ABSTRACT
Improving the diversity and representation in the medical workforce requires intentional and deliberate efforts to improve the pipeline and pathway for underrepresented in medicine (UIM) applicants. Diversity enhances educational experiences and improves patient care and outcomes. Through a critical review of the literature, this manuscript offers evidence-based guidelines for physician pipeline and pathway programs. Recommendations are provided regarding considerations on the types of programs and surrounding implementation to ensure a sound infrastructure and framework. We believe this guide will be valuable for all leaders and faculty members seeking to grow the UIM applicant pool in our efforts to advance diversity, equity, and inclusion within medicine.

BACKGROUND
Diversity in medicine is an academic imperative. Incorporating diversity offers many benefits to the community, within and outside the walls of the Emergency Department (ED). Diversity creates richer educational experiences, amplifies cultural competencies, and strengthens professionalism. A diverse physician group also improves patient care, and outcomes, as physicians underrepresented in medicine (UIM)* enhance cultural sensitivity and are more likely to serve low-income, minority, and disadvantaged populations.

Despite the increased recognition and efforts, only a small number of medical specialties have demonstrated statistically significant increases in representation, suggesting that current efforts are insufficient. When the 20 largest specialties in medicine were analyzed between 2007 to 2018, none represented Black or LatinX populations in proportions comparable to the overall United States (U.S.) population. One study found that Black and LatinX representation was still sparse at the medical school faculty level (7.5%), despite 14.1% representation among medical students and 30% at the U.S. population level. Within Emergency Medicine (EM), women account for only 25% of physicians, while Black, LatinX, and Native American physicians comprise less than 10% of all active EM physicians. Furthermore, a recent study projects that EM will take about 54 years to reach the level of LatinX faculty representation commensurate with that of the U.S. population.

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*The Association of American Medical Colleges (AAMC) defined the term underrepresented minority (URM) to reflect the racial groups of Black, Mexican-American, mainland Puerto Rican, and Native American (American Indian and natives of Alaska and Hawaii). In 2003, to encompass the racial and ethnic populations within medicine who are underrepresented when compared to their respective numbers in the context of the greater population, this was further clarified to “underrepresented in medicine” (URiM or UIM). Although we recognize the use of URiM or UIM interchangeably, for consistency, we will use the term UIM for the duration of this paper.
Pipeline and pathway programs increase opportunities for UIM candidates through outreach, mentorship, and other critical structural support needed to advance diversity, equity, and inclusion (DEI) in medicine. In this paper, we delineate pipeline, pathway, and outreach programs, discuss components of pathway programs, and steps towards successful implementation of DEI initiatives.

CRITICAL APPRAISAL OF THE LITERATURE
The Council of Residency Directors in Emergency Medicine (CORD) Best Practices Subcommittee publishes a series of articles entitled CORD Best Practice reviews; this manuscript is ninth in the series. With the assistance of a medical librarian, a literature review was conducted from inception until January 2021 through MEDLINE via PubMed using the terms and medical subheadings (MeSH) terms focused on diversity, equity, and inclusion (Appendix). Additionally, a bibliography review was conducted for potential articles for inclusion. Two reviewers independently screened the 2080 articles, of which 59 were relevant for this review.

Best practice recommendations were created based on the literature appraisal. Whenever supporting evidence was unavailable, consensus opinion and the author’s combined expertise were utilized. The Oxford Centre for Evidence-Based Medicine criteria (Tables 1 and 2) were implemented to provide the level and grade of evidence for each best practice statement. Prior to submission, the manuscript was reviewed by the CORD Best Practice Subcommittee, followed by a two-week review on the CORD website to seek feedback from the CORD community.

<table>
<thead>
<tr>
<th>Level of Evidence</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>1a</td>
<td>Systematic review of homogenous RCTs</td>
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<tr>
<td>1b</td>
<td>Individual RCT</td>
</tr>
<tr>
<td>2a</td>
<td>Systematic review of homogenous cohort studies</td>
</tr>
<tr>
<td>2b</td>
<td>Individual cohort study or a low-quality RCT*</td>
</tr>
<tr>
<td>3a</td>
<td>Systematic review of homogenous case-control studies</td>
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<tr>
<td>3b</td>
<td>Individual case-control study**</td>
</tr>
<tr>
<td>4</td>
<td>Case series/Qualitative studies or low-quality cohort or case-control study***</td>
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<tr>
<td>5</td>
<td>Expert/consensus opinion</td>
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</tbody>
</table>

*RCT, randomized controlled trial; *, defined as <80% follow up; **, includes survey studies and cross-sectional studies; ***, defined as studies without clearly defined study groups*
Table 2. Oxford Centre for Evidence-Based Medicine Grades of Recommendation

<table>
<thead>
<tr>
<th>Grade of Evidence</th>
<th>Definition</th>
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<tbody>
<tr>
<td>A</td>
<td>Consistent level 1 studies</td>
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<td>B</td>
<td><strong>Consistent</strong> level 2 or 3 studies or extrapolations* from level 1 studies</td>
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<tr>
<td>C</td>
<td>Level 4 studies or extrapolations* from level 2 or 3 studies</td>
</tr>
<tr>
<td>D</td>
<td>Level 5 evidence or troublingly inconsistent or inconclusive studies of any level</td>
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*“Extrapolations” are where data is used in a situation that has potentially clinically important differences than the original study situation.

