

AAIM Perspectives

AAIM is the largest academically focused specialty organization representing departments of internal medicine at medical schools and teaching hospitals in the United States and Canada. As a consortium of five organizations, AAIM represents department chairs and chiefs; clerkship, residency, and fellowship program directors; division chiefs; and academic and business administrators as well as other faculty and staff in departments of internal medicine and their divisions.

Best Practices for Physician-Scientist Training Programs: Recommendations from the Alliance for Academic Internal Medicine



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INTRODUCTION

Physician-scientists serve as the bridge for translation of basic and clinical research into new paradigms of clinical care. Concerns about the declining size and aging of the US physician-scientist workforce have been voiced at many levels for several decades¹⁻¹³; as a result, the nation's long-held standing as the world's leader in biomedical research could soon end.¹⁴

With the goal of increasing the number of qualified trainees entering the physician-scientist workforce, undergraduate and graduate medical education research training programs have been developed. Physician-scientist training programs (PSTPs) operate at the graduate medical education level, combining mentored postdoctoral research training during residency and fellowship, best exemplified by the American Board of Internal Medicine (ABIM) Residency Research Pathway.¹⁵

Consistent standards governing the training and curriculum for physician-scientists and robust measures of a program's success have not been developed. Neither ABIM nor the Accreditation Council for Graduate Medical Education (ACGME) has established curricular standards for PSTPs. Given the concerning attrition rates of physician-scientists and individuals in training to become physician-scientists,^{10,11} we should develop standards for training and methodologies for tracking and continuous improvement.

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SURVEY RESULTS OF PSTP DIRECTORS

These issues were identified during a 2015 conference sponsored by the Alliance for Academic Internal Medicine (AAIM). The purpose of this conference was to “identify current impediments to attracting and supporting the careers of physician-scientists and develop a new set of solutions to sustain and grow the physician-scientist workforce.”¹¹

One outcome of the AAIM’s consensus conference was an initiative to better understand how individual PSTPs organize and operationalize their training experiences. The AAIM developed a survey soliciting detailed programmatic information from current program directors. The survey included 12 questions, with opportunities provided for open-ended answers. The AAIM distributed the survey to 87 directors of PSTPs and received a response rate of 46%. Of the respondents, 75% indicated that their institutions were home to 90 or more categorical residents. There was marked variability among current PSTPs with respect to program size, opportunities for trainees, and sources of salary and research support.

- When asked how many categorical residents were currently enrolled in their institutions’ PSTPs, 10% reported “less than 2,” whereas 25% reported “more than 10” (Figure 1).
- The maximum number of slots offered each year also varied widely among PSTPs: 10% reported a maximum number of 1 or 2 available slots, whereas some 38% reported there was no maximum number (Figure 2).
- In terms of opportunities afforded to trainees to enhance their PSTPs (Table 1), 74% provided combined residency and subspecialty training, and 30% provided an opportunity to pursue a master’s or PhD degree.
- Although 74% guaranteed participants salary and/or research support during the research phase of training, only 36% offered participants enhanced compensation during all or part of their training.
- More than 82% of trainees were funded by the National Institutes of Health (NIH) through institutional T32 or K12 awards; 77% received funding from the host academic department; and 54% received support through their mentors’ research grants (Table 2).

Survey results also indicated that PSTP directors are committed to improving their programs and were enthusiastic about participating in a workshop focused on identifying best practices and continuous improvement strategies for PSTPs.

The AAIM hosted a PSTP Directors Summit on March 22-23, 2017, in Baltimore, Md, which was described as “an interactive summit for identifying best practices and continuous improvement strategies for PSTPs.” The summit spanned 2 days and included 6 breakout sessions, with each breakout assigned 2 co-leaders. Each breakout session included 12-18 participants with self-identified expertise in the topic area and was charged with making recommendations about best practices in the topic area. These sessions were followed by a summary discussion during which best practices were agreed upon by the attendees.

BEST PRACTICE RECOMMENDATIONS

The remainder of this report highlights the group’s recommendations for best practices within each of 6 major categories (see Table 3).

PERSPECTIVES VIEWPOINTS

- The successful US medical research enterprise is contingent on a well-trained physician-scientist workforce.
- There is substantial variability in physician-scientist training and infrastructure.
- There should be a standard curriculum for physician-scientist training programs (PSTPs).
- The best candidates for PSTPs have significant research experience and a balanced commitment to both science and medicine.
- Carefully crafted mentorship teams and formal mentorship training are essential for trainee success.
- The success of PSTPs and their trainees is dependent on institutional and external funding.
- The success of PSTP graduates should be tracked.

