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The Matilda Effect: Underrecognition of Women in Hematology and Oncology Awards

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Key Words. Gender equity • Recognition awards • Disparity • Workforce diversity

Abstract

Background. The proportion of women in the field of hematology and oncology (H&O) has increased over recent decades, but the representation of women in leadership positions remains poor. In an effort to close the gender gap in academia, it is important to report on such inequities in hopes to close these gaps and improve career development.

Materials and Methods. We conducted a retrospective, observational study of published award recipients from 1994 to 2019 from the seven major H&O societies in the world. Gender was determined based on publicly available data. The χ^2 and Cochran-Armitage tests were used for data analysis.

Results. Of the 1,642 awardees over the past 26 years, 915 met inclusion criteria. Award recipients were overwhelmingly men (77.9%) and non-Hispanic White (84.7%). Women awardees received 30.3% of the humanistic and education-related awards, whereas only receiving 16.0% of basic science awards ($p < .01$). Women represent 35.6% of all hematologists and oncologists but only received 24.0% of awards given to these physicians ($p = .004$). Black, Hispanic, and Asian awardees represented 3.7%, 3.3%, and 6.8% of the total awardees, respectively.

Conclusion. From 1994 to 2019, women were less likely to receive recognition awards from the seven major H&O societies studied compared with men. We also observed a considerably low proportion of minority awardees across all oncology subspecialties. Further studies examining how selection criteria favor either gender would be warranted in order to achieve equal representation in academic awards.

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Implications for Practice: In this study, women and minority groups were found to be underrepresented amongst award recipients. Significant disparities were seen in disciplines that have been historically male predominant, such as basic sciences. As awards on an international level enhance academic resumes and assist with career advancement, it is important that awards are being given in an equitable manner. First steps to promote diversity and inclusion in academic medicine is reporting of gender and racial disparities in various areas of academia.

Introduction

In 1993, a historian of science from Cornell University, Margaret W. Rossiter, coined the term "The Matilda Effect" to describe a bias denying recognition to women scientists [1]. Since then, the RAISE project (Recognizing the Achievements of Scholars in Science, Technology, Engineering, the Arts, Mathematics, and Medicine [STEMM]) was launched to

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catalog gender breakdown in STEMM awardees [2]. This large database has demonstrated that women are underrepresented in awards despite the increase in total number of women within STEMM fields over the past 39 years.

In the medical field, recent studies have demonstrated gender disparity in physician recognition awards in a variety of medical specialty societies, including physical medicine and rehabilitation, orthopedic surgery, dermatology, neurology, and otolaryngology [3–7]. Individual recognition awards are typically presented annually to physicians and investigators who have advanced their field by making significant contributions in clinical care, research, education, global health, and/or service. In the field of academic medicine, awards recognize an individual's accomplishments and form an integral part of their career advancement as these recognitions are highly valued by promotion committees [8]. These awards also provide financial support and lectureship, further increasing visibility within the specific medical specialty.

In the U.S., the number of women practicing medicine has increased over time. In 2019, 41% of the active physician workforce and 46% of all resident physicians were women [9]. This increase has been reflected in the membership of medical specialty societies. Medical specialty societies provide leadership development and career advancement opportunities, which has been identified by the American Association of Medical Society Executives (AAMSE) as a significant "value added benefit" [10]. Importantly, these resources can provide substantial professional gains and assist with career advancement [5, 8].