Barriers to Entering the Health Professions
Barriers exist that hinder students from entering the health professions. Recognition of the barriers (Table 3) for UIM, female, and economically disadvantaged students provides perspective on the lived experience and the challenges that must be overcome to pursue a career in medicine. However, this further highlights the importance of pathway programs to ensure a diverse, equitable, and inclusive medical workforce.

Table 3. Barriers to Health Professions Education for UIM

| Socio-economic barriers | • High indebtedness  
                          | • Lack of encouragement to complete high school, enter college, or pursue higher education  
                          | • Lack of financing for college and graduate school  
                          | • Low income/poverty  
                          | • Need to provide financially for family  
                          | • Teen pregnancy/Early parenting |
|-------------------------|------------------------------------------------|
| Educational barriers    | • Concerns regarding duration of training  
                          | • High dropout rates of UIM in high school and college  
                          | • Hidden curriculum propagating bias/racism  
                          | • Less developed networks and lack of mentorship  
                          | • Lack of minority faculty  
                          | • Lack of traditional educational path  
                          | • Low on-time graduation rates  
                          | • Poor performance on standardized achievement tests |
| Psychosocial barriers   | • Difficulties in acclimation to majority culture |
- A sense of isolation due to low visibility of others with similar backgrounds
- Lack of support from family and friends
- Lack of cultural representation
- Stereotype threat—risk of person conforming to stereotypes about their social group
- Undesirable geographic distance of school from student’s home and community
- Low expectations of academic ability by others

However, simply recognizing the barriers is not enough. Deliberate actions to mitigate or remove these barriers is imperative including creation of novel educational and training frameworks that focus on improving trainee performance.\textsuperscript{5,23,24} Pathway programs allow the opportunity to reduce the isolating experiences of UIM by creating a supportive network and inclusive culture as a foundation\textsuperscript{23} which is crucial to maximize retention. Research has demonstrated that the greatest barrier to successful entry into health professions for UIM students is the undergraduate-graduate interface. This is due to the high attrition rate with only 38.1\% of all UIM doctorates completing their degrees, as opposed to 51.3\% of all non-UIM doctorates.\textsuperscript{23}

**Overview of Pipelines, Pathways, and Outreach Programs**

A scoping literature review found the most frequent approaches to increase minority representation in the medical workforce were pipeline programs (43\%), changes in affirmative action laws (23\%), and changes in admission policies (21\%).\textsuperscript{5} Pipeline and pathway terminology are often used interchangeably to describe programs created to increase minority matriculation into medical schools and healthcare workforce diversity. Starting as early as elementary school, these programs offer mentorship to UIM students,\textsuperscript{25} offering opportunities to identify and support future diverse medical students.\textsuperscript{5,25,26} These opportunities inspire other UIM students to serve within the health professions by increasing awareness of the various specialties, and even offer specific skills training.\textsuperscript{25}

The words *pipeline* and *pathway* carry with them different perspectives. *Pipeline* can be considered restrictive, exclusive, and confining and may have potentially harmful attributions, such as the “School-to-Prison” pipeline.\textsuperscript{27} *Pathways*, in contrast, acknowledges a compendium of entry points that support the program. Because of this, some advocate for the move away from the word *pipeline* to favor the use of *pathway*\textsuperscript{27}, and thus *pathway* will be used for the remainder of this manuscript. Outreach programs are typically discrete events, usually consisting of a single or a select number of time points (Table 4),\textsuperscript{3,28,29} and may include second look visits or weekends for UIM applying to medical schools, often run by the medical school’s diversity committees or Student National Medical Association (SNMA) groups.\textsuperscript{3}

**Table 4. Outreach Activities**\textsuperscript{28,29}
Pathway programs effectively enhance academic performance and increase the likelihood that UIM and other disadvantaged undergraduate students enroll in a health professions school. However, the long-term success when targeting high school students remains less than <20%, suggesting that more work still needs to be done to bridge this gap.\textsuperscript{25}

**TYPES OF PATHWAY PROGRAMS**
Pathway programs are a key strategy for increasing the enrollment of UIM students into medical schools.\textsuperscript{25} These programs are created to target different age groups of learners and provide a variety of different educational or developmental benefits to the participants\textsuperscript{25} and encompasses a different goal and approach which is described below.

