THE EVOLVING LANDSCAPE OF FEMALE REPRESENTATION IN OPHTHALMOLOGY RESIDENCY AND CLINICAL PRACTICE

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Abstract

Over the years, men have mostly filled the ranks of practicing ophthalmologists. Even though the number of female medical students has gone up for many years, it is still not clear if this is visible in women joining ophthalmology residencies. Our main goal is to look at the trends in gender representation for ophthalmology residency applicants and compare these with those found in other surgical specialties over the past two decades. Counts of male and female applicants who listed ophthalmology as their number one specialty and those who were successfully placed, were found from data collected by a national residency matching service. We used data that is publicly available and completed a retrospective cross-sectional study. Afterward, trends for female ophthalmology applicants and female ophthalmologists were compared with what was happening in other surgical fields. During the study, a larger number of women applied for transplant and the rate of women who matched increased too. Nevertheless, the data indicated no clear rising trend in these later periods. No significant pattern in match rates was found for male and female applicants. The numbers of women in applicants and practicing ophthalmologists matched the proportions found in other surgical specialties. Female presence among ophthalmology applicants is higher than it was in the past, though the latest data point to a pause and indicate that gender parity continues to elude ophthalmology. More investigation is required to find out about the main reasons behind persistent gender biases.

Key words: Female Representation, Ophthalmology Residency, Gender Equity, Medical Training Trends

Introduction

The issue of gender equity in medical education and training is a topic which has gained increasing attention in the last several decades, where the focus is now on the number of women in residency programs and the medical workforce in general. Although there has been a rise in the number of women joining medical school, there is still disparity in their participation and performance in different medical specialties, especially in areas where there is competition or had always been male dominated like surgery. The implications of these disparities are not only to the diversity and equity of the workforce, but also to care delivery to patients, mentorship and professional growth of future physicians. Comparing patterns of female representation across the residency process of application and matching is thus critical to determining aspects of gains, chronic deficiencies, and possible interventions that can support equitable access and outcomes to all applicants. The matching process of residencies is an imperative point of entry of medical graduates, as it defines the placement of medical graduates into specialty training programs and influences their future career paths. The earlier research has noted gender discrepancy of the specialty selection and matching performance to competitive programs, indicating that women might encounter special obstacles at each of the steps, such as choice of program, application plan, and institutional discrimination. The field of surgery, in particular, has always been showing a low female representation in comparison with other areas, which is also connected with a long-lasting set of structural, cultural, and social aspects that can also affect the choice of the careers. It is thus important to understand the time trends in the representation

of females in the overall residency programs as well as in the respective specialties with high demand to inform policy, mentoring programs and institutional initiatives that may help promote gender equity. The longitudinal studies of residency applications are an efficient way to evaluate the alterations in the female representation during a time frame and record the tendencies in the preferences of applicants and their probability of getting a job in the first-choice programs. The observation of several cohorts through consecutive application cycles will allow observing the times of high growth, level of growth or decrease of female participation, and assessing the role of competitiveness by specialties and program-level factors. Besides, the assessment of patterns in the surgical and non-surgical specialties can result in the overall picture of how gender plays out in medical education, and where the intervention can be most beneficial. The purpose of this research is to examine how the number of females among applicants in the residency programmes and those who are matched to the first-choice programmes changes over consecutive years during the application process. Particular focus is placed on the comparison of overall residency programs and surgical specialties in order to observe the disparity in gender representation and the possibility of the effect of competitiveness in programs. Through the incorporation of descriptive statistics, cohort analysis, and specialty-specific analysis, the study will aim at offering a longitudinal, in-depth, understanding of gender trends in the residency application process, which will be used to provide evidence to support future practice of equal access, mentorship, and career development of female medical trainees.

