

# Demographics and Productivity Trends Among Academically Affiliated Female Retina Specialists in the United States

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Journal of VitreoRetinal Diseases

2025, Vol. 9(6) 842–848

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DOI: 10.1177/24741264251367101

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## Abstract

**Purpose:** To evaluate the impact of personal, professional, and academic experiences on the publication productivity of academically affiliated female retina specialists in the United States. **Methods:** Between April and July 2023, a survey was distributed to academically affiliated female retina specialists in the US whose emails were found on public faculty webpages of ophthalmology departments at academic institutions. The survey gathered demographic information and the timing of personal, professional, and academic life experiences. H-indexes and most productive years were obtained from Scopus. Quantitative data were analyzed using Excel (Microsoft Corp). **Results:** A total of 59 responses were recorded, yielding a 38.6% response rate. The mean h-index of the cohort was  $17.2 \pm 15.7$  (range, 0-74; IQR, 2.2-32.2). Of the 17 respondents (28.8%) who completed a research year during medical school, 16 (94.1%) reported that it was productive owing to their choice of mentor, who was male in 82.4% of cases. Of the 48 respondents (81.4%) with children, 19 (39.6%) delayed childbearing until after their fellowship, while 16 (33.3%) had children during their fellowship. The most productive year corresponded with the years of residency graduation ( $P < .05$ ) and fellowship graduation ( $P < .05$ ). **Conclusions:** Academically affiliated female retina specialists in the US experience male-dominated mentorship and tend to complete residency and fellowship before childbearing. Their average h-index is higher compared to some colleagues. Peaks in productivity correspond with the completion of training, specifically the years of residency and fellowship graduation.

## Keywords

female retina specialist, publication productivity, demographics

## Introduction

Significant gender discrepancies persist within the field of ophthalmology.<sup>1–3</sup> Women have comprised a smaller portion of the workforce in ophthalmology residency programs (41.2%) compared to men,<sup>1</sup> have held only 10% of department chair positions,<sup>2</sup> and have been less likely to receive major research grants.<sup>3</sup> Perhaps most notably, the ophthalmic subspecialties of the medical and surgical retina field have attracted the smallest percentage of women.<sup>4</sup> Gill et al<sup>5</sup> report that women comprise approximately 25% to 30% of the ophthalmology workforce overall. As of 2018, women comprised only 19% of retina specialists in the United States, a lower percentage compared to many other ophthalmic subspecialties: 26% in oculoplastics, 29% in cornea, 34% in glaucoma, and 47% in pediatric ophthalmology.<sup>4,6</sup> As the number of female physicians increases each year, their attitudes toward academic careers have become increasingly relevant.<sup>7,8</sup> However, the impact

of mentorship and work-life decisions, such as childbearing and marriage, on their career outcomes remains poorly studied.

Bibliometrics are increasingly used to evaluate physicians' scholarly productivity for promotions, tenure, recruitment, and

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**Table 1.** Survey Questions.

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Please check the boxes of all the degrees you have earned: MD, DO, MBA, MPH, PhD, Other                                                                                                                                                                            |
| Please upload your most recently updated CV used by your academic institution.                                                                                                                                                                                     |
| How many years of practice have you done since graduating from residency?                                                                                                                                                                                          |
| If you did a research year while you were a medical student, in which year did you take one?                                                                                                                                                                       |
| If you did a research year while you were a medical student, which program did you do your year at, and who was your mentor?                                                                                                                                       |
| Do you feel that your research year as a medical student was productive due to your choice of mentor?                                                                                                                                                              |
| If you took a research year as a medical student, was your mentor male or female? If your mentor does not identify as male or female, please select the “other” option.                                                                                            |
| In which year did you graduate from ophthalmology residency?                                                                                                                                                                                                       |
| Where did you do your ophthalmology residency?                                                                                                                                                                                                                     |
| In which year did you graduate from ophthalmology fellowship?                                                                                                                                                                                                      |
| Where did you do your ophthalmology fellowship?                                                                                                                                                                                                                    |
| If applicable to you: In which year did you deliver your first child? (This includes preterm deliveries and stillbirths.)                                                                                                                                          |
| If applicable to you: In which year did you deliver your second child? (This includes preterm deliveries and stillbirths.)                                                                                                                                         |
| If applicable to you: In which year did you deliver your third child? (This includes preterm deliveries and stillbirths.)                                                                                                                                          |
| If applicable to you: In which year did you get married?                                                                                                                                                                                                           |
| If applicable to you: In which year were you widowed?                                                                                                                                                                                                              |
| If applicable to you: In which year did you get divorced?                                                                                                                                                                                                          |
| If applicable to you: In which year did you experience a physical health stressor that affected your career? (This includes only hospitalizations and surgeries requiring recovery time and an inability to work for at least 3 weeks.)                            |
| If applicable to you: In which year did you experience a mental health stressor that affected your career? (This includes requiring recovery time and an inability to work for at least 3 weeks.)                                                                  |
| If applicable to you: In which year did you request a leave from work of at least 2 weeks to take care of a loved one or family member? (This includes only hospitalizations and surgeries requiring recovery time and an inability to work for at least 3 weeks.) |

