Occupation, past accomplishments, family, hobbies, and pets became a regular part of the intake process. I soon found out that patients responded warmly, and I was now gaining much more satisfaction and meaning in my work. Even symptoms could be better gathered and understood once I knew the person who was experiencing them.

After a while I realized that this new form of encounter needed no more than an open mind, and that personal contact could be established within a few minutes. Without it, our practice can be 100% evidence-based but seriously flawed, as poor Anthea discovered. Disregarding the patient's unique contextual factors can lead to substantial errors in management.[1,2] It also made me realize that understanding the patient's point of view is an all-important virtue for a clinician.[3] This may be key for facilitating relationships and providing the empathy and support that patients want (and that is likely associated with improved health outcomes).[4] It also remains an important (but less frequently observed) behavior in achieving shared decision-making and patient-centered care.[5] Anthea's experience was also an acute example of the power of words. Coming from the patient's practitioner, their impact is amplified many times over. Then, once a stone is dropped into the well, it cannot be recovered. Without ever lying to the patient, even if the news is bad—a slow, gradual, "care-full" and sensitive approach, attuned to what the patient wants to know[6] should be an indispensable part of healing. As Francis Peabody said, "The secret of patient care is in caring for the patient"—an aphorism that can be better appreciated today than a hundred years ago when it was first conceived.[7]

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