Women in medicine face many challenges, including a lack of mentorship, discrimination, gender bias, imposter syndrome, unequal pay, and the need for a better work-life balance [11]. Improvement in gender equity is ethical and critical to ensuring that female physicians are able to reach their full potential and decrease burn out [11]. There is a large body of evidence that reflects the gender inequities in many aspects of academia. A study conducted with 3,473 physicians across 28 specialties and 54 journals concluded that the gender proportions seen on a subscriber level are not reflected on editorial boards [12]. Another study revealed that women were less likely to have the designation of full professor when compared with men with similar professional roles and achievements [13]. This demonstrates that despite the increase in the proportion of women in the medical workforce, we continue to see evidence of gender inequalities in academia and practice. A study that examined speakers' introductions at the American Society of Clinical Oncology (ASCO) Annual Meeting found that when introduced by men, women speakers were less likely to receive a professional address [14]. According to a recently published paper on gendered publication trends in oncology, although representation by women increased between 1990 and 2017, women composed a smaller percentage of first (26.5%) and senior (19.9%) authors [15]. This trend was noted to reflect the increase of representation by women in the oncologic workforce. However, it also mirrors many of the obstacles faced by women in this field such as salary gap and fewer leadership opportunities [16]. Although h-index is often used as a marker of professional success, it overlooks internal and external service work done by individuals. Emerging research demonstrates that women professors tend to perform more service than men, even when controlling for rank, race, and department [17].

Physicians and investigators specializing in hematology and oncology (H&O) represent a large proportion of the physician and scientific workforce, and participate in multiple global conferences in which recognition awards are given. Data are lacking regarding the representation of women and other underrepresented groups in recognition awards on a national and international level within this specialty. We aimed to examine gender and race representation within award recipients from the seven major international H&O societies in the world.

Materials and Methods

Study Design and Selection of Participants

We conducted a retrospective, observational study evaluating the characteristics of awardees from international H&O societies. We compiled a list of the seven major H&O societies and associations in the specialties of medical oncology, hematology, radiation oncology, and surgical oncology. The organizations selected included ASCO, American Association for Cancer Research (AACR), European Society for Medical Oncology (ESMO), European Hematology Association (EHA), American Society of Hematology (ASH), American Society for Radiation Oncology (ASTRO), and Society of Surgical Oncology. Together, these societies are composed of over 100,000 members. The study was submitted to the Mayo Clinic Institutional Review Board and found to be exempt.

All individual recognition awards given by each of these seven organizations over the past 26 years were identified ($n = 1{,}642$). The data were collected from each society Web site and public records. Awards directed toward medical trainees, teams, and abstract awards were excluded from the analysis. Data were assigned by the study lead (S.P.) to each of the eight coders from a diverse background. Awards were collected in chronologic order as they were listed on the society Web site. Thirty-five gender-specific awards were subsequently excluded from the final analysis (Fig. 1).

Data Collection and Processing

A data extraction tool was developed to identify and categorize the awards and recipients. Data on awardee gender, degree, race/ethnicity, academic/nonacademic rank, geographic location, training status, and h-index were collected.

Data were obtained from the awardees' institutional websites and the directory of the respective society or association. Gender was determined based on awardee full name and public data (photographs, pronouns used to describe the awardee, and other publicly available information). The National Institutes of Health (NIH) Office of Management and Budget (OMB) Directive 15 was used as a framework to define racial and ethnic categories, and race was assigned at the discretion of the coders and public information found through institutional websites.

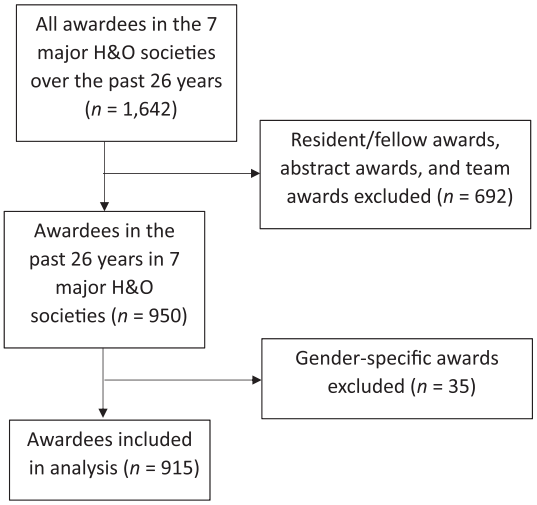

Figure 1. Schematic of study design.
Abbreviation: H&O, hematology and oncology.