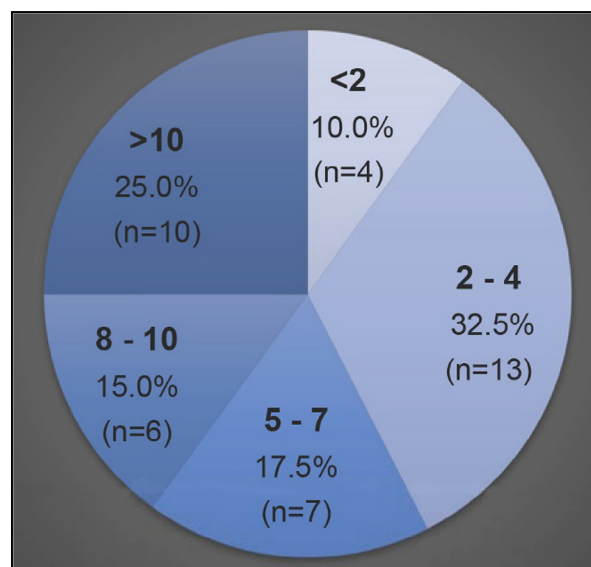


Figure 1 Number of Residents Enrolled in Individual Institutions’ PSTPs (N = 40)

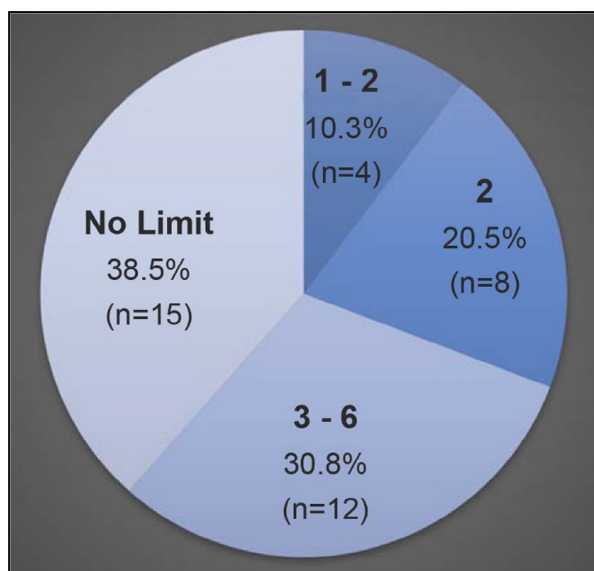


Figure 2 Maximum Number of Slots per Year in Individual Institutions' PSTPs (N = 39)

Curriculum and Infrastructure of PSTPs

Providing combined residency and subspecialty fellowship training is an attractive feature of PSTPs.

Of 364 respondents to a 2013 survey of PSTP graduates, 75% indicated that the opportunity to pursue training as part of a combined residency and subspecialty training experience was among the most desirable features that led them to select a particular PSTP.¹⁶

- PSTPs that provide residency and subspecialty fellowships should ensure integration between the institution's medical subspecialty and core internal medicine residency programs and its PSTP directors.
- Offers of combined residency and subspecialty fellowship training as part of the PSTP should not be unconditionally guaranteed, but should be contingent

Table 1 Opportunities Afforded to Trainees in Physician-Scientist Training Programs (N = 39)

Feature	n (%)
Combined residency/subspecialty training	29 (74)
Guarantee of salary/research support during research phase of training	29 (74)
Guarantee of subspecialty fellowship in chosen field	27 (69)
Recruitment or encouragement of trainees to apply for career development ward during research training	26 (67)
Special consideration for junior faculty position after completion of training	22 (56)
Enhanced compensation during part or all of physician-scientist training program training	14 (36)
Opportunity to pursue master's or PhD degree as part of research training (for those without graduate degrees)	12 (31)

Table 2 Major Sources of Support for Trainees During Physician-Scientist Training Program Research Phase (N = 39)

Source	n (%)
NIH T32 or K12 funding to program or relevant division	32 (82)
Department funding	30 (77)
Mentors' research grants	21 (54)
Individual trainee career development ward (NIH, VA, Other)	15 (39)
Special Program Funding (e.g., Philanthropic Support)	9 (23)
Medical School Funding	3 (8)

NIH = National Institutes of Health; VA = US Department of Veterans Affairs.

on the adequate completion of all clinical residency requirements.