Methods

The retrospective observational study design was used in this research to measure the changes in female representation among applicants to residency and in matched applicants across several application cycles. The national residency matching service database has been searched where data were obtained based on the applicant demographics, program rankings, and match outcomes. They included only those applicants to core residency programs, both surgical and non-surgical. The authors concentrated on the cohorts over multiple years of successive applications to conduct the longitudinal evaluation of the trends in participation and match success among females. The number of applicants to each cohort was stratified by gender and the number of those applicants who ranked their first-choice residency programs was determined. In the same manner, the results of the matches were noted on each applicant indicating whether he/she got his/her favorite program. The proportion of the female applicants with the first-choice programs and the proportion of the female applicants who were successfully matched with the first-choice programs were the main variables of interest. The data were also examined in terms of subsets of specialties, especially those that pertain to surgical specialties to establish gender representations differences among the disciplines. Each cohort had its descriptive statistics which were counts, percentages and proportions. The temporal trends of female representation were measured using proportions of female applicants and matched candidates in successive cohorts. Chi-square tests of proportions were used to assess the statistical significance of effects of change between the two years with the significance level established as $p < 0.05$. By doing so, both substantial growth and decline in the female representation could be identified across time. All residency applicants and applicants to surgical specialties were compared. Each specialty group was calculated as the proportion of applicants ranking first-choice programs as well as the proportion of applicants that were successfully matched. Distinctions in the group of applicants in general and surgical were compared to define the possibility of gender representation differences in highly competitive specialties. Any analysis was conducted with the help of the regular statistical programs. The data were anonymized and aggregated, and the confidentiality of the applicants was kept. There were no identifiers at the individual level, and only summary statistics of the cohorts were provided. The study design allowed the researcher to determine trends in female representation without invading their privacy or the need to meet them face to face. Such methodological approach provided a complete evaluation of the gender trends in the application to be applied to residency and matched results over a number of years. Through the integration of descriptive statistics, cohort

comparisons, and specialty specific analyses, the study brings an understanding of the changes in female participation over time and pinpointing possible areas where gender differences still exist. The method also enabled to assess the overall residency programs and competitive specialty subsets to gain a more specific insight into the trends in female representation across the residency application process.

Statistical Analysis

To include changes in the number of medical students and the growth of residencies, trends were studied by looking at the share of women, not the total number of women applicants. Both the number of female applicants in the top choice group and the matching rate into ophthalmology were studied with the same techniques used for other surgical specialties. The success rate per gender was determined each year by taking the fraction of those matching among applicants ranking ophthalmology first against the total number of applicants that year. In the same way, distributions of male and female ophthalmologists and other surgeons were determined. Researchers applied a fractional regression model that used a logit link because the dependent variables were limited to values between 0 and 1. The objective was to see if there was a significant link between the proportion (DV) and time (IV). Fractional logit models were applied using surgical specialties as category variables, in order to look for differences in trends across disciplines, checking interaction terms to see if there were any significant changes from the reference group (ophthalmology). A statistical correction for making multiple comparisons was used. More investigation was carried out by running fractional logistic regression including interactions to spot patterns of effect modification over time. Every year, Fisher's exact test helped determine whether a participant's sex mattered for finding a match. For each residency program and for practicing female physicians in surgery, descriptive statistics and visual illustrations of trends were created over the ten-year study period.

Result

It can be concluded that female representation among applicants and those matched to the Canadian CaRMS (Canadian Residency Matching Service) process has change over time in terms of trends in the application and match of residency applications and matches across several cohorts. Table 1 shows the percentage of female and their match rates with time. The cohort number of female applicants with their first-choice programs in the years under examination was between 5 and 33, and matched male candidates between 1 and 24. It is also important to note that the percentage of females who chose programs as the first choice dropped in the first years of the study to 20.0, but it rose to 46.5, and the match rates also show a consistent trend, growing to 52.8 in later cohorts. It means that the number and competitiveness of applicants through the residency programs are on the rise. Further Figure 2 demonstrates the temporal patterns in the female representation by comparing successive residency cohorts in Table 2. A greater number of female applicants preferring first-choice programs rose between earlier cohorts, 23.5 percent (n=166) to 36.5 percent (n=181; p=0.001), and so did female match rates of 21.3 percent (n=75) to 41.8 percent (n=110; p=0.001). This trend continued albeit with smaller margins in the following years with percentages of female applicants coming to 41.5% and equal rates 44.4%. Interestingly, the p-values between changes by year of study indicate that early changes were statistically significant, whereas later cohorts exhibited non significant changes by year of study in proportion ranked (p=0.1660.784), matched (p=0.566) and proportion-matched (p=0.3160.969). There is a small decreasing trend in the late years of life in both ranked (37.9) and matched female proportions (35.9; p=0.214 and 0.002, respectively), indicating that there is possibly some variation in the applicant pools of the programs, or the pattern of program selection. Table 3 shows that female representation is particularly higher in surgical specialties, as compared to CaRMS applicants all over. On the whole, the proportion of female CaRMS applicants was 46.3 to 57.4% according to cohorts. Females in surgical specialties accounted to 33.2%-43.0% of first-choice program ranking and 33.2%-43.0% matched, which is overall lower than the representation of CaRMS. This implies that there is continued underrepresentation of women in the surgical fields in

