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An eye on gender equality: A review of the evolving role and representation of women in ophthalmology

Short -title: Representation of Women In Ophthalmology

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Abstract

Purpose: In recent decades, women have achieved greater representation in ophthalmology. Globally, women now constitute about 25-30% of ophthalmologists, and 35-45% of trainees. Nevertheless, women remain under-represented in key areas, including positions of professional and academic leadership and ophthalmic surgical subspecialisation. Furthermore, there is evidence that women in ophthalmology encounter more bias and discrimination across multiple domains than men, including a gender-pay gap that is wider than in many other surgical subspecialties. Women ophthalmologists and trainees report sharply differing training experiences from male peers, including fewer opportunities to operate, more bullying and harassment, less access to mentorship, and contrasting expectations around contributions to family life.

Design: Perspective

Methods: An extensive literature search was undertaken to compile and review papers published with a focus on gender equity across ophthalmology, surgery, and medicine.

Results: We identified eight broad domains that were widely discussed: leadership, research and academics, income, surgical exposure and sub-specialization, harassment, career satisfaction, mentorship, and family and marital differences. We have summarized the current research across each of these areas, and discussed possible solutions to reduce the inequities reported.

Conclusions: This review draws on current research published around representation and experiences of women in ophthalmology and suggests there are opportunities to improve gender inequity.

Representation of Women in Ophthalmology

In 1966, about 7% of United States (US) graduates from medical school were women; however, women now comprise half of the medical school graduates in the western world.³⁻⁵ While women graduate numbers are increasing, a 2019 publication assessing gender equity in the health workforce across 104 countries demonstrated that the percentage of women physicians remains lower than 50% in the majority of regions (Western Pacific 41%, South East Asian 39%, Eastern Mediterranean 35%, Americas 46%, African 28%). Europe leads women representation in medicine with 53% of physicians identifying as women. Within ophthalmology, the number of women trainees and ophthalmologists have also increased over the decades. An analysis of US data found the proportion of women ophthalmologists increased from 4% in 1969 to about 27% in 2019. While the percentage of women in ophthalmology has increased over time, it remains lower than the percentage of women physicians (36.3%) working within medicine as a whole (Figure).⁶ However, in terms of surgical specialities, ophthalmology ranks third in women representation.

Many ophthalmology training programs have set strategic goals with an aim to achieve equal gender representation in years to come. While at present the numbers of women ophthalmology consultants and leaders remains imbalanced, the percentage of women trainees is increasing.^{1, 7-9} In 2016, the Royal College of Ophthalmologists reported just 26% of consultants in the United Kingdom (UK) were women, compared with 43% of full time ophthalmology trainees.¹⁰ Similar numbers have been reported in Australia and New Zealand (33% of incoming ophthalmology trainees were women in 2019),¹¹ and the US (44% of residents and fellows were women in 2019).¹²

Leadership

Women leaders are often thought of as catalysts of organizational culture change as well as advocates for creating supportive career experiences for a diverse medical education and health care workforce. Increasing female representation within leadership remains an important consideration for training and departmental boards, with evidence demonstrating that effective management of diverse and inclusive departments requires diversity among leaders. In addition, the lack of women leaders as role models reduces the likelihood of junior women in early career positions aspiring to leadership roles.¹ Across academic medicine and surgical specialties, women remain under-represented in positions of leadership.^{13, 14} This trend is seen throughout roles of ophthalmology residency program directors and chairs,¹⁵ academic leaders,^{16, 17} journal editors,^{6, 18} and conference program committees.¹⁴ A recent study was undertaken to assess gender distribution of ophthalmology societies' awardees.¹⁹ The authors identified that women received 25.3% of the awards from major ophthalmology societies for the fifty years between 1970- 2020. Only 11% of named lectures were and 22% of achievement awards, and 16% of society awards were conferred to women.¹⁹

