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Programs to Recruit and Retain a More Diverse Workforce in Biomedical Sciences Research

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Abstract

To improve overall healthcare and to reduce health disparities, efforts must focus on increasing the diversity of personnel trained in the biomedical sciences. Here, we describe the development, implementation, and relative outcomes of three pipeline training programs in biomedical sciences research designed to increase workforce diversity institutionally, regionally, and nationally. We report on their effectiveness in improving the recruitment and retention of underrepresented minorities with the long-term goal of remedying health inequities and disparities.

Keywords

Diversity; Education; Biomedical Sciences; Research; Health Equity

INTRODUCTION

Inequities in healthcare can be attributed, in part, to the lack of diversity in the healthcare workforce (Cohen, Gabriel, & Terrell, 2002; Egede, 2006; Grumbach & Mendoza, 2008), starting from training in the biomedical sciences. Historically, certain groups have been far underrepresented in STEM (science, technology, engineering, and math) education and careers based on their percentage of the overall US population. These underrepresented minorities include African-Americans, Hispanics, Pacific Islanders, first-generation college students, and individuals with disabilities or from disadvantaged backgrounds (National Institute of General Medical Sciences, 2016).

Recently, the National Institutes of Health (NIH, 2012) acknowledged that increasing the diversity of the biomedical sciences workforce would improve health equity by increasing our capacity to identify, address, and eliminate health disparities. This goal can be accomplished by recruiting the most talented researchers, improving the educational and training environment, and attracting subjects from diverse backgrounds to participate in

clinical research protocols. The National Institute for General Medical Sciences (NIGMS) along with other NIH institutes and centers support several funding mechanisms aimed at increasing diversity in biomedical sciences training. Faculty from the Wake Forest School of Medicine (WFSM) and the Wake Forest University (WFU) Graduate School of Arts and Sciences solicited funding from NIGMS and the National Heart, Lung and Blood Institute (NHLBI) to achieve this end, regionally and nationally. This paper describes our development and implementation of pipeline programs to increase diversity and their outcomes.

METHODS AND RESULTS

Excellence in Cardiovascular Sciences (EICS)

Administered by the WFSM Hypertension and Vascular Research Center, the EICS program has received continuous NHLBI funding since 1992 (T35HL07790 and R25HL092618). It provides a summer research opportunity (8–9 weeks) for twelve underrepresented minority students who matriculate at undergraduate institutions throughout the United States and Puerto Rico. Each participates in a biomedical research project in the laboratory of a mentor with expertise in hypertension, cardiovascular diseases, atherosclerosis, diabetes, obesity, or vascular disease.

The program aims 1) to increase the students' exposure to biomedical research; 2) to teach them how to evaluate the scientific literature and make scientific presentations; 3) to increase their knowledge about, and interest in, careers in the biomedical sciences, particularly the cardiovascular sciences; and 4) to establish links with faculty mentors who will foster their continued interest in biomedical research. The primary components of the program include: 1) an orientation to ethics in science and training on safe laboratory practices and the use of animals; 2) a research project focused on some aspect of cardiovascular science; 3) a weekly journal club focused on cardiovascular topics; 4) a seminar series focused on career choices related to the biomedical sciences and minority health and health disparities; and 5) a research poster symposium where the participants present their work to the institutional community, their families, and peers.

Over 80 percent of former participants (> 200) who finished their undergraduate degrees from 1993–2012 attained graduate, medical, or industrial/technical positions (Fig. 1). Over 37 percent received PhD or Master's degrees; 30 percent are health professionals; and 14 percent work in industry or technical positions. Approximately 15 percent continued their association with WFSM as PhD students, medical students, or technical/postbaccalaureate students. Note that 20 percent of the PhDs awarded to underrepresented minority students in WFSM graduate programs in the biomedical sciences from 2009–2011 were former EICS program participants. These statistics demonstrate the continuing success of the EICS program in providing training to facilitate the matriculation of underrepresented minority students into graduate programs and careers in biomedical research.

Postbaccalaureate Research and Education Program (PREP)

PREP targets underrepresented minority students who have recently received their baccalaureate degree (BA, BS) and are interested in working toward a PhD in the biomedical sciences. It provides 1–2 years of intensive research experiences, career guidance, and GRE preparation to help participants succeed in graduate school. More than 32 PREP programs throughout the country receive grant support from NIGMS. The WFSM PREP (R25 GM064249) began in 2001 and is the second-longest running PREP (Hall, Mann, & Bender, 2015). Currently, it admits six participants each year.

