

# Factors Influencing Postgraduate Career Decisions of Ophthalmology Residents

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## Abstract

**Objective** This study aims to identify factors that influence ophthalmology residents' decision to pursue fellowship training or to practice comprehensive ophthalmology after residency.

**Design** This is a cross-sectional study.

**Methods** An anonymous survey was sent to ophthalmology residents in the United States from the graduating class of 2018. The main outcome measure was the decision to seek fellowship training or to practice comprehensive ophthalmology. Information on demographics, residency program characteristics, and factors influencing career choices were collected.

**Results** The overall response rate was 24.0% (112/467). Among the 112 respondents, 88 (78.6%) matched into subspecialty training. Compared with residents entering comprehensive ophthalmology, there was a greater proportion of Asians (37.5 vs. 8.3%) and a smaller proportion of non-Hispanic whites (47.7 vs. 70.8%,  $p = 0.029$ ) among residents pursuing fellowship training. Residents pursuing fellowships had fewer children (0.4 vs. 0.8,  $p = 0.049$ ), had less debt (median debt  $\leq$  \$100,000 vs.  $>$  \$200,000,  $p = 0.008$ ), had more first-author publications (4.3 vs. 1.2,  $p < 0.001$ ), decided on their postgraduate career path earlier (median time postgraduate second year [PGY2] versus postgraduate third year [PGY3],  $p = 0.016$ ), and were more likely to plan to practice in an academic setting (51.1 vs. 29.2%,  $p < 0.001$ ) and in an urban location (44.3 vs. 12.5%,  $p = 0.004$ ). In a multiple logistic regression model, factors predictive of fellowship training included a desire to acquire special skills (odds ratio [OR] = 4.39; 95% confidence intervals [CI]: 1.70–16.37) and work with new technology (OR = 2.92; 95% CI: 1.16–10.02). Factors that predicted a career in comprehensive ophthalmology were higher levels of educational debt (OR = 0.35; 95% CI: 0.12–0.77), a later timing of postgraduate decision (OR = 0.17;

## Keywords

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- comprehensive ophthalmology
- career

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95% CI: 0.02–0.65), and lifestyle considerations (OR = 0.13; 95% CI: 0.03–0.36). Gender, prestige, or perceived favorable job market was not significant factors.

**Conclusion** The majority of U.S. ophthalmology residents matched into fellowships. A desire to gain special skills and a desire to work with new technology were major factors influencing residents to seek fellowship training. Lifestyle considerations and educational debt were more important in the decision to choose a comprehensive ophthalmology career. Future research that includes more trainees and programs may minimize the selection bias issues present in this study.

The majority of graduating ophthalmology residents in the United States pursue subspecialty fellowship training. According to data from the Ophthalmology Fellowship Match, 81% of U.S. residents applied to subspecialty fellowship positions in 2017 as opposed to 34% in 1996.<sup>1,2</sup> There have been major changes in the supply and demand for ophthalmologists in the last two decades: while the Eye Care Workforce Study by the RAND Corporation (“research and development”) in 1995 identified an excess of eye care providers and predicted a surplus in subspecialist ophthalmologists in all subspecialty areas by the year 2010,<sup>3</sup> a 2011 study by Adelman and Nwanze reported a consistently growing demand for subspecialist ophthalmologists.<sup>4</sup> Indeed, more recent studies have noted current and future shortages in certain subspecialties. For example, in a survey assessing adequacy of specialist supply, 42% of primary care pediatricians in the United States reported a shortage of pediatric ophthalmologists to meet the needs of their patients.<sup>5</sup> Using data from North American Neuro-Ophthalmology Society and the American Academy of Ophthalmology, Frohman calculated that the demand for neuro-ophthalmologists would soon exceed the supply if the number of subspecialty trainees stays the same.<sup>6</sup> According to data from National Eye Institute, the number of people with open-angle glaucoma is projected to increase 50% from 2010 to 2030 and more than double by 2050.<sup>7</sup> However, data from the Ophthalmology Fellowship Match indicate that the proportion of residents seeking glaucoma fellowship training has increased only slightly from 22 to 24% in the past 8 years,<sup>1</sup> which raises concerns about the adequacy to satisfy the need for glaucoma experts.