**Elementary/High School to College Program Pathways**
Elementary and high school programs help pre-college UIM students succeed through their primary and secondary education and continue progressing down the pathway towards medical school. Early introduction and exposure to healthcare has been shown to effectively influence career decisions.\textsuperscript{17} Studies have found that among all ethnic groups, the major hurdles to attending medical school are obtaining a high school diploma and bachelor’s degree.\textsuperscript{30} Once this hurdle is overcome, the proportion of UIM college graduates to apply to medical school are similar to proportions of White college graduates.\textsuperscript{30}

Goals of these programs include preparing students for college life,\textsuperscript{24,31} exploring different healthcare careers,\textsuperscript{24,32–34} increasing research exposure,\textsuperscript{10,35} and improving basic science knowledge.\textsuperscript{2} Programs vary from summer experiences \textsuperscript{2,11,34} to longitudinal experiences during the school year\textsuperscript{12} and offer educational components, such as core sciences (e.g., biology, chemistry, physics)\textsuperscript{2} or healthcare-related topics (e.g., disparities, physiology, patient interview sessions).\textsuperscript{12–15} Interactive sessions such as simulation, physical exam practice, workshops, and seminars are also included.\textsuperscript{12–14,29,33,36}

College preparation is a significant component of many elementary to high school pathway programs, and include exposure and guidance to the university admissions process\textsuperscript{2,12,14} financial
aid guidance,2,12,14 and college fairs.36 Because standardized test scores continue to be a barrier for UIM, Scholastic Assessment Test (SAT) preparation is also a component of these programs.2,10,37

Mentorship is a crucial component of elementary to high school pathway programs and may be provided by medical students, graduate students, or working professionals.2,14,26,34,38 Shadowing opportunities are important,2,32 including patient care in free clinics.15 Multiple studies suggest that educational content and mentorship can be provided as outreach programs by medical students.13,39 Another strategy was the creation of Health Professions Affinity Clubs, in which AmeriCorps volunteers visited high schools to introduce students to health professions via projects, mentoring, and shadowing opportunities.26

**College to Medical School Pathway**
Undergraduate level pathways serve to expose UIM students to the health professions. The structure of these programs vary in length,28,29 frequency of meetings,40 time of year,10 and depth of contact.40

Another common pathway program is summer internship programs offering opportunities in education,24 research,10,40 clinical care,41 or a combination of these (Table 5).41–44

**Table 5. Examples of Undergraduate Pathway Programs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Programming Details</th>
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| **Summer Medical/Dental Education Program**2,24   | • National summer enrichment program for college undergraduates from disadvantaged backgrounds that provides intensive preparation for medical or dental school.2,24  
  • Provides courses in science, math, writing, and career development skills based on an individualized education plan.24  
  • Medical school acceptance rate of 64% among undergraduate participants.2                                                                 |
| **Health Frontiers in Tijuana Undergraduate Internship Program**41 | • 14 consecutive weekly, 1-hour clinical shadowing engagements.  
  • Integrates US undergraduate students longitudinally in a US-Mexico binational free clinic alongside their Mexican undergraduate peers.  
  • Exposes undergraduate interns to clinicians with different health careers based on students area of interest or at the medical student-run free clinic.  
  • Incorporates education on medical Spanish, conditions seen frequently in clinics, and barriers to healthcare.41 |
| SEALS<sup>42</sup> | • Six-week program that promotes socialization, education in science learning, acquisition of financial literacy, leveraging of mentorship and networks, and resilience  
• Sessions utilize lectures, dissection lab, clinical shadowing, workshops on writing skills, and workshops on professional development.<sup>42</sup> |
| --- | --- |
| Health Disparities Clinical Summer Research Fellowship Program<sup>47</sup> | • Incorporates healthcare exposure with research.  
• Community organization involves: shadowing healthcare professionals, engaging in enrichment activities, providing information on health-professions graduate school admissions, as well as preparing for MCAT. |

<sup>US, United States; MCAT, Medical College Admissions Test</sup>

Longitudinal pathways exist to offer “living and learning communities,” consisting of a designated dorm floor for pre-health students to enhance networking and surround undergraduate students with a supportive cohort.<sup>40</sup> Undergraduate pre-health organizations<sup>40</sup> also provide career counseling, test support, networking opportunities with health professions students and faculty, and shadowing opportunities.<sup>40</sup>

**Bachelor of Science-Medical Doctor (BS-MD) Pathway**

More specialized undergraduate to medical school pathway, the combined BS-MD program can be true high school to medical school pathway. For example, the Premedical Honors College, an eight-year college through medical school program targeting South Texas, involves 13-medically underserved counties,<sup>45</sup> of which the majority of the population (81%) identifies as LatinX. It provides conditional acceptance to medical school based on the completion of the Bachelor of Science and includes rigorous undergraduate curriculum, enrichment experiences, clinical experiences, tutoring, and a summer research program.<sup>45</sup> It has successfully produced 134 medical school matriculations, 110 (82%) of which are UIM and 106 (79%) are LatinX.<sup>46</sup>

