Gender representation in U.S. biomedical informatics leadership and recognition

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ABSTRACT

Objective: This study sought to describe gender representation in leadership and recognition within the U.S. biomedical informatics community.

Materials and Methods: Data were collected from public websites or provided by American Medical Informatics Association (AMIA) personnel from 2017 to 2019, including gender of membership, directors of academic informatics programs, clinical informatics subspecialty fellowships, AMIA leadership (2014-2019), and AMIA awardees (1993-2019). Differences in gender proportions were calculated using chi-square tests.

Results: Men were more often in leadership positions and award recipients ($P < .01$). Men led 74.7% (n = 71 of 95) of academic informatics programs and 83.3% (n = 35 of 42) of clinical informatics fellowships. Within AMIA, men held 56.8% (n = 1086 of 1913) of leadership roles and received 64.1% (n = 59 of 92) of awards.

Discussion: As in other STEM fields, leadership and recognition in biomedical informatics is lower for women.

Conclusions: Quantifying gender inequity should inform data-driven strategies to foster diversity and inclusion. Standardized collection and surveillance of demographic data within biomedical informatics is necessary.

Key words: gender, leadership, awards, equity, informatics

INTRODUCTION

Background and Significance

Gender differences are pervasive in society, and these inequities have been well documented in science and medicine.[1] For example, over the span of 118 years, women comprised only 5% (n = 12 of 219) of Nobel Laureates in Medicine from 1901 to 2019.[2] Women are often underrepresented in leadership, awards, authorship, compensation, and promotion opportunities.[3–6] Underrepresentation is prominent within academic institutions with women constituting only 33% of tenure-track faculty positions in U.S. medical schools.[7] This means fewer visible women role models, mentors, and internal and external service opportunities for women scientists.[1] Aside from issues of fairness, gender diversity is beneficial for scientific discovery by increasing creativity and innovation, expanding aims of inquiry, and addressing health disparities.[8]

In recent years, professional organizations and associations in science and medicine have prioritized gender equity and inclusion, which has led to the establishment of new committees and policies.[8–11] For example, the National Institutes of Health Intramural Research Program Action Task Force to address gender inequality recommended both institutional and individual changes. Strategies for improvement include leadership commitment to gender equity; establishing systems for tracking and reporting gender-related metrics; providing support, mentorship, and coaching; and facilitating opportunities for discussion to identify contributing factors of gender inequality.[8] Additionally, National Academies of Sciences committees recommended similar strategies, including increasing transparency and accountability through data collection and reporting; creating interventions based on these data; rewarding, recognizing, and providing resources for equity efforts; and filling critical knowledge gaps in scholarly research.[2] These data-driven strategies provide actionable approaches for institutions and professional associations to support the recruitment, retention, and advancement of women. In 2019, an increasing number of women (44%, n = 44 of 100) were elected to the National Academy of Medicine,[12,13] and a record high number of women (40%, n = 40 of 100) were elected to the National Academy of Sciences.[14,15] These initiatives may have contributed toward higher proportions of women elected to leadership roles on committees and to the National Academies in recent years.

However, gender equity among biomedical informatics leaders has not yet been studied. The American Medical Informatics Association (AMIA) is a scientific professional association for informaticians focused on the science and practice of informatics within clinical care, research, education, and policy.[16] AMIA is committed to diversity, equity, and inclusion through a number of initiatives, committees, and task forces.[16] Initially an ad hoc task force in 2016, the Women in AMIA initiative became an official AMIA committee in 2018 and currently consists of 4 subcommittees.[17] The Women in AMIA Awards and Leadership Subcommittee's scope includes increasing the number of women in leadership positions and recognized by awards, both within and external to AMIA. This study aimed to characterize gender representation in informatics leadership positions and among AMIA award recipients, as AMIA awards are highly recognized internationally within the field of biomedical informatics.

Objectives

We describe gender representation in leadership and awards recognition within the U.S. biomedical informatics community, including academic institutions with informatics training programs, clinical informatics subspecialty fellowship programs, and AMIA. This study was conducted by members of the Women in AMIA Awards and Leadership Subcommittee.