Optimizing the physician workforce is important for delivering high-quality health care.<sup>8</sup> Aligning the ophthalmology workforce with health needs of the U.S. population requires not only an understanding of the supply and demand for ophthalmologists but also knowledge about factors influencing ophthalmology residents’ decisions on professional career paths. A 2005 study by Gedde et al found that a desire to acquire special skills, perceived prestige, and job market opportunity were significant predictors for ophthalmology residents’ decision to seek subspecialty training. On the other hand, lifestyle considerations, such as work hours and preferred geographic locations, were important in residents’ decisions to practice comprehensive ophthalmology.<sup>2</sup> Since this study is almost 15 years old, more up-to-date

information regarding the fellowship decision-making process is needed. The purpose of the present study is to investigate factors that influence ophthalmology residents to enter fellowship training or a career in comprehensive ophthalmology. Such understanding has important implications for residency curriculum development and future workforce planning.

## Methods

The study was deemed exempt by the Institutional Review Board of the Johns Hopkins University School of Medicine due to the anonymous nature of the survey and the minimal risks involved. U.S. ophthalmology residents from the Class of 2018 were invited to participate in an anonymous 22-question survey during their year of graduation. The completion of the survey served as consent. Survey links were sent to ophthalmology program directors who were Association of University Professors of Ophthalmology (AUPO) members. The program directors were asked to forward the survey to their graduating third-year residents and to inform us when they had done so. Responses were collected between June 12, 2018, and July 12, 2018. Two reminders were sent out during the response collection periods.

The main outcome measure was whether a resident had matched to a subspecialty fellowship or was pursuing comprehensive ophthalmology after residency. Residents could specify if they had other career plans after residency. If a resident planned to pursue fellowship training, the survey asked which subspecialty he or she was matched into.

The survey was adapted from that designed by Gedde et al with additional input from several residency program directors including Steven J. Gedde, Fasika A. Woreta, Laura K. Green, Michael V. Boland, and Jeff Pettey. The survey collected demographic and academic information (age, gender, race/ethnicity, marital status, number of children, level of education debt, academic degrees, alpha-omega-alpha membership status, and number of first-author papers), residency program characteristics (geographic residency program region, number of residents per class, affiliated medical school, affiliated veteran affairs hospitals, surgical cases performed, research requirement, and international electives offered), career plans (timing of the decision to pursue fellowship training or to enter comprehensive ophthalmology, planned practice location, and intended practice

setting), and factors influencing the postgraduate career decision. The importance of each factor in making the decision was rated on a 5-point scale. Residents were asked to provide optional free-text responses regarding whether there were any other important factors in their decision-making process. Various characteristics were compared between residents pursuing subspecialty training and residents planning to practice comprehensive ophthalmology. Continuous variables, such as age and number of children, were compared using unpaired two-tailed *t*-tests. Ordinal variables, such as level of educational debt and Likert's scale responses were compared using Wilcoxon's rank-sum test. Categorical variables, such as gender, race/ethnicity, and practice setting, were compared using Fisher's exact test. A multiple logistic regression analysis was performed to assess the influence of measured factors in the decision to pursue fellowship training. To build a multiple logistic regression model, variables that were significantly different between the fellowship group and the comprehensive ophthalmology group were selected. Akaike's information criterion (AIC) was then utilized to build a restricted model that incorporated all of the truly relevant variables.<sup>9</sup>

All data were analyzed using R version 4.0.0.<sup>10</sup> A *p*-value of 0.05 or less was considered statistically significant.