Other BS-MD programs offer undergraduates conditional acceptance to medical school. The Mount Sinai School of Medicine created a Humanities and Medicine program, an early admissions program, that allows sophomore-year undergraduate students to apply and pursue their interests in humanities and social sciences prior to matriculating to medical school.<sup>10</sup> These programs often do not require MCAT scores and thus remove one barrier to gain acceptance to medical school.<sup>47</sup>

**Community Colleges (CC) to Medical School**

Another undergraduate to medical school pathway is the CC pathway. Community colleges, defined as 2-year post-secondary education institutions, serve as a common pathway to the
attainment of higher education for low-income and UIM students. Talamantes studied medical
students’ educational path to better understand the use of CCs. Of students matriculating into
medical school that used a CC pathway, LatinX were the most common racial-ethnic group
(34%), then Black (28%), White (27%), and Asian (27%) matriculants. This data suggests that
pathway programs targeting CCs may be a promising approach to increasing the diversity of
medical school applicants, although improving processes to transfer credits from CCs to
four-year institutions is recommended. Additionally, four-year institutions and medical schools
can reach out to local CCs with invitations to seminars, didactics, or research projects to help
create pathways to the health professions.

**Post-Baccalaureate Pathways (PBPP)**
PBPP programs are an important strategy for increasing diversity among medical school
matriculants. Studies demonstrate that UIM and disadvantaged students tend to be at greater risk
for academic difficulties and lower MCAT scores, which are known barriers to medical school
admission. PBPPs frequently involves a one- or two-year curriculum that emphasizes
basic science skills required for the MCAT and medical school. Other topics include academic
enrichment skills, personal well-being, and professionalism. Some PBPPs may offer research options, while others focus on clinical opportunities with underserved patients. These PBPP consist of small cohorts (2-8 students) and are often supported through institutional
funding to provide financial support and tuition waivers.

In 2014, 36% of national PBPP identified themselves as having a special focus on UIM or
economically or educationally disadvantaged students. Many programs offer early or
conditional acceptance to degree-confirming MD, PhD, and combined MD/PhD programs,
pending successful completion of the program. A few PBPPs confer Master
degrees or certificates upon successful completion. Academic or civic credit may also be
awarded to students for participating. Students are selected via a national open application
with some PBPPs giving preference to those who had been unsuccessful in their medical school
applications.

Despite having academic profiles that were not traditionally promising for medical school
admissions on entering the Medical/Dental Education Preparatory Program (MEDPREP)
program, 83.3% of graduates successfully matriculated in medical school. Of those, 53%
worked in primary care and 40% worked in medically underserved areas after graduation.
Long-term data has shown that PBPP graduates have pursued careers in every specialty and are
more likely to provide care in underserved areas or for vulnerable populations.

**Historically Black Colleges & Universities (HBCU)**
Historically Black Colleges and Universities (HBCU) and Historically Black Medical Schools
(HBMS) have a significant impact on the diversity of medicine. HBMS is instrumental in the
overall representation of Black chairs, faculty, and students in U.S. medical schools. Xavier University and Howard University are the top two producers of Black graduates of medical schools. Black students who graduate from HBCUs were found to be more likely to go to graduate school and complete their doctoral degrees than Black students from other schools.

HBCUs were found to devote greater effort to premedical training, developing strong relationships with medical schools, and offering a range of sponsored enrichment opportunities to their students. Successful interventions include providing all premedical students a core curriculum instead of allowing them to choose their courses, providing tutors for all first and second year students, and beginning MCAT practice during their first year of college. HBCUs are also successful in building strong pathway partnerships with medical schools, educating on health disparities, and teaching cultural competency skills.

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**Best Practice Recommendations:**

1. Interventions should be focused on helping to overcome the major hurdles to medical school entrance for UIM (e.g., high school diploma and a bachelor’s degree). (Level 5, Grade D)
2. Develop and support pathway programs to create opportunities for the introduction and exposure to healthcare at an early time point in order to influence career decisions in UIM. (Level 4, Grade C)
3. Allow medical students to deliver educational content and mentorship for pathway programs and outreach programs. (Level 5, Grade D)
4. Consider pathway programs targeting community colleges as an approach to increasing the diversity of medical school applicants, most notably LatinX UIM. (Level 5, Grade D)
5. Consider post-baccalaureate premedical programs with a focus on UIM or disadvantaged students as an important strategy to increasing diversity in medical school matriculants. (Level 5, Grade D)
6. Collaboration and support of Historically Black Colleges and Universities (HBCU) is beneficial as they graduate students that are more likely to attend and complete graduate school. (Level 5, Grade D)

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**INFRASTRUCTURE AND FRAMEWORKS FOR IMPLEMENTING PATHWAY PROGRAMS**

Factors related to implementing pathway programs are important determinants of the success of these programs. Below, we explore the following implementation elements: (1) frameworks and theories, (2) partnerships, (3) funding, (4) management structure, (5) participant selection, (6) academic enrichment and instructional design, and (7) mentoring, advising, and networking.