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grant awards, as they provide an objective measure of academic impact.<sup>9</sup> The h-index represents the number of publications a researcher has authored that have been cited at least that number of times in other papers.<sup>9</sup> The h-index has become the standard scientometric measure of a researcher's impact and is often used to predict career potential.<sup>10</sup>

Therefore, the purpose of our study was to collect demographic information and evaluate how personal, professional, and academic experiences affect the publication productivity of academically affiliated female retina specialists in the US.

## Methods

Ethical approval for this study was waived by the University of Texas at Austin Institutional Review Board, as it involved a low-risk method (survey), the information is published in a manner that does not readily identify subjects, and any disclosure of responses outside the research would not reasonably place subjects at risk of moderate to severe liability or harm their financial standing, employability, educational advancement, or reputation. The study and data collection complied with all applicable country, federal, and state laws, and written informed consent was obtained. The study adhered to the tenets of the Declaration of Helsinki.

Ophthalmology departments at academic institutions were identified using Doximity.<sup>11</sup> Publicly accessible faculty webpages were then used to identify female retina specialists and obtain their email addresses.

A panel of 3 self-identified female retina specialists at Bascom Palmer Eye Institute (N.C., H.H., A.M.B.) designed the survey based on a consensus of common life experiences (Table 1). For questions regarding marriage and divorce, respondents were instructed to answer based on their first experience only. A physical health stressor was defined as the first instance in which the respondent required hospitalization or surgery, resulting in at least 3 weeks of recovery time and inability to work. A mental health stressor was defined as the first instance in which the respondent required at least 3 weeks of recovery time and the inability to work. Leave from work to care for a loved one or family member was defined as the first instance of such leave, lasting a minimum of 2 weeks; this definition excluded childcare or maternity leave. The most productive year for each respondent was defined as the first year in which they had their highest number of publications, according to Scopus data.

The electronic survey, created using Google Forms, was distributed via email to academically affiliated female retina specialists (Table 1). Responses were collected using Google Drive between April and June 2023. All participants provided consent for the use of their survey responses by agreeing to the following statement, presented as the first item in the survey: “I have read the description above and consent to taking this survey. The research team conducting this project has my permission to use data collected from the survey for the purpose of this research project only.” H-indexes and most productive years were obtained by searching respondents' names in the Scopus author database.<sup>12</sup> Statistical analyses, including *P*

**Table 2.** Average Age of Respondents During Personal and Professional Experiences.

|                     | Overall Responder | Most Productive Year | Residency Graduation | Fellowship Graduation | Marriage          | First Child | Second Child | Third Child | Divorce | Physical Health Stressor | Mental Health Stressor | Leave From Work |
|---------------------|-------------------|----------------------|----------------------|-----------------------|-------------------|-------------|--------------|-------------|---------|--------------------------|------------------------|-----------------|
| Average age (y)     | 46.1              | 40.2                 | 31.8                 | 33.8                  | 30.6              | 33.1        | 35.6         | 37.1        | 36.0    | 35.9                     | 41.4                   | 38.6            |
| Pearson correlation |                   |                      | 0.287                | 0.295                 | 0.241             |             |              |             |         |                          |                        |                 |
| P value             |                   |                      | .028 <sup>a</sup>    | .023 <sup>b</sup>     | .079 <sup>c</sup> |             |              |             |         |                          |                        |                 |

<sup>a</sup>Most productive year and residency graduation had a statistically significant positive Pearson correlation.

