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Viewpoint

Young investigators are entering the physician-scientist workforce (PSW) at a rate that is insufficient to maintain it (1), threatening the future of a group that plays a vital role in medical progress. New physician-scientists are the products of a training pipeline that encompasses many possible pathways that vary widely in organization and timing of research training. Additionally, within individual pathways, program organization and trainee support differ considerably across phases of training. This complexity leads to training experiences fraught with challenges and uncertainties that may provoke attrition. Thus, leaders in the physician-scientist community have pointed to the training pipeline itself as the bearer of considerable responsibility for the problematic trends facing the PSW (2). To address these issues, Milewicz et al. proposed action items aimed at increasing trainee numbers and diversity, providing broad support throughout training, and decreasing the total time spent in the pipeline (3). This roadmap for improving physician-scientist training has generated substantial discussion about how training programs, institutions, and professional organizations can implement its recommendations. However, notably absent from these discussions has been a role for trainee-driven approaches. As arguably the greatest stakeholders, we, as current physician-scientist trainees, are devoted to being a part of the solution. Here, we present actions we are taking to bolster the front end of the physician-scientist pipeline through initiatives of the American […]

Reinforcing our pipeline: trainee-driven approaches to improving physician-scientist training

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Young investigators are entering the physician-scientist workforce (PSW) at a rate that is insufficient to maintain it (1), threatening the future of a group that plays a vital role in medical progress. New physician-scientists are the products of a training pipeline that encompasses many possible pathways that vary widely in organization and timing of research training. Additionally, within individual pathways, program organization and trainee support differ considerably across phases of training. This complexity leads to training experiences fraught with challenges and uncertainties that may provoke attrition. Thus, leaders in the physician-scientist community have pointed to the training pipeline itself as the bearer of considerable responsibility for the problematic trends facing the PSW (2). To address these issues, Milewicz et al. proposed action items aimed at increasing trainee numbers and diversity, providing broad support throughout training, and decreasing the total time spent in the pipeline (3). This roadmap for improving physician-scientist training has generated substantial discussion about how training programs, institutions, and professional organizations can implement its recommendations. However, notably absent from these discussions has been a role for trainee-driven approaches. As arguably the greatest stakeholders, we, as current physician-scientist trainees, are devoted to being a part of the solution. Here, we present actions we are taking to bolster the front end of the physician-scientist pipeline through initiatives of the American Physician Scientists Association (APSA).

APSA is a trainee-led national professional organization that has been dedicated to serving physician-scientists in training for more than a decade (4). Members of APSA are MD, DO, and dual-degree trainees as well as residents and fellows pursuing careers as physician-scientists. The mission of APSA is to provide trainees with a platform for advancing physician-scientist training and advocating for the future of translational medicine. In this role, APSA brings together trainees from across the country to collaborate on research efforts and initiatives aimed toward our training and future careers. Following publication of the NIH Physician-Scientist Workforce Working Group Report in 2014 (1), APSA leaders considered actions the organization can take to be a part of the solution to issues identified within the PSW. APSA's membership has both intimate experience with the current training environment and past experience as undergraduate students considering future careers as physician-scientists. Thus, APSA is uniquely positioned to take action at the front end of the physician-scientist pipeline with the goals of increasing both the number and the diversity of students entering physician-scientist training and supporting trainees during medical school or dual-degree programs.

Increasing trainee diversity and numbers through mentorship

The recent Association of American Medical Colleges (AAMC) National MD-PhD Program Outcomes Study reported that both applicant numbers and trainee diversity of MD-PhD programs are increasing (5), albeit sluggishly. Despite these encouraging trends, MD-PhD programs are currently graduating new physician-scientists at about half the rate necessary to maintain the PSW, and gender, racial, and ethnic diversity in MD-PhD programs is considerably less than in medical schools (1, 5). Therefore, it is clear that new strategies are essential to achieving the goals of increasing the size and diversity of the physician-scientist pipeline.