- PSTPs should incorporate adequate flexibility in structure to accommodate trainees who either do not wish to complete subspecialty training, are unsure of their subspecialty choice at the start of their training, or change their minds about their subspecialty choice during their training.

Although the timing of courses and training may vary among training programs, all PSTPs should include training in study design, biostatistics, team science, ethics, scientific regulatory requirements, institutional review board application, grant writing, time management, leadership, work/life balance, and mentor/mentee relations. Delivery of a common core curriculum may take a variety of forms, including didactic sessions, panel discussions, and events that foster community among physician-scientist trainees at all phases. Physician-scientist training programs should, whenever possible, align and integrate their curricular design with existing institutional offerings to generate a robust core curricular experience for their trainees.

- Mechanisms to sustain interest among trainees can be initiated during residency and include lecture series, visiting professorships, alumni events, and regular meetings of the PSTP director with the program's trainees.
- Additional support of the core curriculum to enhance community and near-to-peer mentoring can be derived through vertical gatherings of MD-PhD trainees, junior and senior PSTP trainees, and young faculty members.
- Provision of opportunities for trainees to earn either a master's or PhD degree is an attractive option.

Directors of PSTPs would benefit from organizing a formal alliance and meeting regularly.

- The work of an "Alliance of PSTP Directors" should include coordination with the ABIM and ACGME to ensure contemporary training and certification standards.
- A PSTP directors organization could develop and host a shared database of applicants to PSTPs for tracking

Table 3 Summary of Best Practice Recommendations for Physician-Scientist Training Programs (PSTPs)

1. Curriculum and Infrastructure
<ul style="list-style-type: none"> A. Providing combined residency and subspecialty fellowship training is an attractive feature. B. PSTPs should include training in study design, biostatistics, team science, ethics, scientific regulatory requirements, institutional review board application, grant writing, time management, leadership, work/life balance, and mentor/mentee relations. C. Directors of PSTPs would benefit from organizing a formal alliance and meeting regularly.
2. Recruitment and Selection of Trainees
<ul style="list-style-type: none"> A. Candidates for PSTPs most likely to translate their training into successful careers as well-established physician-scientists are those who have significant research experience and can demonstrate a balanced commitment to both science and medicine. B. PSTPs should make increasing diversity among its trainees a stated goal, with active efforts to recruit qualified women and members of underrepresented minority populations. C. Initiatives to recruit qualified international medical graduates as trainees should be increased and additional sources of funding for international medical graduates trainees should be pursued.
3. Mentorship Practices
<ul style="list-style-type: none"> A. Mentoring teams are essential for PSTP trainees and should be carefully crafted. B. Mentors need to be formally trained in mentoring, and they need to be recognized for their contributions.
4. Funding of PSTPs and Their Trainees
<ul style="list-style-type: none"> A. The success of PSTPs and their trainees is highly dependent on strong institutional support. B. The success of PSTPs and their trainees is also highly dependent on adequate levels of external funding including the successful receipt of individual career development awards.
5. Tracking Success of PSTPs and Their Graduates
<ul style="list-style-type: none"> A. Success factors of PSTPs and their graduates should be tracked. B. Tracked data should be coordinated with other PSTPs and shared in a national data base.
6. Sustaining PSTPs and Employing Continuous Improvement Practices
<ul style="list-style-type: none"> A. Sustainability is contingent on institutional support and an adequate census of qualified applicants. B. Sustainability is also impacted by the percentage of trainees who successfully complete their training.

measures of success among its graduates; it should also promote the societal value of physician-scientists by emphasizing the long-term benefits of investing in science.

- PSTPs should have a designated director with 10%-20% protected time, a clear mission of the training program, and clarity about his or her responsibilities.

Recruitment and Selection of Trainees

Candidates for PSTPs most likely to translate their training into successful careers as physician-scientists are individuals who have significant research experience and can demonstrate a balanced commitment to both science and medicine.

- Graduates of NIH-supported medical scientist training programs and combined MD-PhD programs are often excellent candidates for PSTPs because they have demonstrated a strong commitment to biomedical research and have been exposed to a rigorous training curriculum in both medicine and science.
- Similarly, individuals who have earned graduate-level degrees in a medically relevant scientific field before earning their medical degree are likely to be committed to careers as physician-scientists.
- Due consideration also should be given to candidates who have had a productive experience working in a mentored research setting; demonstrated a balanced commitment to both science and medicine; and

belatedly elected to pursue a PSTP during their categorical residency. Multiple “on-ramps” into the PSTPs at different stages of postgraduate training should facilitate recruitment of these “late-bloomers.”