<sup>b</sup>Most productive year and fellowship graduation had a statistically significant positive Pearson correlation.

<sup>c</sup>Most productive year and marriage had a weakly statistically significant positive Pearson correlation.

values, averages, medians, modes, IQRs, SDs, and Pearson correlations, were performed using Microsoft Excel (Microsoft Corp). Statistical significance was set at  $P \leq .05$ , and  $P \leq .10$  was considered borderline significant. Mean/average values are  $\pm$  SD.

## Results

### Cohort Demographics

Of the 153 identified female retina specialists practicing at academic institutions across the US, 59 completed the survey, yielding a response rate of 38.6%. Email addresses were available for all identified profiles, and all respondents fully completed their surveys. The average age of respondents was  $46.1 \pm 8.9$  years (range, 33-69) (Table 2).

All 59 respondents (100%) had a Doctor of Medicine (MD) degree; 11 respondents (18.7%) also held a Doctor of Philosophy (PhD) degree, and 2 respondents (3.4%) had a Master of Business Administration (MBA) degree. The average number of years since residency graduation was  $13 \pm 8.7$  (range, 2-37) (Table 3).

Among the total cohort, 17 respondents (28.8%) completed a research year during medical school in various regions across the US. Of these, 16 (94.1%) reported their research year was productive owing to their choice of mentor. Fourteen (82.4%) had a male mentor, while 3 (17.7%) had a female mentor (Table 3). The average age at residency graduation was  $31.8 \pm 3$  years (range, 27-45), and the average age at fellowship graduation was  $33.8 \pm 2.9$  years (range, 30-47) (Table 2).

Among the total cohort, 48 respondents (81.4%) had at least 1 child, 38 (64.4%) had 2 or more children, and 16 (27.1%) had 3 or more children (Table 3). The average ages at first, second, and third deliveries were  $33.1 \pm 3.8$  years (range, 25-40),  $35.6 \pm 3.5$  years (range, 30-42), and  $37.1 \pm 2.8$  years (range, 32-41), respectively (Table 2). Nineteen respondents (39.58%) delayed childbearing until after fellowship, while 16 (33.33%) had children during fellowship.

Among the total cohort, 55 respondents (93.2%) were married (Table 3), with an average age at marriage of  $30.6 \pm 4.4$  years (range, 23-42) (Table 2). One respondent (1.7%) was widowed, and 6 (10.7%) were divorced (Table 3), with an average age of  $36.0 \pm 5.9$  years (range, 27-45) (Table 2).

Regarding external factors, 13 respondents (22.0%) experienced a physical health stressor (Table 3), with an average age of onset of  $35.9 \pm 16.4$  years (range, 27-48) (Table 2). Five respondents

**Table 3.** Cohort Demographic Information and Personal and Professional Experiences.

| Characteristic              | Value     |
|-----------------------------|-----------|
| Research year status, n (%) |           |
| Completed                   | 17 (28.8) |
| Productive owing to mentor  | 16 (94.1) |
| Male mentor                 | 14 (82.4) |
| Female mentor               | 3 (17.7)  |
| Parental status, n (%)      |           |
| 1 child                     | 48 (81.4) |
| 2 children                  | 38 (64.4) |
| 3 children                  | 16 (27.1) |
| Degree held, n (%)          |           |
| MD                          | 59 (100)  |
| PhD                         | 11 (18.7) |
| MBA                         | 2 (3.4)   |
| Average h-index             | 17.2      |
| Marital status, n (%)       |           |
| Married                     | 55 (93.2) |
| Divorced                    | 6 (10.7)  |
| Stressors, n (%)            |           |
| Physical health             | 13 (22.0) |
| Mental health               | 5 (8.5)   |
| Took leave from work, n (%) | 11 (18.7) |

(8.5%) experienced a mental health stressor (Table 3), occurring at an average age of  $41.4 \pm 13.2$  years (range, 37-39) (Table 2). Additionally, 11 respondents (18.7%) took leave from work to care for a loved one or family member (Table 3), with an average age of  $38.6 \pm 7.7$  years (range, 31-55) (Table 2).