MATERIALS AND METHODS

Data were collected annually from public websites or provided by AMIA personnel from 2017 to 2019. Data for gender representation within AMIA membership were provided by AMIA, and members could manually update their online demographic profiles beginning in 2018. Academic institutions with biomedical informatics training programs in the United States were identified from a list of AMIA Academic Forum memberships[18] and National Library of Medicine University-based Biomedical Informatics and Data Science Research Training Programs.[19] Academic institutions were categorized by the

type of informatics unit the institution contained (eg, center, department, program). Clinical informatics subspecialty fellowship programs accredited by the Accreditation Council for Graduate Medical Education (ACGME) were identified from a list of participating programs on the Association of American Medical Colleges Electronic Residency Application Service website from 2018 to 2019.[20]

AMIA awards included in this study were all types of signature awards, which recognize significant contributions in biomedical informatics for AMIA members at various stages of their career.[21] Award recipients (1993-2019) were identified from published lists of awardees.[21] AMIA leadership roles included members of the AMIA board of directors, general committee chairs, scientific program committee chairs, and working group chairs. Leadership role data from 2014 to 2019 were provided by AMIA personnel. General committees of AMIA included the following: Accreditation, American College of Medical Informatics, Audit, Awards, Education, Ethics, Executive, Finance and Investment, Maintenance of Certification, Membership and Outreach, Nominating, Public Policy, Working Group Steering, and Women in AMIA Steering committees. Scientific Program Committees of AMIA included: Annual Symposium, Clinical Research Informatics Summit, Translational Bioinformatics Summit, iHealth Clinical Informatics Conference, InSpire Conference, Clinical Informatics Conference, and Informatics Educators Forum. AMIA also has approximately 25 working groups which are each led by a chair.

Data were abstracted and logged in Excel by 2 reviewers, including the name and gender of the director, type of biomedical informatics unit, committee or leadership role, and award. Gender was determined based on the pronouns listed for the director or award recipient on the websites, or additional searches were performed to corroborate profile narratives to identify gender. To test for differences in the proportions of men and women, P values were calculated using chi-square tests. Analyses were conducted in Python 3.7.

RESULTS

Between 2017 and 2019, men represented the majority of leadership positions in academic biomedical informatics ($P < .01$) and ACGME-accredited clinical informatics subspecialty fellowship programs ($P < .01$) in the United States. Men led 74.7% (n = 71 of 95) of academic informatics programs and 83.3% (n = 35 of 42) of clinical informatics fellowship programs (Table 1). There were differences in gender proportions ($P < .01$) for institutional directors of programs and other types of informatics units (eg, division, group, institute). There were no women clinical informatics fellowship program directors in 2018; in 2019, women led 18.4% (n = 7 of 38) of fellowships (Figure 1).

As of October 2020, AMIA had approximately 5500 members, which included 45% male, 28% female, 27% not specified (26% incomplete online demographic profiles and 1% preferred not to answer), and <1% nonbinary. Within AMIA, men held slightly over half of leadership roles (56.8%, n = 1086 of 1913) from 2014 to 2019. There were differences in the proportions of gender across all committees ($P < .01$) and working group chairs ($P < .05$), but not for the board of directors. With regards to awardees between 1993 and 2019, men received the majority of awards (64.1%, n = 59 of 92), and no women received awards before 2002. There were differences in gender proportions for 3 AMIA awards (Morris F. Collen Award of Excellence, Donald A.B. Lindberg Award for Innovation in Informatics, and Virginia K. Saba Informatics Award) with the