**Frameworks and Theories**
Several articles outlined pathway programs’ frameworks and theoretical underpinnings. Young built on the knowledge translation framework to generate a 6-part framework for developing pathway programs (Figure 1). When developing a portfolio of comprehensive pathway programs across the educational continuum, Grumbach suggested that institutions adopt a “distal-to-proximal” strategy to prioritize later-stage participant support (e.g., post-baccalaureate programs), then work backwards to include earlier-stage programs.

Figure 1. Young and colleagues framework for diversity-related pathway programs.

Johnson and Bozeman constructed the asset bundles model from other models and theories that focus on human capital (e.g., knowledge and technical abilities) and social capital (e.g., ability to tap into resources embedded in relationships), and the ways in which institutions perpetuate marginalization. Asset bundles are “the specific sets of abilities and resources that individuals develop that help them succeed in educational and professional tasks.” The authors assert that these five asset bundles are critical to retaining UIMs on successful educational pathways (Table 7). Many pathway programs incorporate individual assets, but few programs work to enhance all the assets.

Table 7. Asset Bundle Model Components and Descriptors.

<table>
<thead>
<tr>
<th>Asset Bundle</th>
<th>Description</th>
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<tbody>
<tr>
<td>1. Human Capital: Educational</td>
<td>● Focuses on academic performance, which is primarily determined by students’ high school math and science curricula and teacher quality.</td>
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<td></td>
<td>● Advance courses like advanced placement, international baccalaureate,</td>
</tr>
<tr>
<td>Endowments</td>
<td>and college-prep, as well as hand-on laboratory experiences, study groups, tutors, and systemic educational reform to improve math and science curricula can enhance this asset.</td>
</tr>
</tbody>
</table>
| 2. Human Capital: Science Socialization | ● UIM students may need additional encouragement to envision themselves as physicians and scientists, as it is unlikely that they have regular access to role models in these fields in their homes or proximal communities due to systemic underrepresentation.  
● This can be done by: (1) emphasizing the relevance of science and technology to addressing problems in their community; (2) exposing students to successful identity-concordant scientists and physicians; and (3) developing individualized plans to benchmark students’ progress toward their career goals. |
| 3. Social Capital: Network Development and Expansion | ● Mentoring and extracurricular activities are important avenues to develop and expand social networks.  
● Mentoring that is both identity-concordant and cross-cultural can be successful in expanding students’ networks and facilitating positive career outcomes.  
● Broadening peer networks through multiracial study groups, for instance, may expose UIM students to information and resources they would not otherwise obtain. |
| 4. Social Capital: Family Expectations | ● Family expectations, which may be dictated by constraining social norms such as women in caretaking roles, may create tension with educational goals. Conversely, familial expectations that affirm educational goals can be a positive influence.  
● These dynamics are difficult to impact externally, so programs may need to reinforce other assets like science socialization. |
| 5. Financial Capital: Material Resources | ● Scholarships and grants are critical resources needed to reduce education attrition among students who do not have significant familial financial resources.  
● Economically disadvantaged students often take part-time employment, limiting their time for academic study and extracurricular enrichment, which further limits their competitiveness for scholarships. |

**Partnerships**

Robust, intra- and inter- institutional partnerships are central to the infrastructure of successful pathway programs. Coordinating UIM pathway efforts among institutions can help minimize competition for the same students among organizations with a shared mission of increasing and supporting UIM physicians. Partnerships between majority- and minority- serving organizations can provide a rich synergy of exposures, experiences, and infrastructure for students. This offers increased networking and mentoring opportunities, exchange of diverse ideas and expertise, and ability to detect and augment student readiness for successful medical
careers. Some inter-institutional partnerships were informal and faculty-driven, often resulting from research collaborations (Table 8).

