Training Pathways Working Group Report

Executive Summary

The development of the next generation of investigators and enhancement overall research capacity in strategically important areas of nursing science has been a primary goal of the National Institute of Nursing Research (NINR). In the 21st century, it is even more essential that the scientific workforce of the future be innovative, multidisciplinary, diverse, and entrepreneurial. The Training Pathways Working Group (WG) of the National Advisory Council for Nursing Research (NACNR) was charged with providing NINR leadership with information and recommendations that identify strengths, limitations, challenges, and opportunities that support NINR's renewed efforts to enhance nursing research education and training. Accordingly, the WG identified current challenges and opportunities in short and long-term issues. Specific recommendations include the following:

Building a diverse scientific workforce that contributes knowledge, experiences, and ideas from every corner of our society is a priority for NINR and is essential to eliminating disparities and improving health outcomes. Thus, there is a timely requirement to examine a multitude of factors that impact the initiation of a research program, as well as to support the continuation of a program of research over a nurse researcher's career, and to diversify the nursing research workforce. This will require dedicated funding and mentorship schemes.

Enhancing awareness of the multiple opportunities in nursing research along the career path could attract more students to nursing PhD programs. Undergraduates, particularly underrepresented minorities, should have early exposure to nursing research and its impact on patient outcomes. Undergraduates should be encouraged to enter doctoral programs early in their careers or directly after graduation.

NINR has a unique opportunity to advocate for enhancements across NIH that would **improve opportunities and outcomes for female scientists.** NINR should advocate for funding models that enable optimal participation in a PhD program, post-doctoral fellowship, or early career investigator training, with special funding to reduce the need for outside work and for older students who may be balancing family and work.

NINR should promote strategies to **develop essential skills** in writing, communications, and publication productivity and should develop a roadmap for success in a research career.

Mentoring is associated with increased research productivity, career development, leadership skills, self-efficacy, and salaries. NINR should develop evidence-based, research-focused mentor-sponsor training education modules and/or programs.

Interdisciplinary research and collaboration are essential to the growth and success of nurse researchers. NINR should foster the sharing of resources and mentoring between universities, and collaborations between non-research-intensive institutions and research-intensive programs in nursing and non-nursing research programs, such as medicine and engineering.

There should be greater **tracking, analysis, and documentation of** the impact of nursing science training and career development programs.

Training Pathways Working Group Report

The work of nurse researchers plays a crucial role in influencing healthcare practice by identifying areas to advance evidence-based objectives to improve patient outcomes. The development of the next generation of investigators and enhancing overall research capacity in strategically important areas of nursing science has been a primary goal of the National Institute of Nursing Research (NINR) since its establishment. In the 21st century, it is even more essential that the scientific workforce of the future be innovative, multidisciplinary, and diverse. With the rapid expansion of clinical innovations, nurse researchers across the United States need up-to-date training that fosters their ability to critically evaluate and conduct relevant research projects, and to develop critical programs of research. However, several concerning trends may impede these efforts:

- Enrollment in PhD programs at schools of nursing is declining. Low enrollment in PhD programs threatens the ability to keep up with rapidly evolving healthcare and meet the need for advancing the field of nursing science.
- There is a dearth of PhD-prepared faculty at research-intensive schools of nursing, especially to support PhD programs. Faculty are being drawn in to support Doctorates in Nursing Practice (DNP) programs, which have rapidly rising enrollment.
- While NINR pre-doctoral fellows and trainees have generally applied for post-training RPG applications at higher rates than the overall NIH, their overall post-training funding rates are generally lower than other pre-doctoral fellows and trainees across the NIH.
- As a proportion of all NRSA trainees and fellows, NINR generally prioritizes pre-doctoral fellows more than does the overall-NIH. NINR has been increasing support for pre-doctoral trainees (T32).
- NINR's Early Stage Investigator (ESI) and New Investigator (NI) funding and success rates are lower than the NIH respective rates.
- A lack of diversity across the biomedical research workforce raises the risk for perpetuating the nation's health inequities.