Table 1. Leadership and Award Recipients in Biomedical Informatics by Gender

Leadership or Award Type	Women	Men
Academic Biomedical Informatics Leadership (2017-2019)[a,b]	**24 (25.3)[c]**	**71 (74.7)[c]**
Center	7 (41.2)	10 (58.8)
Department	11 (35.5)	20 (64.5)
Program	2 (8.0)[c]	23 (92.0)[c]
School	3 (30.0)	7 (70.0)
Other (eg, division, group, institute)	1 (8.3)[c]	11 (91.7)[c]
Clinical Informatics Fellowship Program Leadership (2018-2019)[b]	**7 (16.7)[c]**	**35 (83.3)[c]**
AMIA Leadership (2014-2019)[d]	**827 (43.2)[c]**	**1086 (56.8)[c]**
Board of Directors	57 (44.8)	70 (55.2)
Committees	458 (43.5)[c]	595 (56.5)[c]
Scientific Program Committees	252 (42.8)[c]	337 (57.2)[c]
Working Group Chairs	60 (41.7)[e]	84 (58.3)[e]
AMIA Signature Award Recipients (1993-2019)	**33 (35.9)[c]**	**59 (64.1)[c]**
Morris F. Collen Award of Excellence	5 (18.5)[c]	22 (81.5)[c]
Donald A.B. Lindberg Award for Innovation in Informatics	2 (12.5)[c]	14 (87.5)[c]
AMIA New Investigator Award	6 (40.0)	9 (60.0)
Virginia K. Saba Informatics Award	14 (93.3)[c]	1 (6.7)[c]
William W. Stead Award for Thought Leadership in Informatics[f]	1 (14.3)	6 (85.7)
Don Eugene Detmer Award for Health Policy Contributions in Informatics	5 (41.7)	7 (58.3)

Values are n (%).

AMIA: American Medical Informatics Association.

[a]Four academic institutions did not report having a director on their website.

[b]If the director was in the position for more than 1 year at the same institution, this was counted only once.

[c]$P < .01$.

[d]Some AMIA committees had 2-year terms, and committee members were counted each year for consistency and if a new committee member was added or resigned during the term.

[e]$P < .05$.

[f]Chi-square tests were not conducted where the expected value was <5.

Saba award for nursing informatics being primarily awarded to women ($P < .01$). Women received 93.3% (n = 14 of 15) of nursing informatics awards. The overall number of women recipients increased within the last 6 years, which accounted for almost half (47.2%, n = 17 of 36) of all award recipients (Figure 1).

DISCUSSION

Despite growing initiatives from national organizations in medicine and informatics to advance gender equity, leadership and award-based recognition in U.S. biomedical informatics remains lower for women. Aside from nursing informatics awards, men exceeded women in recognition and leadership. Women were least represented in roles as clinical informatics subspecialty fellowship program directors. Having less women in leadership and recognized by awards may partially be due to the lower proportion of women within academic medicine and STEM fields.[7] However, comparing our findings to the larger biomedical informatics community in the United States is difficult because of the lack of a specific occupational category that encompasses the diversity of the informatics workforce.[22] Within AMIA, the proportion of women in leadership

positions (43%) and award recipients (36%) were higher than the proportion of women members overall (28%). However, we cannot conclusively evaluate gender parity given the considerable amount of members with unknown gender (27%) as online demographic profile data collection by AMIA only began recently. As the proportion of women in STEM has increased in recent years,[23] it is possible that individuals in leadership roles and receiving awards reflect more gender-skewed cohorts of decades past. Given these challenges of evaluating gender proportions within the field of biomedical informatics, we recommend the systematic collection, surveillance, and dissemination of demographic data on the biomedical informatics workforce. Such data could also facilitate greater understanding of (in)equitable pathways for advancement across career trajectories, highlighting potential opportunities for advancing equity in biomedical informatics.

While there are several multidimensional factors related to gender equity, prior investigations suggest that academic institutional factors, such as salary inequities and lack of sponsorship, may prevent women from pursuing academic careers or advancing to leadership and recognition.[6,8] Sociocultural beliefs and gendered expectations of women in society may also perpetuate these inequities through implicit biases.[3] As ACGME accredited the first clinical informatics fellowship programs in 2014,[24] institutions should be cognizant of potential inequities within newer subspecialties and look for specific opportunities to recruit diverse leadership and trainees as new fellowship programs are established.[25,26]

The recent increase in women represented across all categories of leadership and award recognition from 2018 to 2019 is promising. Evidence suggests the presence of women on committees who aid in the nomination process, particularly as chairs, may increase the number of women nominees.[3] An aim of the Women in AMIA Awards and Leadership Subcommittee is to increase the pool of women award nominees, which may have contributed to the rising number of women award recipients. This cannot be verified, however, because data on the number and gender of all award nominees were not available for analysis. Our findings illustrate that gender proportions for leadership and recognition are closer within AMIA than among leadership of academic and clinical informatics fellowship programs in the U.S. professional associations may play an important role in prioritizing and influencing equity and inclusion within the profession and the biomedical informatics community.