Table 8. Types of Organizations Included in Partnerships

<table>
<thead>
<tr>
<th>Category</th>
<th>Organizations</th>
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<tbody>
<tr>
<td>Educational</td>
<td>Public School Systems, Community Colleges, Universities, Health Professions</td>
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<tr>
<td></td>
<td>and Graduate Schools and Colleges, Departments, Cultural Centers, Diversity,</td>
</tr>
<tr>
<td></td>
<td>Equity, and Inclusion Offices</td>
</tr>
<tr>
<td>Medical</td>
<td>Federally Qualified Health Centers, Free Clinics, National and Local Medical</td>
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<tr>
<td></td>
<td>Organizations, Teaching Hospitals and Health Systems</td>
</tr>
<tr>
<td>Community</td>
<td>Nonprofit Cultural Organizations and Coalitions, Community Advisory Boards,</td>
</tr>
<tr>
<td></td>
<td>Community-based Educational Centers, Nonprofit Organizations Developed from</td>
</tr>
<tr>
<td></td>
<td>Community-Academic Partnerships and Alumni</td>
</tr>
<tr>
<td>Other</td>
<td>State Legislature, Congressional Delegations, Talent Search Programs, Other</td>
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<tr>
<td></td>
<td>Pathway Programs</td>
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Funding
Sustainable funding is critical for the success and survival of pathway programs. Programs are usually funded from multiple sources, including federal, foundation, and institutional investments. Less commonly, programs also receive funding from non-profit professional organizations, private entities, and state legislative appropriations, or through program alumni efforts. Federal funding for pathway programs has been dramatically reduced over the years. In drafting this manuscript, the authors searched for several of the federal funding sources for the cited programs, which do not appear to currently be taking new applications. As external financial resources for pathway programs shrink, greater onus is on universities and health systems to fund these initiatives.
The program budgets ranged widely from $2,600 (2007 dollars) for a student-run, specialty-specific initiative, to $25,000 (2018 dollars) for a 2-day workshop, to several million dollars for a comprehensive collection of pathway programs. The University of Illinois at Chicago’s Urban Health Program (UHP) is funded by the state and 7 university colleges to amass an approximately $4.3 million budget (2012 dollars) to serve hundreds of preschool through graduate school students annually. The state's financial contribution was tied to metrics that demonstrate success in supporting UIM students matriculation to the health professions. In 2011, highly effective post-baccalaureate programs typically cost $20,000, and those that aimed to support UIM scholars tended to discount fees for students and rely mostly on institutional sources of funding. Some programs offered students stipends, scholarships, and/or wages to cover the costs of travel, tuition, fees, attendance at conferences and workshops, and other financial needs.

**Participant Selection**

Most pathway programs’ objective is to support and facilitate educational and healthcare career advancement for UIM racial and ethnic groups. However, few programs share their participant selection criteria in detail and only rarely explicitly state race/ethnicity criteria. Commonly, programs used proxy criteria for race/ethnicity including being from educationally or economically disadvantaged backgrounds. Another strategy for attracting UIM students was to recruit from majority UIM schools and communities, focus on racial/ethnic health inequities, or select students whose attributes and interests reflected the institution’s mission.

Few programs explicitly stated they used holistic review to select participants. Traditional measures of academic success like grades and test scores were only occasionally included as selection criteria. One program only used academic measures to exclude candidates with extremely low scores, while another program intentionally sought candidates whose academic performance may not match their potential. Nevertheless, satisfactory test scores and grades were used as measures of successful completion of the program.

While most programs included interest in medical or science careers in their selection, one program specifically excluded students who had previously shadowed physicians or participated in medical-related community service in order to capture students who needed an initial exposure to medicine. Most programs only required written application materials, but the MEDPREP post-baccalaureate program also requires on-site reading comprehension testing and 2 faculty interviews. The MERIT program invited students to a 3-week “tryout” medical leadership course where they evaluated students based on peer interactions, homework, and punctuality as indicators of their passion and potential, as opposed to traditional academic measures. Note that this program made a significant and longitudinal investment in their participants for seven years, which likely prompted their intensive screening...
process. A detailed target population resource based on target population, selection criteria, and application components can be seen in the Appendix.

**Academic Enrichment and Instructional Design**

The central feature of pathway programs are educational support and skills development. Many provided math and science enrichment and test prep through locally-developed programs or professionally-delivered courses with several programs developing individualized focused educational plans. Other academic enrichment activities include one-on-one and group tutoring, study skills (e.g., organization, note-taking, time management, learning approaches), critical thinking, leadership skills, public speaking, and writing. A few programs taught professionalism skills such as punctuality, email writing, goal setting, “appearance,” “etiquette,” and “speaking and dressing appropriately”. Some programs hosted wellness sessions and stress reduction techniques to mitigate burnout.

Academic enrichment was provided in both didactic and experiential formats, utilizing large and small group formats, and used multiple educational approaches (Table 9). Clinical shadowing opportunities with faculty and resident physicians were included in many programs. Students began with clinical shadowing, progressed to a combination of shadowing with history-taking, and ended with independent history-taking and oral presentations. Notably, all the programs cited were in-person experiences. Virtual adaptations may reduce costs and increase capacity for more participants, but may also reduce the effects of interpersonal interaction and physical integration into academic environments.