Mentorship is a critical component of physician-scientist training, and it has been suggested that an increased focus should be placed on formal mentorship to improve trainee outcomes (3, 6). We propose that mentorship is equally important to undergraduate students who are contemplating pursuing careers as physician-scientists, especially among women and students underrepresented in medicine (URM), for whom lack of role models is an often-cited explanation for underrepresentation. Mentorship is an established and effective feature of individual programs focused on increasing diversity in physician-scientist training, such as the Gateways to the Laboratory Program of the Tri-Institutional MD-PhD Program (7). However, to our knowledge, there have been no reports of a national mentorship program with the explicit goal of promoting undergraduate interest in physician-scientist training. Consequently, in 2014, APSA developed a mentorship program targeted to undergraduate students.

The APSA Undergraduate Mentorship Program matches APSA members in medical school or dual-degree programs with undergraduate students in one-on-one mentoring pairs. Recruitment of undergraduates occurs primarily by engaging prehealth advisors. In an effort to foster participation of women and URM students, recruitment is focused primarily on institutions with high female-to-male ratios, historically Black colleges and universities, and Hispanic-serving institutions. The program has grown exponentially in the four years since its inception and has met goals for high inclusion of women and URM students (Figure 1). This year, the program had over 700 total participants, with mentees

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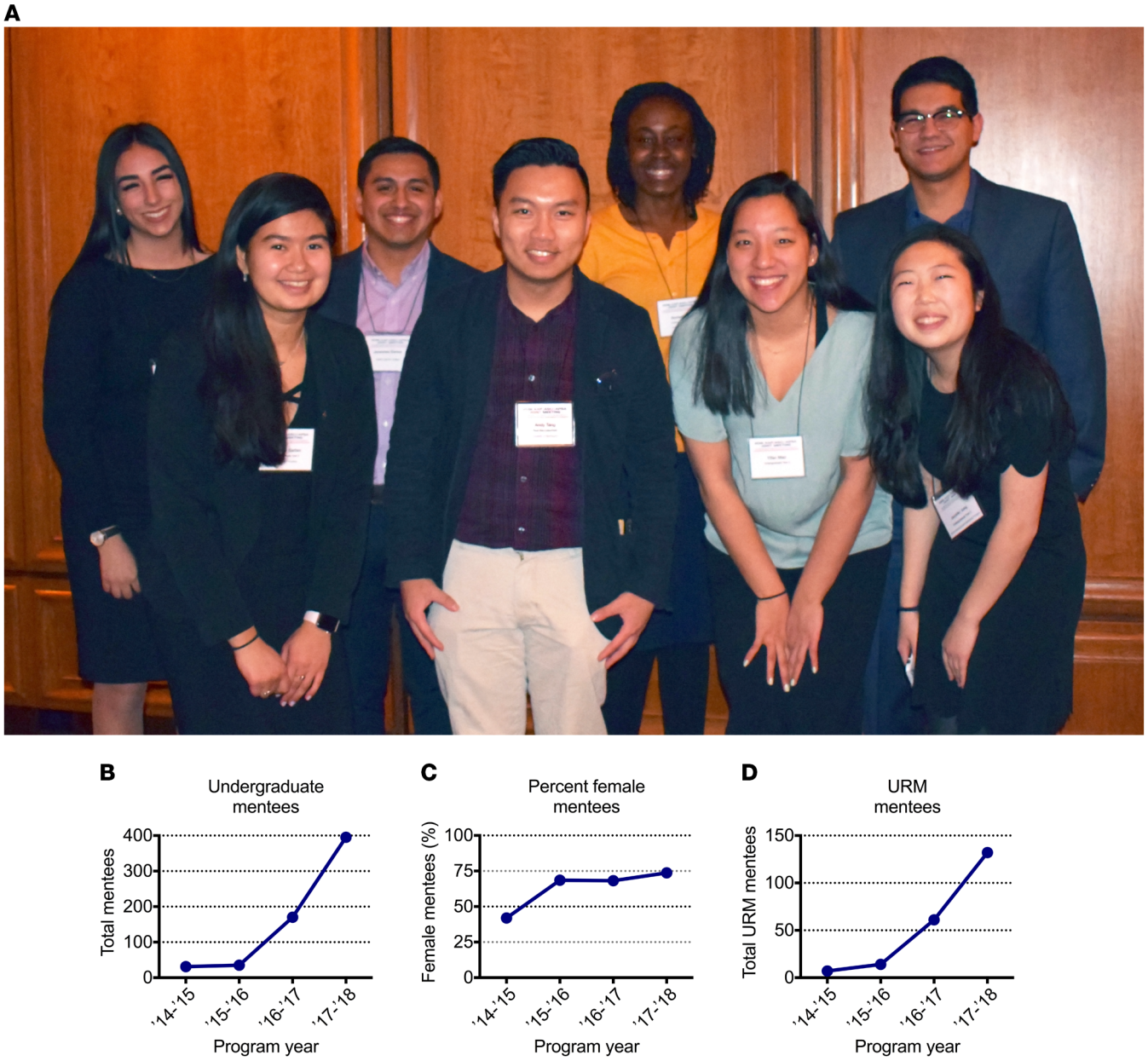