spite of the general increase in applications among the women. It is interesting to note that the difference between the female applications progressing to first-choice surgical programs and the successfully matched ones was not very large, which indicates that matching in this group was fair after the applications were received. In general, these figures originating in Canada indicate an evident trend of the growing female involvement in the residency applications throughout the years of study, with the success of the matching gradually increasing. Nevertheless, surgical specialties do not have as much gender diversity as the larger residency specialties. The results highlight the need to continuously observe gender representation in medical training programs to guide the policy, mentorship, and recruiting efforts to improve equitable access to female medical trainees.

Table 1: Proportion of Female Residency Applicants and Match Rates Over Time

Ranked 1st Choice		Matched 1st Choice		Proportion Female Ranked (%)†	Proportion Female Matched (%)‡
Female (n)	Male (n)	Female (n)	Male (n)		
9	28	4	10	24.3	28.6
9	25	4	11	26.5	26.7
9	24	4	10	27.3	28.6
7	28	3	13	20.0	18.8
5	22	1	15	18.5	6.3
5	17	5	12	22.7	29.4
13	20	7	8	39.4	46.7
14	18	9	10	43.8	47.4
18	29	14	16	38.3	46.7
16	31	11	18	34.0	37.9
24	28	16	18	46.2	47.1
22	37	15	20	37.3	42.9
21	33	11	24	38.9	31.4
28	34	19	17	45.2	52.8
23	39	13	24	37.1	35.1
21	27	16	20	43.8	44.4
26	30	19	19	46.4	50.0
20	33	15	24	37.7	38.5
21	34	17	21	38.2	44.7
18	31	11	23	36.7	32.4
33	38	13	24	46.5	35.1
20	38	13	24	34.5	35.1
25	50	15	22	33.3	40.5

Table 2: Comparison of Female Applicant and Matched Proportions Across Consecutive Residency Cohorts

Proportion Female Ranked % (*n*)†	**p-value (compared to previous year cohort)**	**Proportion Female Matched % (*n*)‡**	**p-value (compared to previous year cohort)**
23.5 (166)	---	21.3 (75)	---
36.5 (181)	0.001	41.8 (110)	0.001
40.8 (289)	0.166	41.8 (177)	0.968
41.5 (212)	0.784	44.4 (151)	0.566
37.9 (253)	0.214	35.9 (145)	0.002

Table 3: Proportion of female applicants to CaRMS and surgical specialties

All CaRMS Applicants	**Surgical CaRMS Applicants$^{\phi}$**	
Total Females % (*n*)	**Ranked 1st Choice, Females % (*n*)†**	**Matched 1st Choice, Females % (*n*)‡**
46.3 (5,724)	22.8 (1,114)	21.8 (749)
54.6 (7,857)	33.2 (1,432)	33.2 (1,053)
57.4 (12,085)	39.7 (2,012)	37.7 (1,507)
55.6 (11,308)	40.1 (1,542)	38.9 (1,118)
55.2 (11,655)	44.0 (1,619)	42.5 (1,062)