<table>
<thead>
<tr>
<th>Table 9. Structured Learning Approaches for Pathway Programs</th>
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<tbody>
<tr>
<td>Lectures and seminars</td>
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<td>Readings</td>
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<td>Videos</td>
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<td>Clinical vignettes</td>
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<td>Problem-based learning</td>
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<td>Hands-on dialectics</td>
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<td>Inquiry-based lab experiments</td>
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<td>Simulation training</td>
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<td>Facilitated review</td>
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<td>Role-playing</td>
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<td>Skits</td>
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<td>Debates on medical ethics</td>
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<td>Games</td>
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<td>Props and Models</td>
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<tr>
<td>Interviewing standardized patients</td>
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<td>Personal narratives</td>
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</tbody>
</table>
Mentoring, Advising, and Networking

Mentorship helps to transform student’s thinking, enhance knowledge, develop technical and scientific skills, broaden aspirations and confidence in a future scientific career, and improve “professional socialization.” Although the characteristics students value in a mentor varied based on the students’ demographics, all agreed that engaged mentors were the most effective. The importance of concordant mentors (racial/ethnic, gender, and sexuality) was also underscored in several studies, citing the intangible benefit of having a mentor that “looks like you” helping students visualize themselves as successful physicians. This minimizes beliefs that their physician aspirations are unattainable and mitigate experiences of isolation that are linked to low self-efficacy as students develop their “scientific identities.” For this reason, learners may prefer to seek their own mentors rather than having mentors assigned to them.

Mentorship may be structured small group led faculty, although most were one-on-one mentoring. Rarely, mentoring and coaching was longitudinal (e.g., duration of a 2-year post-baccalaureate program or all 4 years of undergraduate education), including after participants complete the program and during major transitions (e.g., from high school to university). Peer and near-peer mentoring and advising was also a component of some programs.

In addition to formal mentoring, pathway programs also facilitate networking opportunities in small groups for students to interact with physicians, scientists, medical graduate students, and alumni. Often, formal networking occurs over scheduled lunches. Informal networking occurred during events like career fairs, didactics, research symposium, shadowing, and barbecues.

Several programs also offered mental health counseling and other intensive social and emotional support to their participants. One program noted that they prioritized an affirming learning environment where their scholars felt “safe, welcomed, and supported.” Several programs provided general career advising, covered tips on college and medical school admissions, coached students on interview preparation, and counseled on financial planning and scholarships. The MEDPREP program provided intensive mentoring, career advising, and academic counseling to all participants, but augmented these services when students showed signs of struggles (e.g., C or lower grades or financial difficulties).
**Best Practice Recommendations:**

1. Pathway programs should utilize frameworks and theories that leverage participants' assets, incorporate diverse and developmentally appropriate learning techniques, maximize relevance local health concerns, and center participants’ identities and lived experiences in an affirming way. (Level 5, Grade D)

2. Pathway programs should develop robust, intra- and interinstitutional partnerships to ensure success. (Level 4, Grade C)

3. Federal, foundation, institutional, and private funding is critical and should be sought out and advocated for. (Level 4, Grade C)

4. When creating a program to support UIM groups, clearly state selection criteria including, but not limited to UIM race/ethnicity selection criteria, along with other primary selection criteria (e.g., factors associated with systemic disadvantage, interest in healthcare, markers of academic success). (Level 4, Grade C)

5. Create programs for academic enrichment that utilize a variety of approaches and instructions for both didactic and experiential learning. (Level 4, Grade C)

6. Programs should consider identity-concordant mentoring, coaching, and networking as they are powerful mechanisms to encourage and motivate UIM success. (Level 4, Grade C)

**LIMITATIONS**

This paper focused on pipeline, pathway, and outreach. Recognizing the vastness of DEI, other topics (e.g., faculty recruitment and retention, holistic review, mitigating bias in residency recruitment) will be covered elsewhere. It is possible that we may have missed some relevant articles in our search. To mitigate this, a comprehensive search strategy with the aid of a medical librarian was conducted, supplemented by bibliographic review and additional recommendations from topic experts. Finally, much of the literature of pathways focuses on general fields in health professions education and there is limited literature specifically focused on pathways within Emergency Medicine.

**CONCLUSION**

Pathway programs are critical to increasing diversity and equity within Emergency Medicine. This manuscript summarizes components of pathway programs and steps towards successful implementation through best practice recommendations. We hope this manuscript will inform readers on how best to form and sustain new pathway programs at their institutions.
APPENDIX. Search Strategy

PubMed (Date of Search: 1/21/21)
(((medical education OR meded[tiab]) AND (recruitment OR recruit* OR retention[tiab] OR retain* OR pipeline)) AND (diversity OR diverse OR inclusive OR underrepresented OR minority OR minorities OR ethnic OR ethnicity OR ethnicities OR racial OR race OR tokenism OR token[tiab] OR Black OR Asian OR Blacks OR Asians OR Puerto Rican OR Mexican American OR Native American OR American Indian OR Alaskan Native OR Hawaiian OR African American OR Hispanic OR Latino OR Latinx OR Latina)) AND (physician OR doctor OR trainee OR residency OR trainees OR residency OR interns OR intern OR faculty)

APPENDIX. Target Population, Participant Selection Criteria, and Application Components