## Results

Survey results were received from a total of 112 (24.0%) out of 467 residents graduating in 2018. Among the 112 respondents, 88 (78.6%) were entering subspecialty training in the coming academic year, and 24 (21.4%) were going to practice comprehensive ophthalmology. Among the residents pursuing fellowship training, the three most popular subspecialty fields were cornea, external disease and refractive surgery (27 trainees, 30.7%), glaucoma (23 trainees, 26.1%), and retina (16 trainees, 18.2%; ► **Table 1**).

Demographic information reported by respondents is shown in ► **Table 2**. Compared with residents entering comprehensive ophthalmology, a higher percentage of residents

pursuing fellowship training were Asian (38.6 vs. 12.5%) and a smaller percentage were non Hispanic white (47.7 vs. 70.8%) or African American (1.1 vs. 8.3%, *p* = 0.029). Residents pursuing fellowships had fewer children on average than residents going into comprehensive ophthalmology (0.4 vs. 0.9, *p* = 0.049). Residents pursuing fellowships also had less educational debt than residents entering comprehensive ophthalmology (36.4 vs. 20.8% had no debt; 29.5 vs. 54.2% had more than \$200,000 of debt; *p* = 0.008). There were no statistically significant differences in terms of age and gender between the two groups.

Characteristics of medical school education and residency training are presented in ► **Table 3**. All residents entering comprehensive ophthalmology were from residency programs that had a Veterans Affairs (VA) hospital or county/public hospital at which residents regularly performed surgeries, whereas only 76.1% of residents pursuing fellowships had an associated VA hospital (*p* = 0.006). Residents pursuing fellowship had more first-author publications than residents entering comprehensive ophthalmology (4.3 vs. 1.2, *p* < 0.001). Residents pursuing fellowships performed fewer cases of globe trauma as the primary surgeon in residency than those entering comprehensive ophthalmology (9.9 vs. 14.8, *p* = 0.022). The numbers of the other cases performed were similar between the two resident groups. Alpha-omega-alpha membership or number of graduate degrees held did not significantly influence residents' postgraduate career choice. Additionally, we did not find residency program characteristics such as average number of residents per year, region of the residency program, research requirement at residency, international electives offered, or on-site affiliated medical school to be correlated with the decision to seek fellowship training. The decision to go into subspecialty fellowships was made earlier in the training than the decision to practice comprehensive ophthalmology (median time postgraduate second year [PGY2] vs. postgraduate third year [PGY3], *p* = 0.016). A total of 16 (18.2%) residents pursuing fellowship training made the decision before the start of their ophthalmology residency, while no resident entering comprehensive ophthalmology made their career decision before the beginning of PGY2.

With regard to future practice settings (► **Table 4**), more residents entering fellowship planned to practice in an urban setting (51.1 vs. 29.2%, *p* < 0.001) than residents pursuing comprehensive ophthalmology, who were more likely to work in a suburban setting (41.7 vs. 28.4%, *p* < 0.001). Eighteen percent of residents pursuing subspecialty training were unsure about their future location of practice, while no residents entering comprehensive ophthalmology were unsure about this. In addition, the intended type of practice was significantly different between fellowship and comprehensive groups. A university/academic setting was the most popular choice among residents seeking fellowship training (44.3 vs. 12.5%), whereas small private practice was the most selected practice setting among residents entering comprehensive ophthalmology (41.7 vs. 23.9%, *p* = 0.004).

Residents rated the importance of each factor in influencing their decision to pursue or not to pursue fellowship

**Table 1** Subspecialty choices among residents pursuing fellowships

Subject	n (%)
Cornea, external disease, and refractive surgery	27 (30.7)
Glaucoma	23 (26.1)
Retina	16 (18.2)
Oculoplastics	11 (12.5)
Uveitis	6 (6.8)
Pediatric ophthalmology and strabismus	1 (1.1)
Neuroophthalmology	1 (1.1)
Anterior segment	1 (1.1)
Global ophthalmology	1 (1.1)
Other	1 (1.1)