### Publication Productivity of Cohort

The average h-index among respondents was  $17.2 \pm 15.7$  (range, 0-74; IQR, 2.2 to 32.2) (Table 3). The average age during their most productive year was  $40.2 \pm 8.7$  years (ranging from 27 to 64) (Table 2). The most frequently reported number of publications produced in respondents' most productive years was 4.

### Correlation Between Most Productive Year and Year of Experience

For each respondent, the most productive year closely corresponded with the year of residency graduation (Pearson

**Table 4.** Average Time Between Personal Experience and Most Productive Year.

|                                              | Marriage | First Child | Second Child | Third Child | Divorce | Physical Health Stressor | Mental Health Stressor | Leave From Work |
|----------------------------------------------|----------|-------------|--------------|-------------|---------|--------------------------|------------------------|-----------------|
| Average time before most productive year (y) | 9.0      | 6.9         | 4.7          | 5.7         | 5.7     | 7.7                      | 1.0                    | 1.6             |

correlation 0.287;  $P=.028$ ) and fellowship graduation (Pearson correlation 0.295;  $P=.023$ ). Among married respondents, the most productive year also showed a weak correlation with the year of marriage (Pearson correlation 0.241;  $P=0.079$ ) (Table 2).

### Average Number of Years Between Personal Experiences and the Most Productive Year

The delivery of the first, second, and third child occurred an average of  $6.9 \pm 8.2$ ,  $4.7 \pm 7.4$ , and  $5.7 \pm 8.9$  years, respectively, before respondents' most productive years. The year of marriage was an average of  $9.0 \pm 8.1$  years before the respondents' most productive years, while the year of divorce was an average of  $5.7 \pm 9.4$  years prior. Among respondents who experienced external factors, the year of a physical health stressor occurred an average of  $7.7 \pm 10.2$  years before, and a mental health stressor occurred an average of  $1.0 \pm 2.8$  years before respondents' most productive years. Respondents who took leave from work to care for a loved one or family member did so an average of  $1.6 \pm 4.4$  years before their most productive year (Table 4).

### Conclusions

In 2019, female residents comprised nearly half (41.2%) of the ophthalmology resident workforce,<sup>12</sup> yet retina fellowship training attracted the fewest female residents compared to other ophthalmic subspecialties.<sup>4,6</sup> A 2020 survey of 81 ophthalmology residents found that significantly fewer female residents (23.9%) pursued vitreoretinal surgical training than male residents (76.1%).<sup>13</sup> Nevertheless, the number of female retina specialists in the US has increased, with female membership in the American Society of Retina Specialists rising from 11.0% in 2007 to 19.7% in 2020.<sup>14</sup> Our survey study contributes to understanding the life trajectories of academically affiliated female retina specialists in the US.

Interestingly, none of the respondents in our cohort held a Doctor of Osteopathic Medicine (DO) degree. According to the Association of American Medical Colleges, only 2.5% of active ophthalmologists in 2021 had a DO.<sup>15</sup> Therefore, the composition of our cohort may reflect the continued underrepresentation of this group, regardless of gender.

Furthermore, 94.1% of respondents who completed a research year reported that it was productive owing to their choice of mentor, with 82.4% reporting that their mentor was male (Table 3). As of 2019, 85.2% of chairs, 67.5% of program directors, and 43.0% of medical student educators in ophthalmology were male, highlighting that mentorship among female

retina specialists, and in ophthalmology as a whole, remains largely male-dominated.<sup>16</sup> However, this may reflect the greater number of male retina specialists compared to female retina specialists nationwide.<sup>17</sup>

As 56.1% of female members of the Association of University Professors of Ophthalmology reported that having a same-gender mentor was important,<sup>16</sup> measures aimed at creating more gender-equitable mentorship are warranted. Further studies are needed to explore how female trainees choose their research mentors and whether factors other than availability affect their selection of male mentors.