<table>
<thead>
<tr>
<th>Explicitly Stated or Implied Target Racial/Ethnic Group</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian/Alaskan Native (AIAN)</td>
<td>Acosta 2006; Bellejos 2018; Brodt 2019; Curtis 2012; Smith 2009; Prunuske 2016</td>
</tr>
<tr>
<td>Black/African-American</td>
<td>Derck 2016; Edlow 2007; Fincher 2002; Smith 2009</td>
</tr>
<tr>
<td>LatinX</td>
<td>Burgos 2015; Derck 2016; Edlow 2007; Fernandez 2018; Thomson 2003; Smith 2009</td>
</tr>
<tr>
<td>Underrepresented Asian American and Pacific Islander</td>
<td>Judd 2001</td>
</tr>
<tr>
<td>UIM or racial/ethnic minorities, not otherwise specified</td>
<td>Butts 2012; Crews 2020; Campbell 2019; Deas 2012; Toney 2012; Stewart 2020; Roche 2020; Phillips 2012; Prunuske 2016; Patel 2015; Muppala 2020; Minhas 2018; Metz 2017; Judd 2001; Fritz 2016; Andriole 2015</td>
</tr>
<tr>
<td>“Disadvantaged”, “underresourced”, and “underserved” backgrounds and communities</td>
<td>Acosta 2006; Crews 2020; Deas 2012; Thomson 2003; Stewart 2020; Patel 2015; Judd 2001; Andriole 2015</td>
</tr>
<tr>
<td>First-generation college student or “educationally disadvantaged”</td>
<td>Burgos 2015; Butts 2012; Crews 2020; Stewart 2020; Smith 2009; Prunuske 2016;</td>
</tr>
<tr>
<td><strong>Socioeconomically disadvantaged; household income &lt;200% of the federal poverty level</strong></td>
<td>Burgos 2015; Butts 2012; Crews 2020; Stewart 2020; Schellinger 2020; Prunuske 2016; Minhas 2018; Metz 2017; Mains 2016; Andriole 2015</td>
</tr>
<tr>
<td><strong>Single-parent household</strong></td>
<td>Crews 2020</td>
</tr>
<tr>
<td><strong>From rural or inner city community</strong></td>
<td>Campbell 2019; Smith 2009</td>
</tr>
<tr>
<td><strong>Attending and “underresourced” high school or high school where majority of students live in for low income households</strong></td>
<td>Crews 2020; Metz 2017</td>
</tr>
<tr>
<td><strong>Grew up in community with food deserts</strong></td>
<td>Metz 2017</td>
</tr>
<tr>
<td><strong>Grew up in a health provider shortage area (HPSA)</strong></td>
<td>Metz 2017</td>
</tr>
<tr>
<td><strong>Interested in a health career or health disparities</strong></td>
<td>Acosta 2006; Bellejos 2018; Brodt 2019; Fincher 2002; Stewart 2020; Smith 2009; Roche 2020; Patel 2015; Muppala 2020; Fritz 2016</td>
</tr>
<tr>
<td><strong>Prior healthcare experience</strong></td>
<td>Burgos 2015</td>
</tr>
<tr>
<td><strong>Selected from applicants who were not admitted to the medical school (Post-Baccalaureate Programs Only)</strong></td>
<td>Campbell 2019; Deas 2012; DeCarvalho 2018; Andriole 2015</td>
</tr>
<tr>
<td><strong>Personal statement/essay</strong></td>
<td>Crews 2020; Derck 2016; Stewart 2020; Schellinger 2020; Roche 2020; Patel 2015; Mains 2016; Kana 2020; Fritz 2016</td>
</tr>
<tr>
<td><strong>Potential future academic success</strong></td>
<td>Minhas 2018; Andriole 2015</td>
</tr>
<tr>
<td><strong>Demonstrated prior academic success (GPA, standardized test scores, etc.) or in good academic standing</strong></td>
<td>Crews 2020; Derck 2016; Thomson 2003; Stewart 2020; Smith 2009; Schellinger 2020; Roche 2020; Metz 2017; Kana 2020; Fritz 2016</td>
</tr>
<tr>
<td><strong>Motivation to succeed</strong></td>
<td>Crews 2020</td>
</tr>
</tbody>
</table>
| **Recommendation** | Crews 2020; Thomson 2003; Stewart 2020; Schellinger 2020; Roche 2020; Metz 2017;
<table>
<thead>
<tr>
<th><strong>REFERENCES:</strong></th>
<th>Mains 2016; Kana 2020; Fritz 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identified by teachers or advisors as having an “untapped passion for learning.”</td>
<td>Crews 2020</td>
</tr>
<tr>
<td>Skills (i.e. computer, language, fundraising, writing, etc.)</td>
<td>Burgos 2015</td>
</tr>
</tbody>
</table>


43. Stewart KA, Brown SL, Wrensford G, Hurley MM. Creating a Comprehensive Approach to Exposing Underrepresented Pre-health Professions Students to Clinical Medicine and


59. Thompson MJ, Huntington MK, Hunt DD, Pinsky LE, Brodie JJ. Educational effects of