For the academic year 2018-19 Lautenberger and Dandar reported that females comprised 18% of department chairs at US academic medical centers and 29% of division chiefs were women.²⁰ Similar findings have been reported within ophthalmic societies. A 2020 publication by Camacci et al. found that of the 15 ophthalmic societies analysed, only 2 had women presidents (13.3%), and of the 20 highest-ranked ophthalmic journals, only 1 had a women editor-in-chief (4.2%).¹⁸ This report noted that, although men serving as editorial board members had on average higher “h-indices” (an author-level metric that measures both the productivity and citation impact of the publications of a scientist) than women members, this difference disappeared once allowances were made for the typically shorter length of women’s academic careers (i.e. dividing the h-index by the number of years since first publication to calculate the “m-quotient”). Hence, the authors concluded that men’s over-representation of editor-in-chief and society president positions could not be explained by fundamental differences in quality of academic output.¹⁸

There is, nonetheless, evidence of improvements on this front. The American Academy of Ophthalmology (AAO) appointed their fifth women president in 2021 (the first in 2005); it is notably a positive trend that three of the past five presidents have been women.²¹ In Australia and New Zealand, The Royal Australian and New Zealand College of Ophthalmologists (RANZCO), appointed their first women president in 2020. A recent survey of ophthalmologists found an increase in self-reported leadership positions held by women (48% of men and 39% of women).^{22, 23} While only 17 women were listed in The Ophthalmologist’s Power List of the top 100 most influential people within ophthalmology in 2020, this is considerably more than the six listed in this group in 2015. In 2021, The Ophthalmologist focused exclusively on women in their Power List, highlighting the contributions of women.²⁴ In the survey of awardees within major ophthalmological societies, there were positive trends in trainee (46%) and early-career (37%) women receiving awards.¹⁹ In addition, women received awards at a higher prevalence than the proportion of women in the US ophthalmology workforce gender distribution in several years between 2010-2020.¹⁹

Academics and Research

Although the representation of women in academic medicine is increasing, major differences persist in gender representation at senior faculty and other positions of leadership.^{18, 25, 26} In 2007, only 4% of ophthalmology academic chair positions were held by women in the US; by 2018, it had increased, but only to 10%.²⁷ These findings are consistent with those observed for other surgical specialties. In 2018 in the US, the overwhelming majority of surgical departmental chairs were held by men: plastic surgery (94%), urology (96%), otolaryngology (97%), general surgery (97%), neurosurgery (99%), and orthopaedic surgery (100%).²⁷ Additional data from 2020 demonstrated that women account for 24% of professors, 38% of associate professors, 49% of assistant professors, and 53% of instructors of ophthalmology at US medical schools, emphasising a underrepresentation

of women in senior ranks.²⁸ An area of concern is the finding that the sex ratios for professorial rank have not changed significantly from when data was analysed from the American Association of Medical Colleges for the years 2003 to 2017.²⁹

The status of women within a research field can be an important indicator of inclusivity in its scientific community. Across countries and disciplines, studies show male researchers receive more research funding than their women peers.^{30,31} In a US study in 2014 for example, women principal investigators were less likely to receive grants in their early careers from the National Institutes of Health (NIH) and received smaller awards than men. Reddy and associates also found that women ophthalmologists established fewer industry partnerships and attracted less industry funding.⁷ Svider et al. noted gender disparities in the value of ophthalmology research awards, with the mean grant awarded to women being about one-sixth lower of that for men, while Rusakevich et al. reported male gender to be associated with higher values of start-up funding, and greater current salaries amongst US ophthalmology clinician-scientists.³² In some areas at least, there is evidence of improvement, including a 2020 study of cornea researchers that reported no difference in the median value of NIH awards by gender.³³

Publications are important drivers of promotion considerations in academia. Multiple studies have documented a gender disparity in first and last authorship (which, in contrast with middle author positions, are typically used as indicators of intellectual leadership in papers), although this gap is narrowing.^{26,34} Franco-Cardenas et al. also noted no increase in editorial authorship by women between 2000 and 2010.²⁶ In an analysis of papers published in high ranking ophthalmology journals during 2000-2009, a significant increase was observed over time in the percentage of women first authors (21% to 34%) and last authors (19% to 21%).³⁴ In a survey of over 100,000 ophthalmology publications between 2002 and 2014, Mimouni et al. found that the representation of women scientists increased steadily during this period in first author positions, but less so in last author positions (the last position is often used to denote the senior intellectual leader of a paper).³⁵ Similarly, an analysis of ophthalmology papers published during 2015-2019 found that 38% of papers involved women as first authors and 27% as last authors.³⁶