Additionally, details on geographic location of awardees' medical training (residency and fellowship) and current institution were collected. Scopus and NIH reporter websites [18, 19] were used to gather information on h-index and funding, including K career development awards and independent scientist award (R) history as separate variables.

Historically, those deemed underrepresented in medicine (URM) were defined as Black, Hispanic/Latino, American Indian/Alaska Native, and Native Hawaiian/Pacific Islander, based on the Association of American Medical Colleges (AAMC) classification [20].

To ensure uniformity in coding strategy, coders were trained by the study lead (S.P.). Coders were part of the investigational team and did not receive monetary incentives. The study lead also reviewed and re-extracted the first 15% of awardee data from each coder, and this information was subsequently matched with the original data to confirm accuracy. Gender distribution of physicians over time was obtained from the AAMC database [21].

Data Analysis

Descriptive statistics were used to summarize the demographics of the awardees by society, academic rank, degree, specialty, and race. Cochran-Armitage and χ^2 tests of proportion were used to compare differences in proportions. STATA statistical software (StataCorp 2017; Stata Statistical Software: Release 15, College Station, TX), and JMP (version 14.1.0, SAS Institute Inc., Cary, NC) were used to analyze data. A two-sided p value < .05 was considered statistically significant.

Results

Over the past 26 years, 1,642 awards were presented at the seven major H&O societies across the world, with 915 awards meeting the inclusion criteria for the final analysis (Fig. 1). Of the 915 awardees, award recipients were overwhelmingly men (77.9%) and non-Hispanic White (84.7%). Awardee demographics are described in Table 1. ESMO and ASTRO represented the lowest distribution of women awardees at 9.1% and 11.1%, respectively.

The gender breakdown of active members was available from five of the seven H&O societies (ASCO, AACR, ASTRO, ASH, and ESMO). Award distribution was compared with the gender distribution within each society (Fig. 2). There was no significant difference between the proportion of women in ASCO (34.0%) and women ASCO awardees (27.7%; $p = .07$). AACR, ASTRO, ASH, and ESMO all had a higher proportion of women members than women awardees ($p < .05$). AACR had 42.2% active women members and 22.1% women awardees ($p < .0001$). ASTRO membership was composed of 22.9% women, with only 11.1% of women receiving awards ($p = .0265$). ASH is composed of 35.0% women, although only 23.2% of women received awards ($p = .0007$). ESMO had the highest composition of active women members at 47%, but only 9.1% of all awards were given to women ($p < .0001$). Notably, women awardees received 47.6% of the awards in the categories of humanism, global health, and advocacy, and only 16.0% of awards in the basic science category ($p < .01$). The average h-index of women awardees (59.4) was lower than that of men (88.1) across all societies. The proportion of K-awardees (women: 8.9%; men: 8.7%) was similar between genders ($p = .93$) whereas the proportion of R-grant recipients was higher among men than women (women: 42.1%; men: 50.1%; $p = .04$).

We further divided the data based on subspecialty. Since 2015, the average proportion of women hematologists/oncologists and radiation oncologists was 35.6% and 27.3%, respectively, per the AAMC [22, 23]. In this period, women hematologists/oncologists have received only 21.1% of all awards, suggesting the awardees included in the study period do not represent the proportion of women in the field ($p = .0016$). We found that women awardees in radiation oncology did in fact represent the proportion of women in the specialty, at 28.6% ($n = 14$; $p = .91$). The gender distribution of surgical oncologists is not publicly available. Across both genders, awardees most commonly were in the academic rank of professor/professor emeritus. Importantly, we found that men who received awards were more likely to have the designation of professor or professor emeritus when compared with women (women: 62.3%; men: 83.3%), with $p < .00001$.

Overall, our analysis reported an upward trend in the number of women awardees. Fig. 3 shows an increase from 10% (1994–1998) to 25.6% (2014–2019) over time ($p = .0004$). Specifically, in the past 5 years, the number of women awardees across all societies has increased from 19.2% to 26.9%.