**Table 2** Demographic information of residents

	Total group (n = 112)	Fellowship (n = 88)	Comprehensive (n = 24)	p-Value
<b>Age</b>				
Mean ± SD	31.3 ± 2.5	31.2 ± 2.4	31.5 ± 2.7	0.549
<b>Gender n (%)</b>				
Females	59 (52.7)	45 (51.1)	14 (58.3)	
Males	53 (47.3)	43 (48.9)	10 (41.7)	0.646
<b>Race/ethnicity n (%)</b>				
Non-Hispanic White	59 (52.7)	42 (47.7)	17 (70.8)	
Asian	37 (33.0)	34 (38.6)	3 (12.5)	
AfricanAmerican	3 (2.7)	1 (1.1)	2 (8.3)	
Hispanic	6 (5.4)	5 (5.7)	1 (4.2)	
Other	2 (1.8)	2 (2.3)	0 (0)	
Prefer not to answer	5 (4.5)	4 (4.5)	1 (4.2)	0.029 <sup>a</sup>
<b>Marital status n (%)</b>				
Not married	40 (35.7)	36 (40.9)	4 (16.7)	
Married	72 (64.3)	52 (59.1)	20 (83.3)	0.073
<b>Number of children</b>				
Mean ± SD	0.5 ± 0.9	0.4 ± 0.8	0.9 ± 1.2	0.049 <sup>a</sup>
<b>Range of educational debt n (%)</b>				
None	37 (33.0)	32 (36.4)	5 (20.8)	
≤ \$100,000	14 (12.5)	14 (15.9)	0 (0)	
\$100,001 to ≤200,000	22 (19.6)	16 (18.2)	6 (25.0)	
> \$200,000	39 (34.8)	26 (29.5)	13 (54.2)	0.008 <sup>a</sup>

Abbreviation: SD, standard deviation.

<sup>a</sup>Statistically significant differences between residents matched into fellowship and residents entering comprehensive ophthalmology.**Table 3** Medical school education and residency training

	Total group (n = 112)	Fellowship (n = 88)	Comprehensive (n = 24)	p-Value
<b>Alpha-omega-alpha member n (%)</b>				
Yes	30 (26.8)	24 (27.3)	6 (25.0)	
No	82 (73.2)	64 (72.7)	18 (75.0)	1.000
<b>&gt;1 graduate-level degrees held n (%)</b>				
Yes	14 (12.5)	13 (14.7)	1 (4.2)	
No	98 (87.5)	75 (85.2)	23 (95.8)	0.295
<b>Timing of decision to pursue/not to pursue fellowship n (%)</b>				
Medical school	16 (14.3)	16 (18.2)	0 (0)	
PGY1	4 (3.6)	4 (4.5)	0 (0)	
PGY2	30 (26.8)	25 (28.4)	5 (20.8)	
PGY3	47 (42.0)	35 (39.8)	12 (50.0)	
PGY4	15 (13.4)	8 (9.1)	7 (29.2)	0.016 <sup>a</sup>

(Continued)