Kalavar et al. also noted a significant gender association between first and last authors, with authors more likely to collaborate with people of the same gender.³⁶ This gender clustering in key author positions, which applied to both men and women, is relevant because senior authors often serve as mentors for first authors. This clustering suggests that senior women have helped the progress of junior women scientists by mentoring them. Nevertheless, in a potentially positive sign that more men are taking on mentoring roles for women scientists, Shah et al. reported that the degree of gender clustering in first/last authorship positions of ophthalmology publication decreased during 2015-2019 compared to 2000-2009.^{34,36}

A further indicator of peer esteem is contribution to major scientific and professional meetings and podium presentations. Women filled less than one-fourth of the main podium faculty roles at vitreoretinal meetings included for analysis over a 5-year period, although there was a significant increase in women representation when 2015 and 2019 participation were compared.³⁷ Meetings with at least one woman program committee member were noted to include significantly more

women in podium roles and this difference was reflected in the invited speaker and moderator and panelist categories.³⁷

Several possible explanations have been offered to account for the disparities in academic achievement and recognition between women and men. One is that there is a bottleneck from completing higher degrees to developing independent research programs arising from a combination of lack of mentorship, inflexible academic timelines, difficulties in accessing professional network and in balancing research and family commitments.²² Women in vision sciences, for example, are less likely to transition from postdoctoral fellow to faculty after obtaining their PhD. Similar barriers to academic career achievement have been noted in the broader medical and surgical academia sector.³⁸ According to the National Science Foundation, women complete about half of all doctoral degrees in science, yet represent 22% of the faculty at the full professor level at research institutions in the US. Similarly, a 2019 survey of Australian and New Zealand ophthalmologists demonstrated that a greater proportion of women had completed higher research degrees compared to male respondents.

There is also evidence of gender bias in the awarding of research grants. For example, in an analysis of all 23,918 investigator-initiated grant applications submitted to the Canadian Institutes of Health Research between 2011 and 2016, Witteman et al. found no significant differences in success rates between women and men principal investigators when reviewers primarily assessed an applicant's scientific proposal.³¹ However, when reviewers explicitly assessed the principal investigator's qualities as a scientist, the outcomes for women were less favourable. The authors concluded that gender gaps in grant funding may be attributable to disadvantageous assessments of women as principal investigators, not of the quality of their proposed research.³¹ This interpretation is consistent with the findings of other investigators who identified that women applying to the NIH's R01 programme scheme (the original and historically oldest grant mechanism used by the NIH) were less likely to be described as leaders than men.³⁹

Another explanation is that women produce less measurable output than men. Women, for example, publish fewer papers,⁴⁰ publish in less prominent journals and receive fewer citations. These differences may stem from factors such as disparity in the time spent on childcare, or insufficient mentoring, or discrimination. However, numerous studies suggest that hiring and promotion committees still prefer men over women and women receiving less credit for their citations.⁴¹ Furthermore, there is evidence to suggest that women's academic careers develop later in life. A study by Lopez et al. identified greater publication numbers for male ophthalmologists in their early careers, whereas the publication rates of women increased faster than men later in careers.