Building a scientific workforce that contributes knowledge, experiences, and ideas from every corner of our society is a priority for NINR and is essential to eliminating disparities and improving health outcomes. An excerpt from the NIH diversity statement states, "Scientists and trainees from diverse backgrounds and life experiences expand the range of research questions, and bring different perspectives, creativity, and individual enterprise to address complex scientific problems. There are many benefits that flow from a diverse NIH-supported scientific workforce, including: fostering scientific innovation, contributing to robust learning environments, improving the quality of the researchers, advancing the likelihood that underserved or health disparity populations participate in, and benefit from health research, and enhancing public trust."

Thus, there is a timely requirement to examine a multitude of factors that impact the initiation of a research program, as well as to support the continuation of a program of research over a nurse researcher's career, and to diversify the nursing research workforce. These challenges warrant an examination of factors which may be addressed through recommendations by the Training Pathways Working Group (WG) of the National Advisory Council for Nursing Research (NACNR). The WG was charged with providing NINR leadership with information and recommendations that identify strengths, limitations, challenges, and opportunities that support NINR's renewed efforts to enhance nursing research education and training. Specifically, the WG was directed to identify current deficits and their

effects, as well as short and long-term issues that may be averted through the recommendations provided. The WG was asked to address the following areas:

- Evaluate current limitations in recruitment and training within existing PhD programs, including issues that may compromise the engagement of individuals from minority and underrepresented populations.
- Identify training-related shortfalls and analyze their influence on nursing scientists' ability to successfully design and complete a research program.
- Determine factors that hinder the nurse researcher's career path and progression (e.g., salary, awareness of programs/career opportunities, issues that contribute to/perpetuate disparities).
- Develop suggestions to improve collaborations among NINR and leading organizations to promote the training of a diverse cohort of nurse researchers, reflective of the U.S. population.
- Construct strategic objectives to overcome anticipated issues that may impact the success of future nursing researchers.

The initial WG assembled by the then-Acting Director of NINR was composed of individuals with diverse backgrounds in nursing research and education, including junior and senior faculty members, PhD students, representatives from nursing research organizations, and NINR staff. Events of 2020--the COVID-19 pandemic, racial injustice, natural disasters, and threats to healthcare availability—amplified health care challenges. An expanded charge to address workforce diversity was supported by the addition of three WG members from the nursing research community with relevant backgrounds. Each area of the WG's charge was addressed by one of four subgroups using appropriate approaches, including scoping literature reviews, interviews with leaders in nursing research training, analysis of the evidence, group discussion, and data provided by NINR and other organizations. Below are the collective findings and recommendations:[1]

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Recruiting trainees for research training

There is a continuum of research development that is initiated in baccalaureate and master's nursing programs (BSN and MSN, respectively) to provide a foundation for nursing science and, to a greater degree, inspire nurses to pursue research-focused doctoral degrees. According to data collected by the American Association of Colleges of Nursing (AACN), enrollment in nurse PhD programs has been slowly decreasing since 2013. This downward trend threatens the progress of nursing science by the direct impact on research projects as well as decreasing the ranks of faculty members to train the next generation of researchers. Although DNP programs (which are focused on clinical training) are distinctly different from PhD programs (which are focused on research training), they are sometimes seen as an alternative that surmount commonly cited barriers to nurse PhD programs: length of programs, cost, and desire for more experiences.

Many nurses entering graduate programs are older than in other programs in biomedicine. They have established clinical careers that have often stimulated their interest in pursuing graduate research training. However, logistical issues, such as balancing the time commitment of an intensive graduate program with family responsibilities, stepping away from clinical duties, and loss of income can deter even the most ardent prospective students, who may not have been aware of opportunities in nursing research earlier in their careers. We need to develop robust workforce models that are inclusive of the

[1] N.B.: there is some overlap in recommendations between the categories.

nurse scientist recognizing multiple entry points for research intensive training, and promote funding models that foster not only research and training but demonstrate impact and influence on the health of individuals, families, and communities.