Physician-scientist training programs should make increasing diversity among its trainees a stated goal, with active efforts to recruit qualified women and members of underrepresented minority (URM) populations. For the past 5 years, women and minority populations have been underrepresented in the nation’s MD-PhD programs.

- Recruiting strategies for PSTPs should use several initiatives to identify qualified candidates that likely would be found attractive by women and members of URM populations, including, for example, highlighting women and URM mentors as potential role models and peer-mentoring of women and URM medical students who may be candidates for acceptance into a PSTP.
- Selection criteria for PSTP admittance should provide consideration of each applicant’s life experiences. Providing post-interview “second-look” opportunities and research observerships may be helpful.
- PSTPs should strongly encourage their institution’s recruitment of women and URM faculty members who can serve as mentors and role models for their trainees.

Initiatives to recruit qualified international medical graduates (IMGs) as trainees should be increased, and

additional sources of funding for IMG trainees should be pursued. Although large numbers of international scholars contribute to the success of the US scientific workforce, only a small percentage of these individuals enter the field as physician-scientists.

- PSTPs should recognize the unique value of IMGs mentored by an internationally acclaimed investigator. With a strong reference from the former mentor and identification of an appropriate mentor in the United States, efforts should be made to recruit and fund IMGs.
- Before recruiting IMG candidates, PSTP directors should confirm whether the scope and quality of the candidate's undergraduate medical training is comparable to that of US medical schools.

Mentorship Practices

Mentoring teams are essential for PSTP trainees and should be carefully crafted. Mentoring teams encompass many benefits and can ameliorate the possibility of "mentor fatigue." Teams should include advising mentors, who may rotate over time; coaches, who direct the trainee's career development and have a more open relationship with the trainee than the advising mentors; and sponsors, who advocate for the trainee. Although mentoring teams may change over time, at all times one mentor must be identified as having ultimate responsibility for the actions and progress of the trainee.

- Mentees and mentors should complete a "mentoring contract" and complete individual development plans. Mentoring contracts should provide an explicit assessment of expectations, limitations, and milestones. PSTP directors should provide guidance for mentoring contracts and review trainee individual development plans annually.
- Formal processes should be established to ensure that mentee and mentor experiences are catalogued, and a database of individuals considered to be excellent mentors should be maintained. Such a database could be used to identify specific research project opportunities for mentees. Similarly, development of a "mentoring biosketch" to document previous experience and successes is likely to be highly beneficial.
- Clinical mentorship should start immediately with internship, and it can be linked to a research mentorship when appropriate, thus avoiding a mismatch from premature decisions made earlier in the training process than optimal for the trainee's development.
- PSTP directors need to ensure that no mentor becomes overly burdened; they may need to play the role of "matchmaker" between trainees and potential mentors.
- Mini-sabbaticals could be implemented to allow trainees to discover other research opportunities and expose them to additional senior faculty members.

Mentors need to be formally trained in mentoring, and they need to be recognized for their contributions.

Physician-scientist training programs might consider completion of formal mentoring courses as a requirement to work with their trainees.

- PSTPs should include an oversight structure for mentors that provides them with constructive feedback about their mentoring activities.
- Opportunities for emerging mentors should be provided (allowing junior faculty members to co-mentor a trainee with a more senior mentor).
- PSTPs should provide a culture that values mentorship, and their institutions should formalize mentoring accomplishments that support promotion.
- Mentors should be provided support for the time they spend mentoring, including protected time or compensation in the form of equivalent relative value units.
- Institutions should recognize excellent mentors with formalized awards. The AAIM should also consider sponsoring awards dedicated to mentors.

Funding of PSTPs and Their Trainees

The success of PSTPs and their trainees is highly dependent on strong institutional support. Medical schools, teaching hospitals, and academic departments of internal medicine need to clearly articulate and actively demonstrate the value they place on contributing to the pipeline of physician-scientists. Ideally, PSTPs would provide uninterrupted funding and a seamless transition from ACGME-approved clinical years to research training, as well as facilitate trainee independent careers as physician-scientists.

- Institutional support should include bridge funding for the trainees when possible.
- Leveraging programmatic resources could enhance the overall mission of the PSTP if it were led within the dean's office.
- Coordination between PSTPs, the department of internal medicine's research office, and other departments within the institution can add value to the operations of the PSTP.