Black, Hispanic, and Asian awardees represented 3.7% (34/915), 3.3% (30/915), and 6.8% (62/915) of the total awardees, respectively. Of the 64 Black and Hispanic awardees, 60.9% of awards were given for investigating health care disparities, and only 4.6% were given for basic science research. The societies with the highest number of awardees from URM were ASH (16.3%) and AACR (8.4%). Both EHA and ESMO had zero awardees from URM. Race distribution by society is outlined in Table 2.

Table 1. Awardee demographics

Demographic	Women *n* (%), total *n* = 202	Men *n* (%), total *n* = 713
Society		
ASCO	54 (27.8)	140 (72.2)
ASTRO	7 (11.1)	56 (88.9)
AACR	50 (22.1)	176 (77.9)
ASH	44 (23.2)	146 (76.8)
EHA	8 (20.5)	31 (79.5)
ESMO	6 (9.1)	60 (90.9)
SSO	33 (24.1)	104 (75.9)
Academic rank		
Professor/professor emeritus	126 (17.5)	594 (82.5)
Assistant/associate professor	20 (55.6)	16 (44.4)
Instructor	2 (50.0)	2 (50.0)
Community physician	4 (9.8)	37 (90.2)
Not applicable/unknown	50 (43.9)	64 (56.1)
Degree		
M.D.	82 (17.5)	386 (82.5)
M.D. and master's degree	13 (34.2)	25 (65.8)
M.D./Ph.D.	25 (15.9)	132 (84.1)
Ph.D.	51 (26.4)	142 (73.6)
Other/unknown	31 (52.5)	28 (47.5)
Time period		
1994–1998	8 (10.0)	72 (90.0)
1999–2003	16 (16.8)	79 (83.2)
2004–2008	26 (17.4)	123 (82.6)
2009–2013	61 (26.1)	173 (73.9)
2014–2019	91 (25.6)	265 (74.4)
Specialty		
Medical oncology	43 (17.6)	201 (82.4)
Hematology	38 (20.7)	146 (79.3)
Surgical oncology	18 (21.7)	65 (78.3)
Radiation oncology	8 (13.8)	50 (86.2)
Pediatric hematology and oncology	14 (27.5)	37 (72.5)
Other	38 (26.4)	106 (73.6)
Not applicable/unknown	43 (28.5)	108 (71.5)
Award type		
Advancing the field	18 (14.5)	106 (85.5)
Basic sciences	59 (16.0)	310 (84.0)
Research	21 (28.0)	54 (72.0)
Clinical practice	48 (27.3)	128 (72.7)
Education	8 (15.1)	45 (84.9)
Global health	4 (40.0)	6 (60.0)
Humanitarian	23 (39.7)	35 (60.3)
Advocacy	12 (85.7)	2 (14.3)
Other	9 (25.0)	27 (75.0)
Race		
Non-Hispanic White	157 (77.7)	618 (86.7)
Black or African American	19 (9.4)	15 (2.1)
Asian	13 (6.4)	49 (6.9)
American Indian/Alaska Native	0 (0.0)	0 (0.0)
Native Hawaiian/Pacific Islander	0 (0.0)	0 (0.0)
Hispanic/Latinx	10 (5.0)	20 (2.8)
Unknown	3 (1.5)	11 (1.5)

Abbreviations: AACR, American Association for Cancer Research; ASCO, American Society of Clinical Oncology; ASH, American Society of Hematology; ASTRO, American Society for Radiation Oncology; EHA, European Hematology Association; ESMO, European Society for Medical Oncology; SSO, Society of Surgical Oncology.

