DIVERSITY AND PROFESSIONAL ADVANCEMENT IN MEDICAL PHYSICS

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Introduction

Limited diversity in STEM and medicine is a long-standing issue [1, 2]. Despite improvements at the undergraduate level, disparities persist in higher educational attainment, amongst faculty, and in activities classically representative of professional advancement, including scientific authorship and amongst award and grant recipients [3-9].

While less work has focused on medical physics specifically, existing scholarship suggests similar issues within the field. Analysis of the American Association of Physicists in Medicine (AAPM) membership revealed significant, long-term underrepresentation of women as AAPM members and even more so within clinical and leadership positions [10]. Development and analysis of the AAPM-NIH Research Database also revealed disparities in the allocation of NIH grant funding by principal investigator (PI) gender [11].

Improvements in the representation and career advancement of women and minority medical physicists would benefit the entire medical physics workforce, as a diverse and inclusive climate begets enhancements in innovation, productivity, and morale [12, 13]. Increased workforce diversity may also yield improvement in public health and individual patient experiences [14-18]. Given that, in 2019, 78% of PhD, board-certified medical physicists reported their role to be “Primarily Clinical” [19], efforts to increase diversity in medical physics stand to produce meaningful improvements in patient care and outcomes.

Objectives

In this study, we seek to:

- **Analyze diversity within the medical physics workforce and in cohorts representative of professional advancement.**
- **Examine trends in medical physics grant funding by principal investigator (PI) gender identity, race, and ethnicity.**

This work will provide meaningful context to support the development of actionable policy that ensures diversity and equitable opportunity for professional advancement within medical physics.

Materials and Methods

The 2020 AAPM membership was queried as surrogate for the current medical physics workforce. Subsets of the AAPM membership were queried as surrogates for ‘professional advancement’ and ‘early-career professional advancement’ in medical physics. Inclusion criteria are summarized below.

Inclusion Criteria for Study Analysis Groups

2020 AAPM Membership

- Active member of AAPM in 2020

‘Professional Advancement’ (PA) Cohort

- CAMPEP program directors
- NIH grant recipients
- AAPM committee members and chairs
- AAPM award recipients

‘Early-Career Professional Advancement’ (ECPA) Cohort

- Member of PA cohort and age <40 as of 1/1/2020 *or*
- NIH K- or F-grant recipient, AAPM early career or junior investigator award recipient, or AAPM Research Seed Grant recipient between 2016-2020

AAPM membership, committee, and awards records, the AAPM-NIH Research Database, the CAMPEP website, and AAPM Education and Research Fund Recipients data were used to identify study analysis group members [11, 20, 21].

Voluntary, self-reported AAPM-member demographics data were provided by AAPM. U.S. population demographics data were obtained from the 2020 U.S. Decennial Census and 2019 American Community Survey [22-24]. Demographic characteristics of the 2020 AAPM membership were compared to those of the PA cohort, ECPA cohort, and U.S. population using the one-sample test for proportions. Temporal trends in member demographics were evaluated using historical AAPM membership data.

The AAPM-NIH Research Database was appended with AAPM demographics data. Distribution of grants by PI demographics were analyzed. To investigate historical trends, grants were stratified by first year of funding.

Results

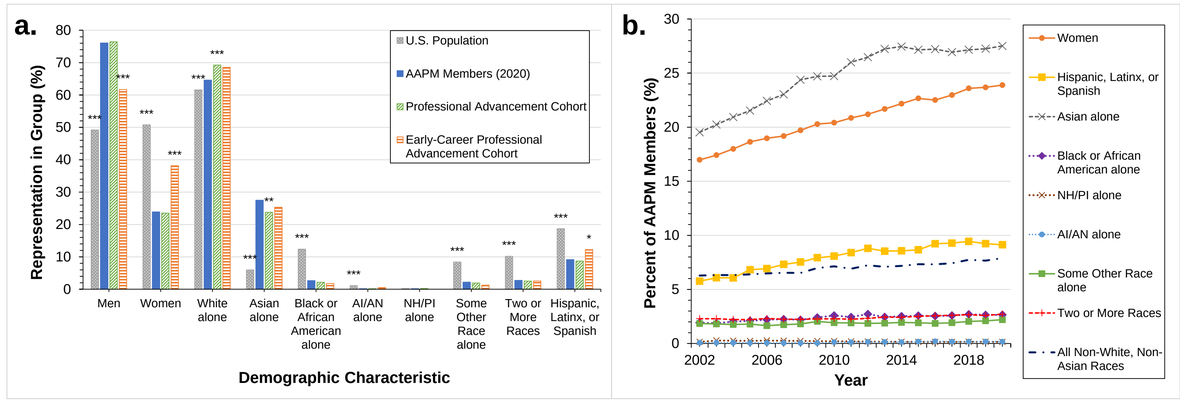

Figure 1. Diversity in the current and historical medical physics workforce. (a) Representation of various demographic groups in the 2020 AAPM membership were calculated and compared to those in the U.S. population, ‘professional advancement’ cohort, and ‘early-career professional advancement’ cohort. Stars denote a statistically significant difference between the percentage of the 2020 AAPM membership reporting a given demographic characteristic and the percentage of individuals in the respective comparison group reporting the same characteristic. * = p<0.05, ** = p<0.01, *** = p<0.001. ‘AI/AN’ = ‘American Indian or Alaska Native. ‘NH/PI’ = ‘Native Hawaiian or Pacific Islander’. (b) Historical trends in AAPM membership demographics.

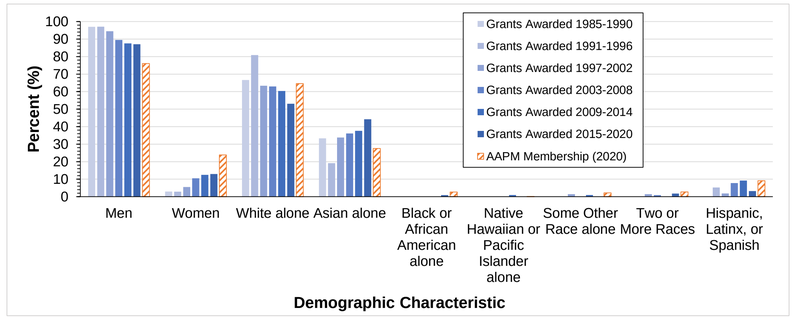

Figure 2. Trends in the Allocation of NIH Grants to AAPM Members by Principal Investigator Demographic Characteristics. Grants listed in the AAPM-NIH Research Database were stratified by first year of funding. Percentages of grants awarded by principal investigator demographic characteristic were calculated for each time period (blue bars). Percentages of the 2020 AAPM membership by demographic group are provided for context (striped, orange bars).

Women and most minority groups remain underrepresented in medical physics, and, in many cases, are even further underrepresented in groups representative of professional advancement in the field. Additionally, very few NIH grants have been awarded to women or minority PIs. However, there have been modest increases in workforce diversity observed over the past several decades, and relatively increased diversity within the ECPA cohort may be indicative of an increasingly inclusive field.

Discussion

Although our findings suggest increasing diversity in medical physics, it remains limited relative to the overall U.S. population. Efforts to recruit, retain, and support a diverse workforce should address the unique professional challenges faced by women and minority medical physicists. Future work may pursue a qualitative understanding of these challenges, which will support successful application of our findings to the development of policy and protocol that ensures diversity, equity, and inclusivity in medical physics.

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