Income

Studies across multiple countries have found that women doctors earn less than men, even after accounting for number of hours worked. Ophthalmology is no exception. A 2016 publication assessing physician salaries in the US demonstrated that specialty surgeons had the largest absolute

adjusted gender differences in salary in medicine, above orthopaedics and general surgery.⁴² This finding was reinforced by 2016 data, which found ophthalmology to have one of the largest gender pay gaps of all specialties, with men reportedly earning 36% more than their women. Data published in 2017 reported that the average woman ophthalmologist collected \$0.58 cents for every \$1 USD collected by a man.⁴³ Similar findings have been reported internationally in nations such as and Australia and New Zealand,^{4,44} India, and the UK,⁴⁵

Recently published 2020 US data demonstrated this gap persists, reporting women ophthalmologists earn 12.5% less than men in the first year of clinical practice, with salary differences persisting after controlling for demographic, educational, and practice type.⁴⁶ An income gap is also observed amongst academics and salaried positions. Following adjustment for specialty, rank, leadership roles, publications and research time, Jagsi et al. reported the salaries of women ophthalmic researchers were on average to be 84% of those of men.⁴⁷ Explanations for gender pay gaps are varied and multifactorial. One notable difference is that women are less well-represented in surgical sub-specialties (such as vitreoretinal surgery), perform less procedural work and have less operative hours than men.^{4,44} Margo et al. reported that male ophthalmic surgeons in Florida logged more than twice as many cataract surgeries per year than their women colleagues between 2005 and 2012. Although women are entering higher-earning subspecialties (cataract and retina) at greater rates than before, the percentage of women pursuing them remains lower than for men.^{43,48} For example, the 2018 data from the American Board of Ophthalmology indicated that women comprised 20% of practicing board-certified self-identified vitreo-retinal specialists and 26% of corneal sub-specialists

Consult and treatment practice patterns are also likely to contribute to the gender pay gap. Women ophthalmologists see fewer patients and have lower Medicare collections.⁴³

While men and women ophthalmologists charge similar fees for similar services, disparity in income may reflect women providing longer consultation times.^{4,49,50} In addition, women are less likely to own private practices or to work in regional centres with higher income opportunities.^{4,22} Finally, it has been proposed that female physicians also place less emphasis on salary negotiations.⁴²

A common explanation for differential earnings is that more women engage in part-time work during their career (79% vs. 29%) than men,²² for reasons including differential household responsibilities, childrearing, and personal preferences related to work-life balance. However, a gender gap in earnings persists even after taking into account part-time work, practice profile, and sub-specialty.^{51,52}

Surgical exposure and sub-specialization

Surgical experiences for women in tend to differ considerably from those of men. Women trainees report having fewer surgical opportunities, with resultant disparities in surgical numbers of surgical procedures completed.⁵³⁻⁵⁵ For example, a study of US residents between 2005 and 2017 in the US found that women residents performed up to 22 (12.5%) fewer cataract operations and 80 (15.7%) fewer total procedures compared to men.⁵⁶ Similar results have been published in the UK, with women less likely to perform the expected number of phacoemulsification procedures during their training and having fewer opportunities for wet lab sessions.⁵⁷ Lower surgical exposure may contribute to fewer women trainees selecting surgical sub-specialization. Women are more likely to subspecialize in medical retina, uveitis and pediatrics, compared to men who are more likely to undertake fellowships in surgical retina, oculoplastics, and cornea.^{4, 44} Meyerson et al. documented a significant bias against women residents across seven US academic institutions, with women rating their operative autonomy (opportunity to complete a procedure with only passive help or supervision from faculty) at 19.3% compared to 33.3% rating for men.⁵³

Harassment

In recent years bullying and harassment within medicine, which has been linked to higher rates of burnout and suicide within the medical workforce, has received global attention.^{58, 59} A 2015 survey reported that women trainees and fellows, in keeping with women training in other surgical specialties, experience a higher rates of harassment, discrimination and sexual harassment in the workplace than men.⁶⁰ A 2020 survey of ophthalmology trainees found that 66% of women compared to 43% of men had experienced bullying or harassment during their training, with male supervising ophthalmologists cited as more frequent sources of these behaviours than females (35% vs 12%).^{61, 62} Additionally, 40% of women trainees reported receiving less respect from their medical team members when compared to men.⁶¹