It is plausible that rates of gender-equitable mentorship will improve organically as the number of female retina specialists in the US continues to increase, as evidenced by American Society of Retina Specialists data from 2007 to 2020,<sup>13,14</sup> and as more female retina specialists reach career stages that enable them to serve as mentors. However, to ensure this growth, active efforts will be necessary; for example, those created by entities such as the Perry Initiative, a not-for-profit organization that aims to increase young women's exposure to orthopedic surgery and engineering.<sup>18</sup> O'Fee et al reported that female residents felt having a female retina mentor would have increased their likelihood of pursuing the field. Additionally, both residents and retina fellows felt that longer retina rotations, more opportunities for resident participation in retinal research, and increased mentorship from female retina specialists could encourage more female residents to become vitreoretinal specialists.<sup>13</sup>

Our results show that 39.58% of female retina specialists completed fellowship prior to having children. Female ophthalmologists report a lack of information about maternity leave, increased burnout upon returning to work, lack of full pay during maternity leave, and dissatisfaction with their maternity leave experience.<sup>19</sup> Female retina specialists may delay childbearing until after training because, although maternity leave is available to varying degrees, it comes with many challenges and persistent stigma.<sup>19,20</sup>

In our cohort, the average age of divorce among female retina specialists was  $36 \pm 5.9$  years, which is lower than the national average of 40.1 years for women in the US as of 2020 (Table 2).<sup>21</sup> Our survey does not provide insights into why the average age of divorce for female retina specialists might be lower than the national average. As of 2017, women earn 57.3% of bachelor's degrees, 60.1% of master's degrees, and 53.3% of doctoral degrees,<sup>22</sup> and comprise 51.1% of the paid workforce in the US.<sup>23</sup>

Parker et al<sup>24</sup> report that the increasing participation of educated women in the workforce has dramatically shifted in their

relationships, given the historical dependence of women on men. Recently, the median annual wage for professional women aged 35 to 44 years in the US was approximately \$57,824 per year.<sup>25</sup> Ophthalmologists earned an average of \$345,000 per year in 2017, ranking above the median salary for all physician specialties.<sup>26</sup>

Among ophthalmic subspecialties, the retina field is considered 1 of the higher-paying specialties.<sup>27</sup> The American Academy of Ophthalmology's job listings report salaries for retina specialists as high as \$700,000 per year in certain regions.<sup>28</sup> Therefore, our results may reflect the ability of female retina specialists to afford divorce at a younger age owing to their relatively high income.

Additionally, our results show that academically affiliated female retina specialists in the US have a higher average h-index (17.2) compared to their colleagues in other countries and medical subspecialties (Table 3). In 2021, Tanya et al<sup>29</sup> reported that Canadian female ophthalmologists had an average h-index of 6.7, while Findlay et al<sup>30</sup> reported that academically affiliated female urologists had an average h-index of 7 in the same year. Furthermore, Gershoni et al<sup>9</sup> reported that the mean h-index across all academic ophthalmic specialties in the US in 2019 was 9.9.

Our results showed a statistically significant correlation between respondents' most productive years and the approximate timing of their residency and fellowship graduation (Table 3). Huang et al reported that among 418 ophthalmology residents who graduated in 2021, the average number of peer-reviewed publications per resident was  $2.68 \pm 3.81$ . Among the 176 residents pursuing fellowship, the average number of publications was  $3.18 \pm 4.44$ .<sup>31</sup>

Yannuzzi et al<sup>32</sup> reported that among applicants to the Bascom Palmer Eye Institute vitreoretinal surgery fellowship between 2015 and 2018, the average number of peer-reviewed publications, first-author publications, and abstracts/posters were 5.31, 2.49, and 5.38, respectively. Huang et al<sup>33</sup> reported that academic ophthalmologists trained in vitreoretinal disease or ophthalmic pathology demonstrated the highest scholarly productivity compared to other ophthalmic subspecialties. Although the Accreditation Council for Graduate Medical Education allows US ophthalmology residency programs to vary in their emphasis on research, research and scholarly commitment remain important factors for applicants to the competitive retina specialty.<sup>34</sup>

These factors may explain why our results show that academically affiliated female retina specialists in the US tend to reach their most productive year following academic milestones, such as residency and fellowship graduation. However, our results may be influenced by the fact that the retina specialty publishes more frequently than other ophthalmic subspecialties owing to its image-intensive nature, which makes it more feasible to produce manuscripts like case reports and retrospective reviews.<sup>35,36</sup> Additionally, our results could be influenced by the fact that publications appearing in the final year of residency or fellowship may have originated as project ideas 6

to 12 months earlier, because of the lengthy process involved in data collection, analysis, manuscript preparation, and the peer-review timeline.<sup>37,38</sup>

Our results also show that academically affiliated female retina specialists in the US tend to reach their most productive year following significant life events such as marriage, divorce, childbearing, or caregiving for a loved one or family member (Table 3). Reed et al<sup>39</sup> reported a similar finding, noting that among their cohort of academically affiliated physicians followed over 20 years, female publication productivity eventually matched and surpassed that of men in the later stages of their academic careers. Our results, along with those of Reed et al,<sup>39–42</sup> may be explained by previous studies showing that female physicians may prioritize family and personal responsibilities, such as marriage, childbearing, and caregiving for a family member or loved one, during the early phases of their careers.