**Table 3** (Continued)

	Total group (n = 112)	Fellowship (n = 88)	Comprehensive (n = 24)	p-Value
Region of residency program n (%)				
Northeast	37 (33.0)	33 (37.5)	4 (16.7)	
Midwest	30 (26.8)	23 (26.1)	7 (29.2)	
Southeast	24 (21.4)	17 (19.3)	7 (29.2)	
West	15 (13.4)	10 (11.4)	5 (20.8)	
Southwest	5 (4.5)	4 (4.5)	1 (4.2)	
Other	1 (0.9)	1 (1.1)	0 (0)	0.337
Research requirement at residency n (%)				
Yes	100 (89.3)	76 (86.4)	24 (100.0)	
No	9 (8.0)	9 (10.2)	0 (0)	
Unsure	3 (2.7)	3 (3.4)	0 (0)	0.293
International elective offered n (%)				
Yes	52 (46.4)	43 (48.9)	9 (37.5)	
No	58 (51.8)	44 (50.0)	14 (58.3)	
Unsure	2 (1.8)	1 (1.1)	1 (4.2)	0.311
Associated VA n (%)				
Yes	91 (81.3)	67 (76.1)	24 (100.0)	
No	21 (18.8)	21 (23.9)	0 (0)	0.006 <sup>a</sup>
On-site affiliated med school n (%)				
Yes	100 (89.3)	77 (87.5)	23 (95.8)	
No	12 (10.7)	11 (12.5)	1 (4.2)	0.456
Average resident/year				
Mean ± SD	4.7 ± 1.6	4.7 ± 1.6	4.5 ± 1.5	0.535
Range	2 - 8	2 - 8	2- 7	
Average research papers as first author				
Mean ± SD	3.7 ± 4.4	4.3 ± 4.7	1.2 ± 1.5	<0.001 <sup>a</sup>
Cases performed as primary surgeon Mean ± SD				
Cataract	196.5 ± 66.4	197.4 ± 66.8	193.1 ± 66.7	0.806
Cornea surgery	10.2 ± 8.7	10.6 ± 9.2	8.9 ± 6.7	0.385
Refractive	6.8 ± 11.7	5.2 ± 9.1	12.8 ± 17.3	0.080
Glauc filtering/shunting/MIGS	14.8 ± 11.8	15.1 ± 11.8	13.6 ± 12.1	0.636
Glaucoma lasers	30.6 ± 22.6	30.2 ± 20.2	32.3 ± 30.4	0.776
Retina (PPV or buckle)	7.6 ± 12.0	7.6 ± 11.8	7.3 ± 13.2	0.930
Retina (lasers or injections)	225.9 ± 237.9	226.5 ± 257.2	223.9 ± 152.3	0.956
Oculoplastics and orbit	74.0 ± 70.0	73.6 ± 73.5	75.3 ± 57.1	0.919
Globe trauma	10.9 ± 6.9	9.9 ± 6.2	14.8 ± 8.2	0.022 <sup>a</sup>
Total	577.3 ± 285.3	576.0 ± 306.0	582.1 ± 197.7	0.918

Abbreviations: Glauc filtering/MIGS, glaucoma filtering/shunting/minimally invasive glaucoma surgery; PGY, postgraduate year; PPV, pars plana vitrectomy; SD, standard deviation; VF, Veterans Affairs.

<sup>a</sup>Statistically significant differences between residents matched into fellowship and residents entering comprehensive ophthalmology.

**Table 4** Intended future practice setting

	Total group (n = 112)	Fellowship (n = 88)	Comprehensive (n = 24)	p-Value
Location of practice n (%)				
Urban	52 (46.4)	45 (51.1)	7 (29.2)	
Suburban	35 (31.3)	25 (28.4)	10 (41.7)	
Rural	9 (8.0)	2 (2.2)	7 (29.2)	
Unsure	16 (14.3)	16 (18.2)	0 (0)	<0.001 <sup>a</sup>
Type of practice n (%)				
University/academic setting	42 (37.5)	39 (44.3)	3 (12.5)	
Large/mid private practice	25 (22.3)	19 (21.6)	6 (25.0)	
Small private practice	31 (27.7)	21 (23.9)	10 (41.7)	
HMO	5 (4.5)	1 (1.1)	4 (16.7)	
Community	2 (1.8)	2 (2.3)	0 (0)	
VA	1 (0.9)	1 (1.1)	0 (0)	
Other	6 (5.4)	5 (5.7)	1 (4.2)	0.004 <sup>a</sup>

Abbreviations: HMO, health maintenance organization; VF, Veterans Affairs.

<sup>a</sup>Statistically significant differences between residents matched into fellowship and residents entering comprehensive ophthalmology.