Recommendations
Enhancing awareness of the multiple opportunities in nursing research along the career path through targeted and effective marketing could attract more students to nursing PhD programs.

- Undergraduates (both nursing and non-nursing), particularly underrepresented minorities, should have early exposure to nursing research and its impact on patient outcomes. Engaging these students, as well as clinical nurses, in ongoing research projects could stimulate interest in research careers. Part-time job, college credit, or volunteer opportunities for undergraduate students can be arranged with universities, non-university and academic medical centers.

- Consider funding research internships for students who are considering a research career. This could be a 25 to 50% effort for one year to create an immersive experience.

- Undergraduates should be encouraged to enter doctoral programs early in their careers or directly after graduation. Availability of streamlined programs, such as BSN-to-PhD, MSN-to-PhD, and DNP-to-PhD could facilitate the path to doctoral programs.

- Students should be informed about the differences between the roles of PhD- and DNP-prepared nurses to help them choose the pathway that best suits their interests and skills (1), as well as the ways in which PhDs and DNPs are working together to improve patient care (2).

Funding

The development of a strong cadre of nurse scientists has been a primary goal of NINR since its establishment. In addressing the goal of preparing a diverse and talented research workforce, NINR supports a variety of training opportunities for scientists and trainees at all career levels, particularly those at an early career stage who are so critical to sustaining the future of innovative research and high quality health care. NINR devotes significant support to individual and institutional pre- and postdoctoral research fellowships, as well as career development awards (2017-2021 NINR Strategic Plan).

In 2019, NINR had the second highest percent of total budget (4.5%) for National Service Research Awards (NRSAs) across NIH, second only to the National Institute for General Medical Sciences (Appendix: NINR Portfolio Overview, slide 17); the NIH average is 2.3%. NRSA individual awards have decreased overall over ten years. NINR's support of Research Career Development (K) Awards was 2.5% of its total budget, just above the NIH average of 2.1%, for a total of 33 career awards, the largest number in this mechanism since 2005 (36 awards).(Appendix: NINR Portfolio Overview, slide 20).[2]

NINR success rates for individual F-awards tends to be higher than NIH's, while NINR's institutional T-award success rates are lower than NIH's (NINR Portfolio Overview, slide 18). K-award success rates are

[2] Given the wide range of overall NIH Institute and Center budgets, the 'percentage-of-budget' metric is commonly used for demonstrating NIH Institute and Center research and program priorities.

comparable to those of NIH, but fluctuate depending on competing funds availability (grant cycling) (Appendix: NINR Portfolio Overview, slide 19).

From 2014-2019, about half of NINR's support to schools of nursing went to research project grants (RPGs) and half to training/career awards (NINR Portfolio Overview, slide 29).

Programs located at schools with T32 and/or Clinical & Translational Science Award (CTSA) funding are more likely to incorporate the AACN core curricular elements that promote research science careers. These elements include an emphasis on nursing inquiry, newer technologies, and methods such as informatics and biophysical measurement, leadership, content related to current priority areas, and emerging areas of science (3).

Younger age and no more than 12 hours per week of work outside of the educational program are associated with PhD students' successful publication records and external research funding awards. To reduce the need for outside work, financial support for PhD education is needed (4). Individual pre-doctoral training awards (e.g., F31s), pilot and small study funding awards, and 1-2 publications are associated with subsequent larger grant awards, including K and R awards (5).

Despite having the highest rate of grant applications across NIH, NINR-funded pre-doctoral and postdoctoral trainees have the lowest success rate among NIH Institutes and Centers in obtaining subsequent NIH research grant awards. NINR's Early Stage Investigator (ESI) and New Investigator (NI) funding and success rates are lower than the NIH respective rates.

NINR participates in several trans-NIH funding opportunities (e.g., R15, REAP), designed to stimulate research at small, less prominent educational institutions that provide baccalaureate and/or advanced degrees for a significant number of the Nation's research scientists, but that have not been major recipients of NIH support. In addition, NINR participates in the Stephen I. Katz Early Stage Investigator Research Project Grant, which supports an innovative project that represents a change in research direction for an ESI and for which no preliminary data exist.