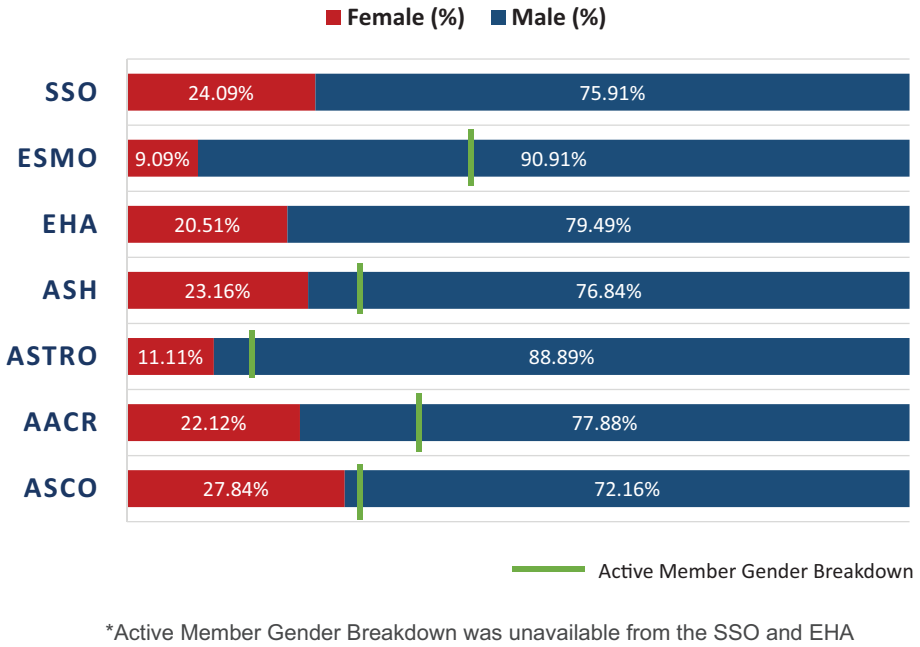

Figure 2. Gender breakdown of awardees in seven hematology and oncology societies. Red bars represent women and blue bars represent men. Green vertical line in each bar represents active member gender breakdown.
Abbreviations: AACR, American Association for Cancer Research; ASCO, American Society of Clinical Oncology; ASH, American Society of Hematology; ASTRO, American Society for Radiation Oncology; EHA, European Hematology Association; ESMO, European Society for Medical Oncology; SSO, Society of Surgical Oncology.

Of the 520 physician awardees working at institutions in the U.S., 83.1% graduated from U.S. medical schools (supplemental online Table 1). Across the 663 physician awardees internationally, more than three-fourths were from institutions in the U.S., followed by one-sixth from Europe. Representation from Africa, Australia, South and East Asia, Central and South America, the Middle East, and Canada combined was less than 5% of total awardees (supplemental online Table 2).

Discussion

To our knowledge, this study is the first to assess the gender and race representation in recognition awards presented by the major H&O specialties, including medical oncology, hematology, radiation oncology, and surgical oncology. During our study period, women physicians and investigators were less likely to receive recognition awards at the seven major hematology and oncology societies in the world, compared with men. When the data were adjusted to account for the gender distribution of membership, these disparities remained in four of the five organizations from which data was available. Thus, our study mirrors that of Silver et al. [5], which found inequity in the representation of women among recipients of physician recognition awards from 11 medical societies representing seven specialties, and adds the perspective of H&O awards. An encouraging fact is that the proportion of women awardees has increased over the past 26 years, although significant underrepresentation remains. It is important to note that aggregate numbers for awardee percentage may hide considerable differences within award type. As evidenced in Table 1, the proportion of women receiving basic science awards is significantly less than those receiving awards in the categories of humanism, global health, or advocacy. Disciplines that are male predominant, such as basic science, tend to show unusually slow improvements in the gender ratio over time [24]. These specific disciplines require additional interventions if parity is to be reached. Fostering more women in basic research may benefit representation by women at many levels of academia and improve productivity, collaboration, and recruitment.