Its goal is to increase diversity in the biomedical sciences workforce by increasing the entry and retention of underrepresented minorities in PhD programs both nationally and in WFSM biomedical sciences graduate programs. Components include 1) full-time engagement in a biomedical research project; 2) graduate-level coursework; 3) a GRE preparation course; 4) seminars focused on enhancing such professional skills as scientific writing and presentation; and 5) creation of an individual development plan (IDP) to identify and outline strategies to achieve personal academic goals and objectives. Students select their research mentors according to their research interests, and established scientists serve as career mentors based on the student's long-term professional development interests. Like first-year graduate students, PREP students participate in individualized coursework and courses in scientific integrity, ethics, and the responsible conduct of research that are required of all graduate students. A research symposium at the end of the academic year provides an opportunity for students to showcase their projects to their families, peers, and graduate admissions faculty.

Figure 2 shows that from 2001 to 2015, 74 trainees participated in the WFSM PREP. As a result, 95 percent remain in science-related careers; and 25 percent (17) remained in WFSM biomedical sciences graduate programs after completing PREP. Approximately 75 percent were African American and 18 percent Hispanic. Career choices include entry into PhD programs (63 percent), Master's programs (35 percent), professional schools (13 percent), and math or science teaching or technical positions (15 percent); the percentage exceeds 100 because individual participants fell into more than one category. Note that retention in graduate and professional schools exceeds 90 percent, well above the national average for NIGMS PREPs (Hall, Mann, & Bender, 2015). PREP trainees represent approximately 25 percent of the minority students in WFSM biomedical science graduate programs, and since PREP started, the percentage of underrepresented minority students in these graduate programs has nearly tripled from a starting value of less than 5 percent. To date, sixteen students have completed the PhD, and three hold faculty positions as assistant professors. The program has increased the success of underrepresented minorities, including the disadvantaged, in WFSM and national PhD programs in the biomedical sciences.

Postdoctoral Research, Instruction, and Mentoring Experience (PRIME)

The unrepresentative diversity of faculty in medical and allied health professional schools is a significant barrier to achieving health equity in the United States. While the allied health professions readily attract students from a broad range of backgrounds with various professional goals, a comparable increase in diverse research and teaching faculty has yet to

follow. This NIGMS (K12-GM102773) Institutional Research Academic and Career Development Award (IRACDA) at WFSM provides postdoctoral training designed to promote entry of underrepresented minority PhDs into faculty teaching/research positions in the biomedical sciences. To date, twenty-one IRACDA programs exist nationwide; our PRIME began in 2013.

Its goals are 1) to develop highly skilled biomedical scientists to teach the next generation of clinical researchers and medical/allied health professionals; 2) to increase the diversity of academic researchers in the medical and allied health professions; and 3) to train postdoctoral scholars to use innovative methods that enhance the learning environment and support the career development of pre-professional and allied health professions students from underrepresented backgrounds. PRIME scholars commit 75 percent effort to research and 25 percent to teaching activities over the three-year program. First, they take coursework designed to develop their teaching styles and pedagogy. In the second and third years, through a partnership with the departments of Physical Therapy and Biological Sciences at Winston-Salem State University (WSSU), their mentored teaching experiences include tutoring, lecturing, laboratory design and development, and guiding students through simulations, case-based learning (CBL), and open-source digital teaching tools. In addition, they select research faculty advisors within their disciplines and develop a research project that can progress to an independent research focus after they secure a faculty position.

Eight PRIME fellows have participated in the program since October 2013, increasing underrepresented minority participation in WFSM postdoctoral programs by 10 percent and contributing significantly to institutional diversity. Each of the three scholars recruited during the first year obtained a faculty position (100 percent) prior to the completion of the fellowship, and one of the three recruited during the second year has already obtained a faculty appointment far in advance of completing the fellowship term. Thus, half of our PRIME scholars have already secured faculty positions in the US biomedical sciences, as the others continue their training.