Even with these novel opportunities, the research funding climate has been and continues to be challenging. NIH R01 funding rates have slightly increased from 10 years ago, while NINR R01 funding rates have been relatively steady over that time, averaging about 14% (Appendix: NINR Portfolio Overview, slide 6). This contributes to an insufficient number of PhD program faculty with a track record of external funding who can support the research training of nurses (6), including racial and ethnically diverse faculty (7).

Notably, among all the NIH institutes, NINR proportionately supports many more female than male scientists. NINR has a unique responsibility to advocate for enhancements across NIH that would improve opportunities and outcomes for female scientists. There is a critical need to transform the NIH ethos that equates rapid pace and volume with evidence of talent and potential impact. Outcomes of NINR's advocacy would greatly enhance the desirability and realistic possibility of successfully pursuing a nurse scientist career.

Recommendations

- There should be incentives in FOAs to support the inclusion of trainees in RPGs. For example, select FOAs can require participation of undergraduate and Master's degree trainees in research teams. In addition, graduate students should be supported through funding to fulfill research assistant roles on their mentors' RPGs.

- NINR should advocate for funding models that enable optimal participation in a PhD program, post-doctoral fellowship, or early career investigator training with special funding to reduce the need for outside work and for older students who may be balancing family and work. NINR should also encourage discussions about the detrimental impact of tenure clocks, which even when extended for childrearing, negatively impact on retaining talented scientists. NINR should promote a culture which supports transparency about personal challenges and responsibilities.

- NINR can help strengthen the postdoctoral experience by developing additional low-cost or funded summer training programs similar to, or partner with, the National Heart, Lung, and Blood Institute's Programs to Increase Diversity Among Individuals Engaged in Health-Related Research (PRIDE), which offers research education and mentoring for post-docs and junior scientist from underrepresented groups. The potential to leverage digital strategies for engagement should be actively explored.

- NINR should create new funding opportunities that are focused on the training needs of clinician scientists, the vulnerable period of obtaining a first large grant (e.g., R01, R34) after postdoctoral training, those who cannot relocate for training, those in non-research intensive universities, underrepresented minorities (URMs), and individuals who have career interruptions. This can be accomplished with small grants (e.g., R03 and R15) that can lead to larger grants; bridge periods between career stages (e.g., F31 to F32; post-doc to first R-award); joint programs of research training across institutions; allowance of expenditures in training awards to conduct research in addition to stipends; re-entry to research after career interruptions; expansion of diversity awards; the inclusion of ESIs and research graduates on funded grants; and facilitating distance research training. These new funding mechanisms will provide more flexibility in research training opportunities, address vulnerabilities in the training pathway, and potentially expand the pool of qualified nurse scientists who have successful research careers.

- Funding options to increase the number and scope of scientific laboratory facilities at schools of nursing should be explored.

- NINR should revise policies and practices to allow for more opportunities for ESIs, NIs, and URMs to be included as reviewers or in other roles to better understand the review processes for applications.

Skills development

Weak writing skills can be a barrier to scholarship productivity and effectiveness (8). Practical research training for graduate research assistants is associated with greater peer-reviewed publications and external research funding for nurses (4).

Time to publication and number of peer-reviewed publications are higher for students completing the manuscript dissertation option versus the traditional dissertation option (9). Participation at

professional conferences can lead to publication opportunities. For example, publications can be developed from conference presentations and scholarly collaborations are initiated and fostered through networking opportunities (5).

Post-doctoral appointments allow PhD prepared students to gain independence and autonomy, which are needed in a research-focused faculty role (10). Postdoctoral programs providing high quality mentorship and protected time for independent research support trainee efforts to increase their repertoire of research skills, such as developing their program of research, publishing manuscripts, grant writing, project management skills, and interprofessional development and networking. Creating a "culture of post-docs" can foster the expectation that a post doc position is a normal step in the academic career path (11).