Trainees should be strongly encouraged to apply for individual career development awards, because receipt of these awards has been correlated with future career success. Sources of external funding often include NIH institutional and individual awards; Department of Veterans Affairs career development awards; Howard Hughes Medical Institute Career Awards for Medical Scientists and Hanna H. Gray Fellowships; Doris Duke Charitable Foundation Clinical Scientist Development Awards; and Robert Wood Johnson Foundation Clinical Scholars awards.

- National Institutes of Health institutional research training grant programs are important to the overall health of PTSPs. Decreasing or eliminating these programs

could have a major disruptive effect on the physician-scientist workforce.

- Planning for individual career development awards should begin as early as the first or second residency year, underscoring the importance of committed mentors.
- Some trainees may need to be supported through an NIH institutional research training award until they are ready to submit a proposal for an individual career development award.
- PSTP directors should interact closely with funding agencies and be well-versed in funding opportunities relevant to their trainees.

Tracking Success of PSTPs and Their Graduates

Success factors of PSTPs and their graduates should be tracked.

- The number of applicants, especially as a percentage of available positions, can easily be tracked; PSTPs should record these data each year.
- It is easy to track the number, percentage, and diversity characteristics of the trainees who successfully complete the PSTP. The time to complete the PSTP depends on several factors; however, these data should be recorded.
- PSTP directors need to be vigilant in tracking the careers of their graduates and recording their successes in a database.
- Data that should be tracked include the percentage of graduates who pursue careers in academics; their record of external research funding; their publication record, including number of articles and number of articles in which they appear as first author; promotion and tenure; and honors and awards.

Tracked data should be coordinated with other PSTPs and shared in a national database.

- These data should be coordinated in a national database, possibly under the direction of a PSTP directors organization.
- Analysis and interpretation of the data can assist in identifying continuous improvement practices for PSTPs, both at an individual level and on a national scale.

Sustaining PSTPs and Employing Continuous Improvement Practices

Physician-scientist training program sustainability is contingent on institutional support and an adequate census of qualified applicants. Launching and sustaining a PSTP requires the strong support of the institution's senior leadership. A dwindling pool of qualified PSTP applicants over a sustained amount of time may be an indicator that institutional support is lacking.

- The level of institutional support for its PSTP can change over time. Reasons include a change in leadership, lack of resources, or the departure of senior researchers and mentors. Senior leaders need to be candid about any changes in their level of support for PSTPs and act decisively—perhaps suspending or closing operations—to maintain the reputation of its institution.
- If a PSTP fails to attract qualified applicants for more than 3 years, there probably exist institution-wide issues that need addressing (eg, lack of qualified mentors or research initiatives on campus; program may not be competitive with other PSTPs). It is important to identify these issues so that strategies to address them can be implemented.

Physician-scientist training program sustainability is also impacted by the percentage of trainees who successfully complete their training.

- PSTP personnel need to be aware of issues affecting the trainees. Financial pressure can be mitigated by providing progressive educational loan forgiveness that increases as trainees successfully move through their research training; a direct stipend during trainee research years; and a departmental commitment to favored status when trainees are seeking their first faculty positions or, if appropriate, a firm commitment of faculty positions with a startup package after conclusion of training.
- PSTP directors need to keep themselves fully apprised of the mentor-mentee relationships of their trainees. Specific programmatic elements should be enforced to immediately address unsatisfactory relationships.
- The timeframe in which an individual typically spends as a PSTP trainee often coincides with the same timeframe in which a trainee may be starting and/or maintaining a family. PSTPs should include flexible policies that allow for a temporary leave of absence or part-time employment.

SUMMARY

The success of the medical research enterprise is dependent on a well-trained physician-scientist workforce. Ensuring high-quality training programs to increase our physician-scientist workforce is critical. There exists, however, substantial variability in PSTP training infrastructure and support. For general internal medicine and fellowship training, the ABIM and ACGME prescribe the duration and infrastructure for PSTP training. Moreover, although the ABIM prescribes dwell time for the research component of PSTPs, it does not specify content. The ACGME neither has requirements for research training nor does it provide oversight or accreditation of PSTPs. The absence of standards contributes to variability in physician-scientist training and outcomes. We

identify best practices for PSTP recruiting and training to ensure that graduates can succeed in research that meets our nation's health care needs and expectations.

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