Women in medicine are also at higher risk of harassment by patients.⁶³⁻⁶⁵ Scruggs et al. reported 87% of US women trainees and fellows had been sexually harassed by patients at some point in their training, compared to 44% of men. Sexual harassment reported by women was also noted to be more severe and frequent, with 55% of women and 31% men experiencing sexual harassment weekly. A concerning element of this data was that only 6% of these trainees, male or female, reported this abuse, and that only one third of trainees felt their institutions had prepared them adequately for addressing sexual harassment.⁶⁶

The experiences of women trainees in ophthalmology have been echoed by women ophthalmologists who report higher rates of discrimination, harassment, sexual harassment, and bullying than men.^{22, 23} A recent survey of ophthalmologists who took part in a sexual harassment workshop reported 100% of women and 58% of men had personally experienced patient-initiated sexual harassment during their career.⁶⁷ Workplace sexual harassment decreases job satisfaction and negatively impacts both personal confidence and professional career advancement.⁶⁷

Career satisfaction

While significant differences exist in the clinical and life experiences of women and men ophthalmologists, multiple studies confirm no differences in reported career satisfaction.^{4, 44, 49, 50} Similar commentaries have been published for other surgical specialties. While career satisfaction data is reassuring, women ophthalmologists report greater frustration in “trying to do it all” with balancing work and family commitments.^{5,22, 44} A Canadian study noted higher rates of burnout and psychological distress in women ophthalmologists compared to their male peers. Compared to women general surgeons, women ophthalmologists report higher satisfaction in balancing their career and personal life.⁴⁴

Mentorship

Mentorship can have a significant impact on trainees and the paths they choose to follow within the field of ophthalmology. Benefits of effective mentorship include reduction in stress, guidance on balancing career and personal life, subspecialty choice advice, promotion of political advocacy, facilitation of career advancement, and advice around non-clinical areas of practice.¹⁵ Often gaps left by a formal curriculum can be filled by strong mentorship. Concerns have been raised that in the wake of the #Metoo movement, there has been a global decrease in women mentorship provided to women by senior men in ophthalmology due to the perceived potential for misunderstandings to arise from such interactions.

In a survey of Australian and New Zealand ophthalmologists for example, women reported increased difficulty in receiving mentorship compared to men.²² This pattern is echoed throughout academic surgery and medicine. Effective mentorship does not necessitate that the mentor and mentee be of the same sex. Mentorship provides the opportunity for modelling and navigation through potential challenging career situations. Following a recently retracted and controversial publication by Nature,⁶⁸ there has been extensive discussion of the importance and strength in female mentorship.⁶⁹ The evidence suggests it is important both male and female senior ophthalmologists increase their mentorship of women to allow them to realise the full benefits.⁷⁰

Family and marital differences

In eight countries polled by The Economist and YouGov in 2017, 44–75% of women with children living at home said they had started working fewer hours or switched to a less-demanding job, since

becoming mothers. Only 13– 37% of fathers said they had done the same.⁷¹ Women ophthalmologists are more likely to contribute to child-rearing than their male peers,^{22, 44, 49} with a 2019 survey outlining that 67% of women ophthalmologists were involved in childcare for >20 hours per week, compared to 8% of males.²² Jinapriya et al. found that while women ophthalmologists work similar hours to their men, they contribute significantly more to caring for children.⁴⁹ A contributing factor to increased child rearing hours may be that spouses of women ophthalmologists are more likely to be in full time employment than spouses of male ophthalmologists, and therefore child rearing duties need to be shared.^{4, 44, 49} For ophthalmologists who had worked part time, the very large majority of women ophthalmologists had done so for child rearing (88%), whereas male ophthalmologist who worked part-time cited reasoning of lifestyle-work balance, family, or personal preferences fairly equally.²²

Women ophthalmologists were more likely to report that having children slowed their career progression and that they experienced discrimination for making family-centred choices.^{4, 44, 49, 50} Women also experienced greater frustration with balancing work and family commitments.²² These factors likely impact women ophthalmologists' and trainees' decisions to have children, or to have children later in their career. Multiple studies have reported that women ophthalmologists are less likely to have children than their male peers.^{22, 44} For those women who do have children, Australian/New Zealand studies have found that they are more likely to wait to have their first child until after fellowship training, at a mean age of 35, compared to men who are more likely to have their first child during training.^{22, 44} When compared to other surgical specialties, women in ophthalmology have higher rates of both child-bearing and marriage.^{4, 22} The issue of work-life balance is not unique to women. There has been a trend among younger generations of doctors, both women and male, towards opting for careers with better work-life balance.