Conclusion

Here, we report the outcomes of three training programs offered at WFSM to increase the recruitment and retention of a more diverse workforce in the biomedical sciences. We show that each program interested underrepresented minorities in pursuing biomedical research careers and effectively achieved the outcomes expected for the programmatic funding mechanisms. Their structures focused on different levels across the training spectrum, compounding their value by facilitating near-peer mentoring relationships within and between programs. By the summer, the PREP scholars are well-acclimated to their own research projects and have developed skills/techniques that they can pass on to the immense benefit of the incoming EICS undergraduate trainees. Postdoctoral PRIME scholars working with WFSM faculty have opportunities to oversee the research training of WSSU MARC U*STAR and MBRS-RISE undergraduates as well as PREP students. PRIME scholars may also interact with these students during the lectures that are part of their teacher training.

The WFSM training programs increase institutional diversity as well as the diversity of the biomedical sciences workforce as a whole. As EICS participants gain exposure and develop interests in biomedical research, our records indicate that they pursue further training in the biomedical sciences at institutions throughout the country. Our PREP participants gain admission into graduate programs nationwide. PRIME has not only increased faculty diversity but serves as a recruiting tool to increase underrepresented minority enrollment at the medical and allied health professional schools where these faculty secure positions.

We anticipate that increasing underrepresented minority recruitment and retention at the various training stages will increase diversity in the biomedical sciences workforce at large. As training programs of this type emerge nationwide, they will help to remedy health inequities and disparities.

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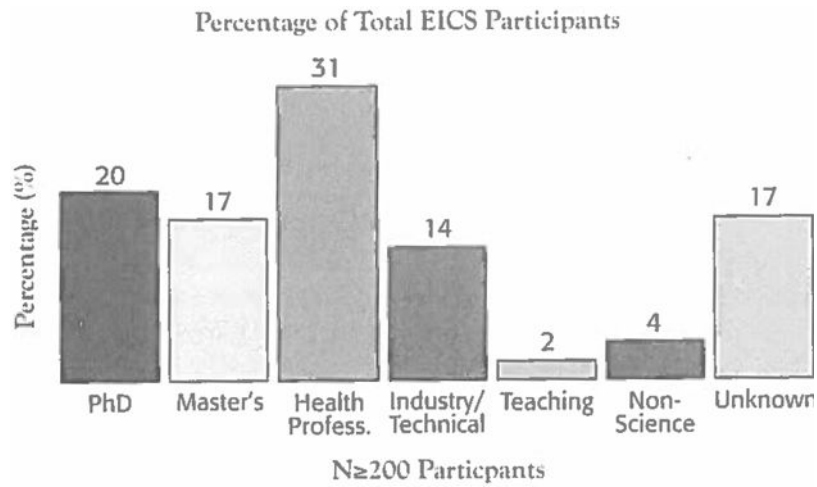


Figure 1. Summary Statistics for EICS Participants

Distribution of outcomes for individuals participating in the Excellence in Cardiovascular Sciences (EICS) summer training program. The total percentage for all categories combined exceeds 100 percent, as some individuals obtained degrees in more than one category.

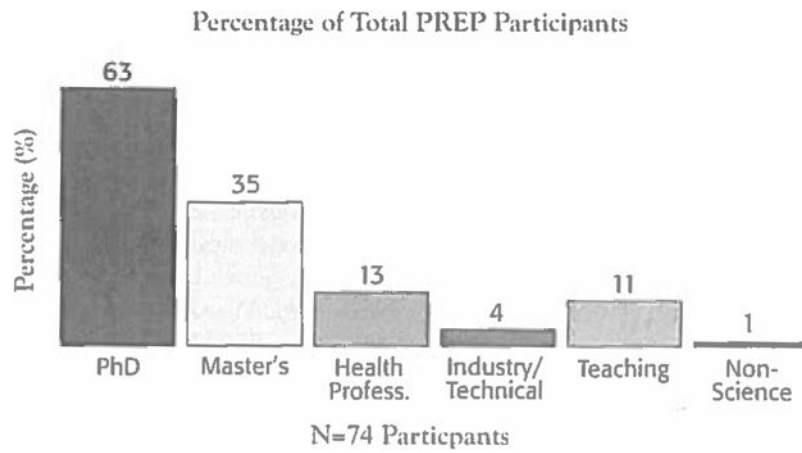


Figure 2. Summary Statistics for PREP

Distribution of outcomes for individuals participating in the Postbaccalaureate Research and Education Program (PREP). The total percentage exceeds 100, as some individuals obtained degrees in more than one category.