Within the ophthalmology community, organizations such as Women in Ophthalmology<sup>43</sup> and Women Professors of Ophthalmology<sup>44</sup> were formed to provide support, mentorship, and networking for female ophthalmologists. Retina-specific organizations such as Women in Retina<sup>45</sup> have also formed with similar goals. Nevertheless, additional measures are warranted to further support women entering not only the field of ophthalmology but also the community of US retina specialists.<sup>4,6</sup> This study contributes to understanding trends and patterns regarding publication productivity and personal life experiences among current female retina specialists in the US so that future generations of female retina specialists can be better mentored, supported, and advised as they navigate their careers and personal lives.

Our study has inherent limitations common to survey research, including potential survey errors, constraints, selection bias, and survey-related effects. Survey-related effects include the wording of a question, question structure, and open- or closed-ended style. Mode effects, such as the method of survey administration, can influence respondents' answers. Consequently, responses may differ when a question is asked via electronic survey compared to face-to-face or telephone formats.

To minimize bias, most questions in our survey sought objective responses, such as age at marriage or divorce. However, the survey also included subjective questions, which may inherently lead to survey bias. We made every effort to reduce survey bias in the construction and delivery of the survey. Additionally, our study is limited by a relatively small cohort; however, as previously noted, there is a small number of academically affiliated female retina specialists in the US,<sup>4,6</sup> and our response rate (38.6%) falls within the appropriate range for survey studies.<sup>46</sup>

Additionally, our survey was not distributed to academically affiliated male retina specialists in the US; therefore, this study does not provide a direct comparison between these 2 groups. Further studies are needed to explore this comparison. Gender in our study was determined based on institutional website profile pictures and names. Our findings on mentorship may be influenced by the fact that we did not ask respondents whether

they actively sought out male mentors rather than female mentors, owing to an abundance of male mentors in the field. Future research should explore this concept.

Our study defined the timeframes of 3 weeks of inability to work resulting from a physical health stressor or a mental health stressor, and 2 weeks from caregiving for a loved one or family member, based on experience and consensus. This could affect results because the length of leave can vary depending on the individual circumstance.

Our results show that academically affiliated female retina specialists in the US may experience male-dominated mentorship during training and tend to delay childbearing until after completing both residency and fellowship. Additionally, they demonstrate a higher average h-index compared to their colleagues in other countries and in other medical and surgical subspecialties. Peaks in productivity correspond with the completion of training, specifically around the years of residency and fellowship graduation.

### Ethical Approval

Ethical approval for this study was waived by the University of Texas at Austin Institutional Review Board, as the study involved a low-risk method and used a survey to collect de-identified data. This study was conducted in accordance with the Declaration of Helsinki.

### Statement of Informed Consent

Written informed consent was obtained from all participants prior to their participation in the study.

### Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Zahra Markatia is a consultant for Johnson & Johnson. Hong-Uyen Hua is a consultant for Allergan/AbbVie, Alimera, and Genentech. Ta Chen Chang is a consultant for CRISPRx. Audina M. Berrocal is a consultant for Alcon, Allergan, Zeiss, Dutch Ophthalmic Research Center, Novartis, ProQR, and Oculus. The remaining authors declare no conflicts of interest.

### Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by funding from Research to Prevent Blindness Unrestricted [Grant GR004596]; NIH Center Core [Grant P30EY014801]; Department of Defense [Grant #W81XWH-09-1-0675]; 2022 ARVO Foundation for Eye Research and EyeFind Research Grant; 2022 Research to Prevent Blindness/Bascom Palmer Eye Institute Pilot Grant; and the 2021 RPB/AAO Award for IRIS Registry Research. The sponsor or funding organization had no role in the design or conduct of this study.

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