Solutions

Achieving gender equality is a complex path and therefore solutions will need to be multi-faceted. There is no doubt significant progress has been made, so discussions regarding solutions should be focused on building on the successes that have been achieved. We suggest that any strategy should embrace several over-arching principles. First, strategies should be evidence-based so that initiatives effectively address the problems. Second, because there are multiple dimensions to gender equality a holistic approach is necessary. In addition, a climate of change requires a supportive and collegial environment with both men and women working together. A positive social climate should embrace people of all gender identities recognising the greater discrimination against women of color and nonbinary people. In addition, there needs to be transparency, a willingness to try and not fear failure.

Identifying the Problem

Awareness and acknowledgement of gender inequity is a critical step. Landmark work conducted by

Fried et al. at Johns Hopkins University School of Medicine identified that once the problem of retention and promotion of women was identified as an issue, the implementation of specific interventions made substantive improvements in the development of women's careers.⁷² Specifically, more than a five-fold increase in the number of women at the associate professor rank was seen over a 5 year period, with measurable improvements in timeliness of promotions, access to information needed for faculty development and salary equity, and a decrease in reported isolation and manifestations of gender bias. The changes made were also noted to benefit male faculty, with increased reported satisfaction.⁷²

Structural/Institutional and Policy Change

There is strong evidence that effective change requires a wide-reaching strategy which encompasses the individual, structural, and organizational initiatives.⁷³ In their Lancet review, Kang and Kaplan⁷³ outline the evidence that progress requires structural and systemic change and that individual change is more successful when it is embedded in such structures. Institutional and structural programs should focus on creating mentorship systems and having policies that support work-life balance. Furthermore, there needs to be a clear recognition that surgical training overlaps with childbearing, and creative strategies to support this should be developed such as strategies to address structural career impediments. Improving the awareness of implicit gender bias and the depth that it may extend is also important. In addition, explicit skill development programs in leadership, negotiating, assertiveness should be offered.

Institutional and structural change also needs to directly tackle bullying and sexual harassment. All ophthalmologists should have access to tools empowering them to address sexual harassment. To elicit change, departments and leaders need to encourage the teaching and development of effective response strategies towards such behaviours. To sustain meaningful change, ophthalmologists and trainee supervisors need to be prepared to call out and remedy harassment, rather than turn a blind eye.

Roles of Leaders/Sponsors

Senior leadership as well as organizational policies and political will are powerful sources of change. The behaviour of leaders filters across the entire organization and those who advocate and challenge gender norms can result in significant shifts in culture. Likewise, sponsorship programs have been shown to be one of the most effective mechanisms for achieving gender equity. Sponsors can have an integral role in championing under-represented minorities by incorporating them into powerful networks and mentorship.

Setting Measures and Set Targets

In order to improve a situation, one needs to be able to measure it. Organizations need to set goals, timelines and targets. Strategies should also be introduced that address the underlying implicit and

overt gender bias that exists. For example, organizations that have adopted a point-based system, instead of traditional nomination-selection processes tend to have higher proportion of women receiving awards.¹⁹

There is also a substantial and growing body of evidence that setting targets (and quotas) are effective in addressing inequities.⁷⁴ Targets are often rejected on the argument that it undermines the meritocratic process.^{73, 75} However, research has shown that 'meritocratic' organizations have inherent biases that discriminate against women and minorities.⁷⁵ Studies that control for quality have shown that female gender by itself leads to devaluation of the person/CV.^{73, 75}

Several organizations have begun to adopt targets and quotas in their organizational strategies: RANZCO has adopted a target of 35% for its Board and College Committees; the Royal Australasian College of Surgeons has established a business plan with tangible indicators to promote leadership and flexible training for its female surgeons;^{76, 77} and the Australian Medical Association of Victoria changed its constitution to include a 40% gender quota for its board.⁷⁸ However, targets need to extend beyond merely the number of women in the field or on committees and should incorporate a wide-spectrum of professional and academic domains. This also involves addressing the underlying pressures that push women out of the pipeline. However quotas have potential pitfalls. Women may be perceived as less competent when selected by a quota, in comparison to women selected on the basis of merit.