**Table 5** Percentages of Likert's-scale responses for each of the factors influencing the postgraduate career choices of ophthalmology residents

	Very important (%)	Moderately important (%)	Somewhat important (%)	Slightly important (%)	Not important at all (%)
Role models/mentors <sup>a</sup>					
Fellowship	63.6	28.4	6.8	1.1	0
Comprehensive	45.8	29.2	8.3	8.3	8.3
Clinical rotations					
Fellowship	48.9	31.8	14.8	1.1	3.4
Comprehensive	54.2	29.2	8.3	0	8.3
Research experience <sup>a</sup>					
Fellowship	17.0	17.0	20.5	14.8	30.7
Comprehensive	4.2	12.5	16.7	12.5	54.2
Types of patient problem					
Fellowship	53.4	38.6	6.8	1.1	0
Comprehensive	33.3	50.0	16.7	0	0
Types of surgeries <sup>a</sup>					
Fellowship	76.1	19.3	1.1	2.3	1.1
Comprehensive	54.2	41.7	4.2	0	0
Working with new technology <sup>a</sup>					
Fellowship	34.1	42.0	12.5	6.8	4.5
Comprehensive	16.7	25.0	29.2	20.8	8.3
Favorable job market					
Fellowship	34.1	31.8	18.2	5.7	10.2
Comprehensive	29.2	45.8	20.8	0	4.2

(Continued)

**Table 5** (Continued)

	Very important (%)	Moderately important (%)	Somewhat important (%)	Slightly important (%)	Not important at all (%)
Preferred geographic area					
Fellowship	27.3	25.0	22.7	5.7	19.3
Comprehensive	45.8	20.8	25.0	4.2	4.2
Earning potential					
Fellowship	17.0	22.7	27.3	18.2	14.8
Comprehensive	29.2	29.2	16.7	12.5	12.5
Prestige					
Fellowship	10.2	21.6	22.7	18.2	27.3
Comprehensive	0	8.3	29.2	45.8	16.7
Working hours/lifestyle <sup>a</sup>					
Fellowship	22.7	20.5	31.8	15.9	9.1
Comprehensive	62.5	25.0	8.3	0	4.2
Interest in academic career					
Fellowship	26.1	21.6	15.9	12.5	23.9
Comprehensive	20.8	12.5	16.7	25.0	25.0
Peer interaction					
Fellowship	23.9%	33.0	23.9	9.1	10.2
Comprehensive	20.8	16.7	29.2	20.8	12.5
Desire to gain special skills <sup>a</sup>					
Fellowship	59.1	27.3	13.6	0	0
Comprehensive	12.5	20.8	33.3	20.8	12.5
Inadequate to practice independently					
Fellowship	2.3	8.0	13.6	20.5	55.7
Comprehensive	0	12.5	4.2	12.5	70.8

<sup>a</sup>Statistically significant differences between residents matched into fellowship and residents entering comprehensive ophthalmology.

training. The distribution of the responses is presented in ▶ **Table 5**. Factors that were found to be rated significantly higher by residents seeking subspecialty training than residents entering comprehensive ophthalmology included role models/mentors (median, “very important” vs. “moderately important,”  $p = 0.042$ ), research experience (median, “somewhat important” vs. “not important at all,”  $p = 0.025$ ), types of surgeries (median, “very important” vs. “very important,”  $p = 0.049$ ), working with new technology (median, “moderately important” vs. “somewhat important,”  $p = 0.005$ ), and a desire to gain special skills (median, “very important” vs. “somewhat important,”  $p < 0.001$ ). In contrast, residents pursuing fellowships rated working hours/lifestyle as a significantly less important determinant in their career decision than residents going into comprehensive ophthalmology (median, “somewhat important” vs. “very important,”  $p < 0.001$ ).

In a multiple logistic regression analysis (▶ **Table 6**), factors associated with pursuing fellowship training included a desire to acquire special skills (odds ratio [OR] = 4.39; 95% confidence interval [CI]: 1.70–16.37) and working with

**Table 6** Multiple logistic regression analysis of factors associated with the decision to seek subspecialty training or to practice comprehensive ophthalmology

	Odds ratio (95% confidence interval)	p-Value
Desire to gain special skills	4.39 (1.70–16.37)	0.008 <sup>a</sup>
Working with new technology	2.92 (1.16–10.02)	0.045 <sup>a</sup>
Role models/mentors	1.94 (0.82–5.48)	0.155
Number of children	0.45 (0.17–1.00)	0.070
Level of educational debt	0.35 (0.12–0.77)	0.021 <sup>a</sup>
Timing of decision	0.17 (0.02–0.65)	0.039 <sup>a</sup>
Working hours/lifestyle	0.13 (0.03–0.36)	0.001 <sup>a</sup>

<sup>a</sup>Statistical significance between residents matched into fellowship and residents entering comprehensive ophthalmology.