Discussion

This research will offer significant data on the changing patterns of female representation among residency applicants and those that are matched successfully through multiple application cycles, and reveal a variety of improvements and existing disparities in specific specialties. The proportion of female applicants to the first-choice programs and the proportion of females matched successfully to the preferred programs showed a remarkable rise in the number of applicants over the years studied, which can be viewed as an indication of both increased interest and competitive spirit among women entering medical residency training. Initial groups showed tremendous progressions with the percentage of female applicants turning into 36.5% and match rates turning to 41.8% which emphasizes a phase of impressive growth in female participation. These patterns not only give the impression of a growing number of women in the residency applicant pool but also imply that the residency programs have become more accommodating to the said population, possibly because of the changes in attitudes to the idea of gender equity, mentorship programs, and institutional efforts to diversify the composition of the trainee group. Late cohorts however recorded a stalling growth with proportions of applicants and matched candidate remaining at the 41%-44% range and some years showing minor declines indicating that possibly, initial significant increases in female representation has stabilised or the tendency may be affected by other factors including specialty competitiveness, program capacity, or applicant preferences. It is important to note that the analysis of the surgical specialties showed that there was constant underrepresentation among female applicants to residencies relative to the overall residency applicants with females taking 33.2%-44.0% of the first-choice program rankings and those who were matched with an equivalent percentage. It denotes that, in spite of the overall development, the structural or cultural boundaries can still restrict the variety

of gender in surgical specialties that have the highest demand and that more specific mechanisms could be needed to promote the involvement and maintenance of women in the fields. Interestingly, the comparatively small change in percentage of women applicants to first-choice surgical programs and applicants successfully matched indicates that after women apply to the programs they face similar success rates to their male counterparts indicating that barriers may not be found in the selection or matching process but rather in the application choice. Fractional regression models and year-to-year comparisons supported these observations by indicating statistically significant improvements in young cohorts and no changes in older cohorts, which once again showed that although significant improvements have been achieved, constant monitoring is essential to reveal some subtle changes or new differences with time. In general, the trends in time, present in this research, help to highlight the significance of longitudinal evaluation of gender representation in medical training courses, as they are the valuable contribution to policymakers, educators, and program directors who want to encourage equal access, mentorship, and career advancement prospects among female trainees. The results also indicate that further work on the elimination of specialty-specific gender disparities, especially in the field of surgical practice, remains required to make sure that the advancements in the field of general representation will lead to the positive changes in the diversification of all medical practice types. This study adds to the overall discourse on gender dynamics in resident training in that it offers a detailed analysis of the trend over several application cycles and subsets of specialties, both in terms of successes and where additional interventions are justified to facilitate equitable participation and academic growth and successful matching of female medical trainees to a variety of residency programs.

Conclusion

The analysis demonstrates that in the last two decades, both the presence of female applicants and successful women in ophthalmology residency programs has grown significantly. Although there is progress, the main jump happened earlier on and more recent numbers show either an unchanged or reduced number of matched female residents. The research showed that although women are much better represented in medical school, they do not yet reach parity in getting into and matching in ophthalmology residency. The large difference between female medical students and female ophthalmologists shows that more than just candidate availability is deciding who goes into each specialty. Notably, no signs of gender bias were identified in the outcomes of ophthalmology matches which suggests that fewer women may be applying for these jobs rather than the reason being unequal qualifications. People have given many reasons for the lack of women in ophthalmology and other areas of surgery. Some examples are unequal access to female mentors, pressure from society and family and the problem of balancing work and family. Even though ophthalmology supports a good work-life balance, it still finds it hard to interest and keep women in training positions. Because the number of female ophthalmologists is growing slower than the number of female residents, it is clear that age differences, working part-time and maternity leave greatly impact the field. Even now, the effects of having mostly male ophthalmologists in the past are seen. Becoming balanced will probably take harder work and many more years. Because this study was done using data from past applicants and selected only those who ranked ophthalmology first, it does not reflect information for applicants with other preferences. Moreover, gender was labeled by just two categories which could not represent the full range of applicants. In the future, more study is required to learn the roots of the problem and look for ways to encourage more gender equity in higher education. More inclusive and diverse teams in ophthalmology can be achieved by introducing policies and mentorship opportunities that handle these issues.

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