As shown throughout this perspective, inequality exists with women at a disadvantage at multiple junctures in their professional life. Eliminating gender bias is essential to allow all practitioners to engage, progress, and thrive within their careers, and to provide the best possible care for their patients. While progress has been made, continued research and evidence-based interventions are essential to changing the current landscape within ophthalmology.

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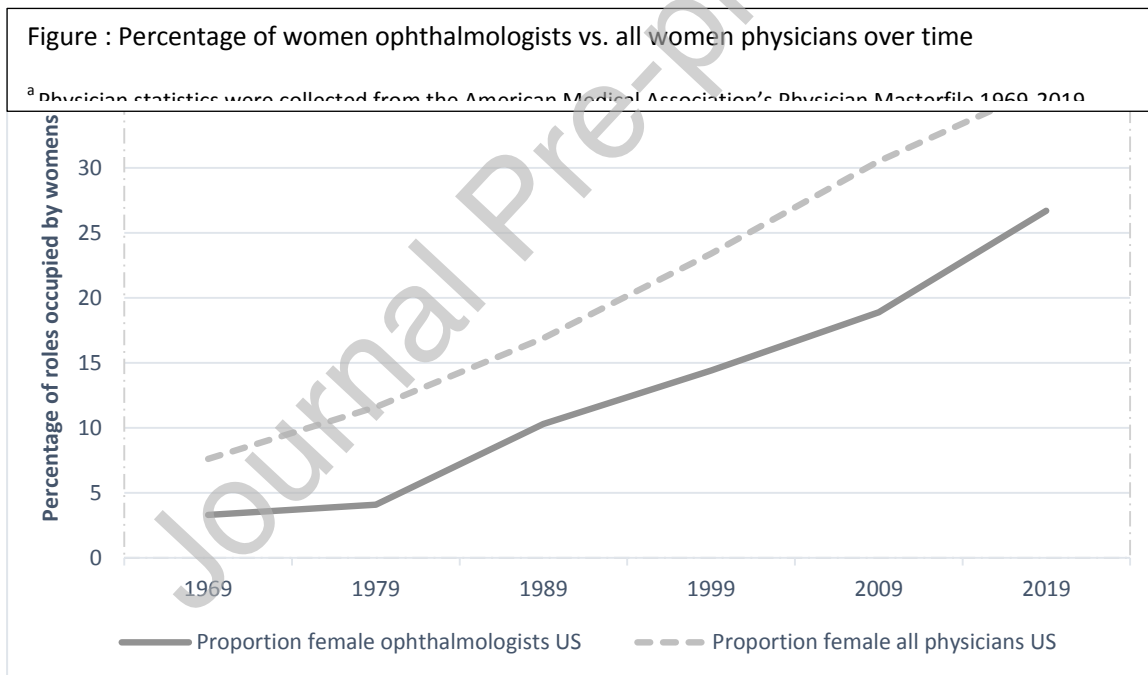
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Figure caption: Physician statistics were collected from the American Medical Association's Physician Masterfile 1969-2019





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Under the mentorship of Professor Helen Danesh-Meyer and Dr. Rachael Niederer, Hannah has been involved in several research projects, notably focusing on gender representation within the ophthalmology workforce.

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Table of Contents Statement

This perspective draws on the literature which describes the representation of in ophthalmology in several domains: leadership, research and academics, income, surgical experience, bullying and discrimination, mentorship, and career satisfaction and family factors. It reviews the progress and outline challenges for women in ophthalmology. Finally, provides a discussion around ways to achieve and sustain change.

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