**Table 7** Free-text comments on additional factors influencing the postgraduate decision on whether to pursue fellowship training or to practice comprehensive ophthalmology

Theme	Comments (career path)
Special skills/ area of interest	<ul style="list-style-type: none"> <li>● “Interest in specialty-specific pathology” (fellowship)</li> <li>● “I’m not passionate about cataract surgery. I narrowed down to surgical retina or peds” (fellowship)</li> <li>● “Decided I felt I did not need additional training to do the kinds of surgery I was interested in” (comprehensive)</li> </ul>
Patient population	<ul style="list-style-type: none"> <li>● “I really want to work mainly with children in my practice and I love ophthalmology. Hence, pediatric ophthalmology combines those things” (fellowship)</li> </ul>
Mentors	<ul style="list-style-type: none"> <li>● “Mentors” (fellowship)</li> <li>● “Counseling by my attendings” (comprehensive)</li> </ul>
Family	<ul style="list-style-type: none"> <li>● “Family circumstances” (comprehensive)</li> <li>● “Family” (comprehensive)</li> </ul>
Job opportunities	<ul style="list-style-type: none"> <li>● “Opportunity arose for a 100% teaching position at my institution, for a comprehensive ophthalmologist” (comprehensive)</li> <li>● “Went on interviews for pediatric fellowship at the same time as interviewing for comprehensive jobs, found good job offers for comprehensive and realized from fellowship interviews that another year of training would potentially limit the range of my practice and marketability more than help it in the areas I was looking to practice” (comprehensive)</li> </ul>
Burnout	<ul style="list-style-type: none"> <li>● “I was simply burnt out of training environment” (comprehensive)</li> <li>● “Burnout” (comprehensive)</li> </ul>
Salary	<ul style="list-style-type: none"> <li>● “Wanted specialty with cash pay” (fellowship)</li> </ul>

new technology (OR = 2.92; 95% CI: 1.16–10.02). On the other hand, factors associated with practicing comprehensive ophthalmology were higher levels of educational debt (OR = 0.35; 95% CI: 0.12–0.77), later timing of postgraduate decision (OR = 0.17; 95% CI: 0.02–0.65), and lifestyle considerations (OR = 0.13; 95% CI: 0.03–0.36).

► **Table 7** shows the free-text comments on factors influencing the postgraduate decision. Several themes from the comments are as follows: special skills/area of interest, patient population, mentors, family, job opportunities, burnout, and salary.

## Discussion

The proportion of ophthalmology residents pursuing fellowship training has increased since the 1990s, reaching 81% in 2017.<sup>1</sup> The rate of subspecialty training has important implications for residency curriculum development and physician workforce planning. This study updates our understanding of factors affecting ophthalmology residents' career choices to seek subspecialty fellowship training or to practice comprehensive ophthalmology. Our study found several factors that remained important in residents' decision-making since the 2005 study by Gedde et al, including a desire to acquire special skills and working hours/lifestyle considerations.<sup>2</sup> Cornea, glaucoma, and retina continue to be the three most popular fellowship choices. On the other hand, our study found some potential changes in resident decision-making regarding postgraduate career choices. In our study, a larger proportion of residents pursuing fellowships were female. In the previous study, prestige, perceived more favorable job market, intended practice type, and location were significant predictors of a resident pursuing

fellowship training. The present study did not find such associations. Instead, we observed several additional factors to be correlated with postgraduate career choices of recent residents including working with new technology, educational debt, and timing of career decision. Although the difference in response rates could contribute to the differences between the previous and our current study, changes in residents' perceptions of the career paths also likely gave rise to the changes.