Post-doctoral training is less prevalent among nurse scientists than in other fields of biomedical research. However, many nurse scientists obtain their doctoral degrees at an older age, after several years of clinical work, familial commitments, financial constraints, and difficulty obtaining research funding as an independent principal investigator are barriers to post-doctoral work (10)(11)).

Effective time management, work-life balance skills, and the ability to negotiate protected time to spend on research and scholarship-related activities are likely associated with greater research and scholarship productivity (12).

Recommendations

- NINR should promote strategies that enhance writing skills, communication strategies, and publication productivity, such as: scholarly writing and grant writing courses in PhD programs; the manuscript dissertation option for PhD students planning research careers; modules or resources for students and ESIs focused on writing skills and grant writing; and writing accountability groups and residential retreats.

- NINR should develop guidelines for programs to create a culture of research, including: the importance of incorporating the AACN core curricular elements that promote research science careers; strategies and resources for facilitating interdisciplinary research and collaboration; practical research training through graduate assistantships, and research residencies and funding for pilot or small studies.

- NINR should develop a roadmap for success in a research career identifying guiding principles to inform and influence procedures, funding models and policies, and institutional policies.

- NINR to create a dedicated Early Career webpage that is continually updated with pertinent resources and opportunities. Enactment of these changes would lead to sustainable infrastructures that develop community, promote visibility, and enhance equity amongst early career scientists.

Mentoring

The lack of mentoring is a significant concern for early researchers. Mentoring is associated with increased research productivity, career development, leadership skills, self-efficacy, and salaries (13, 14).

An engaging mentor-mentee relationship includes early and frequent meetings, collaboration on presentations and publications (15), and use of individual development plans to communicate and plan goals to expedite academic progress (McSweeney et al. 2020). Research experiences should include research residencies or work on mentors' studies (16).

High research performance among faculty members is not always synonymous with mentorship skills and the capacity to develop nurse leaders. It is vital that students are matched with mentors who will be able to support them in their areas of interest. Mentor training in biomedical research can improve mentoring skills and will likely improve mentee outcomes (17).

Recommendations

- NINR should develop evidence-based, research-focused mentor-sponsor training education modules and/or programs. Potential components are:
  - Mentorship models and existing mentor training programs such as the National Research Mentoring Network.
  - Participation from well-funded and experienced "master mentors" (history of sustained funding and research-intensive training and the successful development of the careers of others) for help in developing mentor education materials.
  - Coaching and other strategies that focus on productivity and resilience, cultural awareness in mentoring, and how to provide a compelling vision for mentees as researchers.
  - Supporting successful mentors with protected time, resources, and awards.

- Consider longitudinal programs of mentorship and engagement with awardees along the career path, for example, pre-doctoral F-awards to independent R-awards. These programs could focus on leadership development. Engaging partnership, mentorship, and sponsorship from organizations such as the Friends of NINR could leverage NINR's investment.

- NINR could create a formal mentee/mentor platform that includes both peer and senior mentorship options, in order to connect individuals both within NINR and among other institutes. In addition, NINR should offer both distance and in-person educational opportunities that give guidance to senior leaders and early career scientists on mentee/mentor roles, importance of continued formalized mentorship, and career development.

- Developing mentoring programs through NINR to enhance current and future collaborations between multiple universities and organizations that may involve "shared" training programs between institutions, distance mentoring models, and grant mechanisms that require ESIs as co-investigators.

Collaboration

Research-intensive institutions or access to a network are associated with higher productivity (18). Fostering national networks and communities of practice could foster research productivity. Interdisciplinary research and collaboration are essential to the growth and success of nurse researchers (19)(NIH 2014). In addition, sharing resources and mentoring between universities, and faculty between universities and academic health centers, would also help address faculty shortages.
Nursing research should investigate approaches taken by training programs in other professional disciplines that have clinical and research aspects, such as dentistry and clinical psychology, to see if there are strategies that could be adopted.

There are also training opportunities offered by STEM disciplines that have not traditionally included nurse scientist trainees.