It is important to note that there are external factors that could contribute to the discrepancy in gender distribution of these awards. Namely, the h-index, which acts as a marker to describe the quantity and quality of research output, was higher in men than in women. This could contribute to a portion of this discrepancy, specifically in the basic science category. However, the literature also demonstrates that women are disadvantaged when applying for research funding and obtaining high impact publications [25, 26]. A study looking at NIH grant funding demonstrated that women applicants are held to higher evaluation standards than their male counterparts. This study found that NIH grant-funding reviewers assigned significantly worse scores to women principal investigators compared with men, despite using more positive adjectives in their comments on women's applications [25]. Similarly, our data suggest a lower number of R grants among women, which decreases their potential for research productivity. It is also important to note that the h-index does not reflect academic service, including serving on committees, teaching, mentoring, or serving on boards of professional organizations. These activities add value to a candidate's leadership but take away from time and opportunity to conduct additional research.

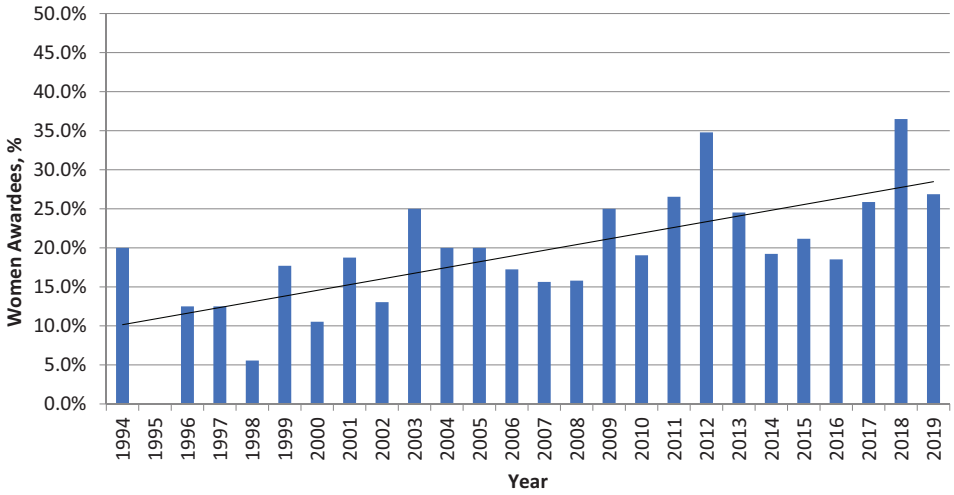

Figure 3. Trend in percentage of women awardees in hematology and oncology specialties over the past 26 years (1994 to 2019).

Men also had higher rates of professor/professor emeritus status, an important factor in the selection of awardees. However, existing data suggest that women generally have lower academic ranking compared with men despite similar academic achievements [13]. In this context, it is challenging to translate merit based on academic rank alone. Finally, we note that awards tend to be given at a later career stage, and as numbers of women in medicine and in H&O continue to increase, we may see a natural increase in women awardees.

We also observed a considerably low proportion of minority awardees in all oncology subspecialties. Although there may be a component of low representation in the medical workforce at large, the reason is likely multifactorial. Lack of representation of URM in leadership roles despite similar qualifying factors has been demonstrated in a variety of specialties [27–30]. Leadership roles contribute to visibility and opportunities, which, in turn, can help with career advancement and recognition. Additionally, many minority faculty are given the task to improve diversity and inclusion efforts in the workplace, also known as the "minority tax." These extra responsibilities often detract from time spent on scholarly productivity, which is commonly used as a benchmark for awards. It is important to note that more than half of the awards to Black and Hispanic physicians and investigators were given for investigating health care disparities, whereas very few were awarded in the basic science category. Our study is consistent with prior studies in medicine that demonstrate the low representation of URM physicians in many aspects of academia, such as admissions and leadership.

International medical graduates practicing in the U.S. also made up a disproportionally low number of awardees. According to the Accreditation Council of Graduate Medical Education, 36.4% of active hematologist-oncologists in the U.S. are international medical graduates [31]. Moreover, 40.9% of hematology-oncology fellows in the U.S. are international medical graduates [32]. International medical graduates make up a very significant component of the oncological workforce in the U.S. but are underrepresented as award recipients.