Figure 1. APSA undergraduate mentorship program travel awardees and program statistics by year. (**A**) Undergraduate students from the APSA Undergraduate Mentorship Program pose for a group photo at the 2018 AAP/ASCI/APSA Joint Meeting. These students' travel was made possible by a grant from the Burroughs Wellcome Fund that sought to increase interest in the physician-scientist career path among URM students. (**B**–**D**) Program statistics for the mentorship program by year for total number of undergraduate participants (**B**), percentage of female undergraduate participants (**C**), and total number of URM undergraduate participants (**D**).

comprising 74% women, 33% URM students, and 33% first-generation college students. To facilitate mentoring relationships that educate mentees about the careers of physician-scientists and address key issues that dissuade students from pursuing physician-scientist training, mentors and mentees receive monthly prompts that provide topics for discussion. Additionally, we strive to provide professional development opportunities to program participants, and this year, a grant from the Burroughs Wellcome Fund made it possible to send nine undergraduate mentees to the 2018 AAP/ASCI/APSA Joint Meeting (Figure 1). Moving forward, we are tracking participants' educational progress to determine how many students pursue physician-scientist training.

Expanding support for trainees during medical and graduate school

Attrition from MD-PhD programs is 10%–15%, and the rate at which MD and DO trainees lose interest in pursuing research careers is unknown (3). Attrition at this training stage may be preventable if unmet needs are addressed. One action item from Milewicz et al. was to create physician-scientist career development offices at medical schools, in part to foster a sense of community among all physician-scientist trainees (3). Consistent with this goal, APSA has developed a national local chapter (LC) program that brings together physician-scientist trainees at their home institutions,

irrespective of degree program or training level. These chapters seek to fill training deficiencies by providing a forum for local trainee-driven initiatives. To support these efforts, APSA provides resources to LCs, including grants to support chapter events and invite outside speakers, travel awards for trainees to attend the AAP/ASCI/APSA Joint Meeting, and interactive sessions for chapter leaders to exchange ideas across institutions. The program has grown to 31 LCs nationwide in only four years of existence, providing evidence of the need for these local communities.

To further support trainees, APSA has developed targeted resources for addressing apparent unmet needs. For MD and DO trainees, APSA hosts online interactive sessions in which successful physician-scientists share specialized advice for trainees not pursuing a PhD. To aid trainees in optimal residency selection, APSA has developed a centralized database of programs that integrate clinical and research training. This resource facilitates the delivery of information that can often be difficult to locate, particularly in specialties outside of internal medicine and pathology. To develop trainees' specialty interests, APSA offers resources derived from its partnerships with 33 medical and specialty organizations. These include APSA travel awards to partner associations' meetings and interactive career guidance sessions with prominent physician-scientists from partner associations' clinical specialties. Moving forward, APSA will continue ongoing research efforts concerning issues affecting physician-scientist trainees and utilize this information to develop programs and resources to supplement their training.

Recognizing a common vision through partnership

Addressing the issues facing the PSW is a priority that we, as trainees, share with the physician-scientist community, and APSA is a mechanism whereby trainees can act in a unified way. The strategies we have implemented to confront important challenges are both innovative and complementary to the ongoing efforts of the physician-scientist community. Recognizing our common goals, we call on program directors and institutional leaders to encourage their trainees to join APSA and participate in trainee-driven solutions. In addition, we encourage professional associations to support and partner with APSA in an effort to recruit future physician-scientists to their specialties. Surely, this type of mutual support and coordination of efforts will be necessary to maximize our impact. Together, we can safeguard the future of the next generation of physician-scientists and ensure their role in developing the cures of tomorrow.

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