Recommendations

- NINR should contact organizations within and outside of nursing, including professional associations, to expand existing collaborative relationships and develop new ones, with a focus on training. NINR should hold standing meetings in which leading organizations are invited to collaborate to further strengthen the training pathway.
- For example, the Symptom Science Advances in Oncology Nursing symposium, scheduled for February 4-5, 2021, is a collaboration between NINR, the National Cancer Institute, and Oncology Nursing Society. In addition to highlighting symptom science advances, this virtual event will provide an opportunity for networking and research mentorship to support the next generation of nurse scientists.

  NINR should facilitate collaborations between non-nursing programs (e.g., engineering, medicine) and nursing programs, as well as collaborations between non-research-intensive institutions, including minority-serving institutions, and research-intensive programs at schools of nursing,), to provide joint training opportunities
- Students should be exposed to research at a young age by implementing partnerships between local schools and schools of nursing or hospitals, to develop programs for school-age children. Robust programs can be matched with rural areas and similar communities with less access to technology.

Diversity, equity and inclusion

Like our clinical environment, nurse scientists should reflect the sociodemographic characteristics of the communities we serve. Thoughtful and intentional guiding principles can drive strategy, promote execution, drive culture change and inform evaluation.

In the wake of tragic events in 2020, NINR set forth to:

- Amend the charge of the WG to include recommendations on increasing the diversity of trainees and ESIs

- Review its ESI programs to consider mechanisms to increase opportunities for African American and other underrepresented nurse scientists who are building their research programs

- Evaluating its technical assistance processes to ensure guidance on the application and grant process is reaching minority-serving institutions, professional societies, and organizations

- Ensuring its post-review decision-making process is equitable and inclusive

Data from AACN, document a steady increase in minority enrollment at all levels of nursing programs (BSN, MSN, PhD, and DNP) from 2010 to 2019. NINR training opportunities (F/T/K) at minority-serving academic institutions comprise 5%-10% of academic institutions; and, about one-third of NINR and NIH trainees and/or fellows are minorities (NIH Internal IMPAC II Data – QVR Report August 2020; Internal NIH Data Request regarding FY2015-FY2019 NINR Trainees):

Currently, NINR participates in relevant trans-NIH initiatives, including:

- Research Supplements to Promote Diversity in Health-Related Research program, which aims to enhance the diversity of the research workforce by recruiting and supporting students, postdoctoral fellowships, and eligible investigators from underrepresented backgrounds, including those from groups that have been shown to be nationally underrepresented in health-related research; and
- Maximizing Opportunities for Scientific and Academic Independent Careers (MOSAIC): Postdoctoral Career Transition Award to Promote Diversity (K99/R00).
- Ruth L. Kirschstein National Research Service Award (NRSA) Individual Predoctoral Fellowship to Promote Diversity in Health-Related Research (Parent F31-Diversity), which supports pre-doctoral training for students from diverse backgrounds

Recommendations

- NINR should encourage minority-serving academic institutions to increase diversity, equity, and inclusion in offerings and training through recruitment and retention of nurse researchers.

- There should be additional funding opportunities specifically for diversity applicants and those applications should be provided additional consideration. Definitions, review procedures, and funding decisions should be addressed with an intention to expedite the review process. These policy changes will also help advance opportunities for ESIs, especially those with personal or systemic challenges to overcome in their journey toward research independence.

- NINR should develop a diversity and inclusion plan that is addressed in NINR's forthcoming Strategic Plan. Considerations include specific funding mechanisms for URMs, dedicated mentorship, training, and educational opportunities for URMs, and increased attention to tracking and reporting data regarding URM outcomes. It is critical that this new diversity and inclusion plan be endorsed and routinely executed throughout all facets of NINR, including daily operations of NINR leadership and staff and drafting of NINR scientific priorities, such as disparities research.

Improve tracking and analysis of training and early career outcomes data

There is insufficient information regarding the actual number of PhD nursing students. There should be greater effort to document and assess the impact of nurse training programs.