All seven societies are based in the U.S. or Europe, and as such, international physicians and investigators were considered those from non-U.S. or European countries. International physicians/investigators represented less than 5% of all awardees. These data highlight the opportunity to increase the number of international collaborations in the field of H&O. Collaboration between physicians/

Table 2. Racial distribution by society

Race	ASCO, *n* (%)	ASTRO, *n* (%)	AACR, *n* (%)	ASH, *n* (%)	EHA, *n* (%)	ESMO, *n* (%)	SSO, *n* (%)
Non-Hispanic White	169 (87.1)	53 (84.1)	193 (85.4)	148 (77.9)	37 (94.9)	63 (95.5)	112 (81.8)
Black or African American	5 (2.6)	1 (1.6)	11 (4.9)	16 (8.4)	0 (0.0)	0 (0.0)	1 (0.7)
Asian	15 (7.7)	7 (11.1)	12 (5.3)	9 (4.7)	0 (0.0)	2 (3.0)	17 (12.4)
American Indian/Alaska Native	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Native Hawaiian/Pacific Islander	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Hispanic/Latinx	4 (2.1)	1 (1.6)	8 (3.5)	15 (7.9)	0 (0.0)	0 (0.0)	2 (1.5)
Unknown	1 (0.5)	1 (1.6)	2 (0.9)	2 (1.1)	2 (5.1)	1 (1.5)	5 (3.6)

Abbreviations: AACR, American Association for Cancer Research; ASCO, American Society of Clinical Oncology; ASH, American Society of Hematology; ASTRO, American Society for Radiation Oncology; EHA, European Hematology Association; ESMO, European Society for Medical Oncology; SSO, Society of Surgical Oncology.

investigators from different countries would likely increase diversity in patient populations and ultimately would benefit medical advancements within the field.

Our study has limitations, starting with its retrospective design. In our study, gender assignment was binary, which could have led to the misclassification of awardees from gender minorities. Additionally, no self-reported data on gender or race were available, although we ensured our coders were from diverse backgrounds to mitigate potential bias. Importantly, our methodology for race assignment had limitations as awardees were assigned at the discretion of the coder. Incorporating race into research has its challenges, as these variables are difficult to define. Coders used the NIH's OMB Directive 15 as a framework to mitigate this. Despite this limitation, it is essential to begin characterizing the racial disparities within awards from processional societies given the impact of these awards on career advancement. Additionally, as bias is often the basis of inequality, it is important to note that the perception of a person's gender or race can affect how they are viewed by the selection committees. This is similar to how they were coded in our study, providing valuable information on the demographics of awardees.

Further studies should aim to determine the gender and racial bias behind selection criteria for awards. Efforts should be made to encompass different types of academic strengths and ensure criteria that do not disproportionately favor one gender or race over the others. Additionally, it will be important to consider the racial and gender representation on the committees that choose the candidates for these awards. Moreover, having awardees self-report their gender with nonbinary categories and race going forward would ensure awardees are appropriately classified. To further research in this area to reach parity, professional societies can collect gender, race, and other variables so that they can examine their own diversity internally.

Conclusion

Between 1994 and 2019, women physicians and investigators were less likely to receive recognition awards from the seven major H&O societies compared with men. A considerably low proportion of minority awardees were seen in all H&O subspecialties. Although the proportion of women awardees has increased over time, significant underrepresentation remains. Further studies examining how selection criteria favor either gender would be warranted to achieve equal representation in academic awards.

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Disclosures

Ana I. Velazquez: Johnson & Johnson Innovations (E–family member), Corbus Pharmaceutical, Portola, Midatech (OI–family member); **Narjust Duma:** Pfizer, AstraZeneca, Bristol-Myers Squibb, Inivata, Neogenomics, Janssen, BI Oncology (SAB, C/A). The other authors indicated no financial relationships.

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