Limitations

Data examined were cross-sectional and collected across multiple years. Thus, it is possible that leadership roles or gender profiles changed outside of the period of data collection. As the field of biomedical informatics is multidisciplinary and encompasses various training pathways and careers, it is difficult to clearly identify biomedical informatics practitioners in existing occupational classifications at a population level. Therefore, gender proportions within the biomedical informatics workforce are not currently known. Consequently, the proportion of women in leadership positions and award recipients cannot be compared with an existing benchmark in the U.S. biomedical informatics community. Within AMIA, conclusive benchmarking of gender representation is also not possible due to missing gender data among membership (27% not specified). Benchmarking could not be performed for specific biomedical informatics disciplines, such as nursing informatics, as the data on the proportion of members self-identifying as nurse informaticians and their gender were not publicly available. Data were also collected from
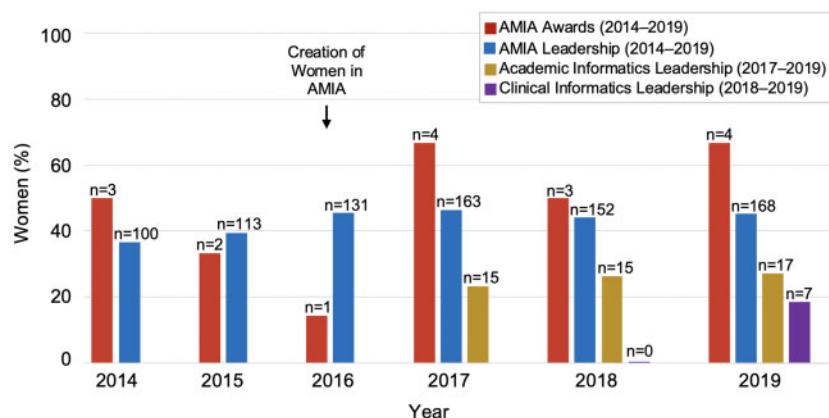
Figure 1. Proportion of Women in Biomedical Informatics Leadership Roles and Award Recipients (2014-2019)

U.S. academic biomedical informatics institutions and fellowship programs and are not necessarily generalizable to international biomedical informatics institutions. Our findings may also not be representative of other informatics professional organizations, such as the Healthcare Information and Management Systems Society or the American Health Information Management Association, as the analysis was focused on AMIA.

CONCLUSION

Although leadership and award recognition in biomedical informatics is lower for women as compared with men in the United States, recent positive trends and ongoing efforts to address gender inequities in academia are encouraging. It is also important to assess representation and other aspects of diversity in addition to gender, such as race, ethnicity, geography, age, and other intersectional characteristics across career stages.[27] The COVID-19 (coronavirus disease 2019) pandemic has also raised concerns within many scientific communities about acutely exacerbating gender inequities, such as reduced research productivity for women scientists,[28] which may have unknown longer-term consequences for their career advancement. Professional organizations can be role models and important contributors to advance societal and institutional values around identifying and reducing gender inequities.[29] Quantifying inequities are a necessary initial step, although the field lacks complete demographic data. This study highlights the importance of prioritizing the systematic collection, surveillance, and dissemination of demographic data about the biomedical informatics workforce. This is foundational to more comprehensive workforce gender diversity assessments and the development of impactful strategies to promote diversity, equity, and inclusion in biomedical informatics communities.

FUNDING

AUTHOR CONTRIBUTIONS

All authors contributed to the study design and participated in writing the manuscript. All authors are responsible for this research and approved the final manuscript.

ACKNOWLEDGMENTS

CONFLICT OF INTEREST

None declared.

DATA AVAILABILITY

The data underlying this article will be shared on reasonable request to the corresponding author.

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