Recommendations

- NINR should routinely track and report data about the outcomes of early career nursing faculty. In order to assess impact of interventions it is critical to capture the right data elements. These include characteristics of investigators including socio-demographics, environmental resources, and outcomes (dissemination, retention in research workforce, career advancement, and policy impact).
- There should be an annual, publicly accessible report of investigator characteristics, longitudinal outcomes, and predictors of success. Such transparency ensures continued evaluation and refinement of strategies to grow and retain early career nursing faculty.

NINR actions

In the short term, we need to create an advisory which would sustain the work of the task force and advocate for recommendations within the NIH, NINR, nursing schools, and professional organizations, such as AACN and the American Academy of Nursing.

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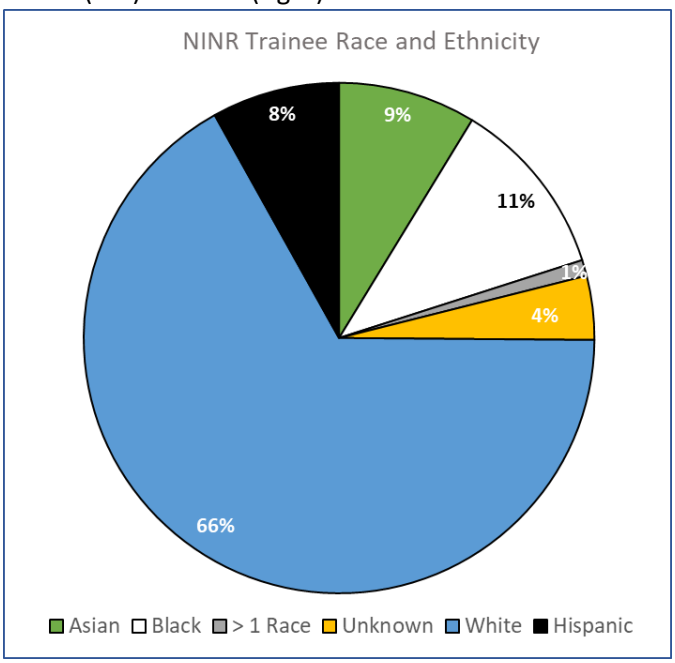
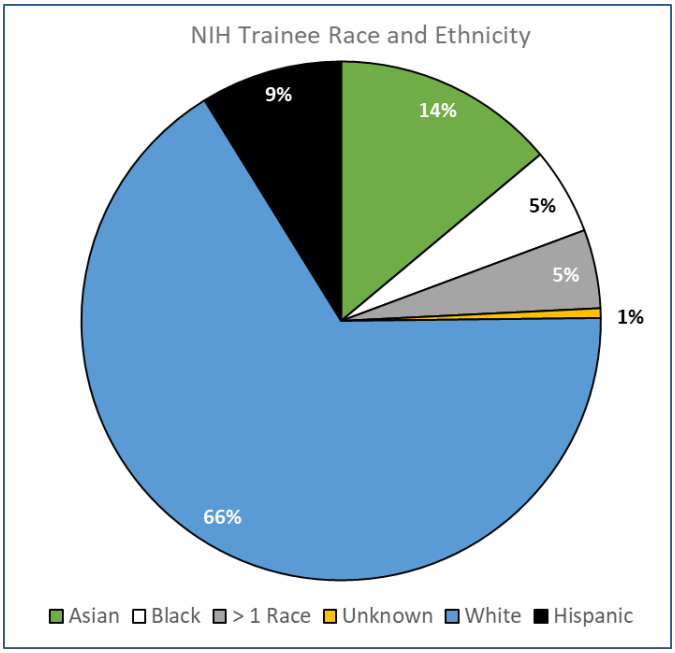
Appendix

NINR (left) and NIH (right) NRSA Trainees and Fellows by ethnicity and race[3]





[3] NINR Data represent NRSA fellows and trainees from 2015-2019 (internal NIH data); NIH Data represent fellows and trainees from 2017 (https://www.report.nih.gov/nihdatabook/category/19)