Fellowship programs focus on the attainment of clinical and research expertise over and above the competencies of residency. The goal of subspecialty training fits well with the desire of fellowship-seeking residents to acquire special skills and to work with new technology. Recent advances in technology, such as refractive surgery technology and microinvasive glaucoma surgical techniques, have revolutionized multiple ophthalmic subspecialties,<sup>11–13</sup> which motivates residents to seek fellowship training to obtain skills to work with new technology. The constant popularity of cornea, glaucoma, and retina fellowships parallels the higher numbers of fellowship positions available in these fields. In 2017, 97 subspecialty training positions were offered for cornea (14.1% increase from 2012), 81 offered for glaucoma (24.6% increase), and 148 offered for retina (21.3% increase). In contrast, 65 positions were offered for pediatric and strabismus ophthalmology (8.3% increase from 2012), 28 position offered for ophthalmic plastic and reconstructive surgery (33.3% increase), 17 positions offered for uveitis (21.4% increase), and even fewer positions for ophthalmic pathology or neuroophthalmology.

Work hours and lifestyle have remained a more important consideration for residents choosing comprehensive ophthalmology than residents entering fellowships. In the free-



text response, several residents mentioned family as an influential factor in their decision to practice comprehensive ophthalmology. Perceptions of a more controllable lifestyle account for their decision. Research has found that lifestyle considerations influence postresidency career choices across a range of medical and surgical specialties, including radiology, orthopaedics, obstetrics and gynecology, and internal medicine.<sup>14–17</sup>

One factor that we found to be insignificant in influencing the decision of residents to pursue fellowship was gender. We noted no statistical difference between the proportion of females pursuing subspecialty training versus females entering comprehensive ophthalmology. In recent years, there has been a push to achieve gender equity in medicine through routinely assessing compensation equity, minimizing unconscious gender bias, establishing policies regarding family and medical leave, and engaging leadership.<sup>18–20</sup> Several studies have explored the issue of gender disparities in ophthalmology. Gong et al found that female ophthalmology residents performed on average 36 to 80 fewer total surgical procedures during residency than their male counterparts, suggesting unequal training experiences.<sup>21</sup> The majority of ophthalmology chairs are males who specialize in cornea, retina, or glaucoma.<sup>22</sup> Editor-in-chief and society president positions in ophthalmology are held predominantly by males.<sup>23</sup> A study on the past 10 years of ophthalmology papers found that women held fewer last authorships and were less frequently cited compared with men, although there has been an increase in percentages of female first and last authorships in recent years.<sup>24</sup> Patel et al noted that the proportions of female presenters at ophthalmology conferences between 2015 and 2017 exceeded estimates of female ophthalmologists, especially for general conferences.<sup>25</sup> However, their analysis found that the gender gap still remained at subspecialty conferences. Overall, these studies pointed out existing gender disparities in the education and practice of ophthalmology, but some also highlighted positive trends toward achieving gender equality. Gender neutrality in the decision to pursue fellowship training or comprehensive ophthalmology in the current study is one potential step toward future gender disparity in ophthalmology.

Our study found that residents choosing comprehensive ophthalmology had higher levels of educational debt than those seeking subspecialty training. Medical school tuition and student debt levels have continued to climb during the past two decades.<sup>26,27</sup> While some ophthalmology subspecialties offer a higher income than comprehensive ophthalmology, fellowship training entails the opportunity cost in terms of 1 or 2 years of working as an attending physician and building a practice. With the interest of educational debt accruing, entering comprehensive ophthalmology right after residency is a reasonable choice. In addition, residents planning to practice comprehensive ophthalmology also had more children on average at the time of residency graduation than those pursuing fellowships. The financial pressure of raising a family may add to the burden of educational debts and influence these residents to practice comprehensive ophthalmology and start an attending job earlier.

Another interesting finding of our study is the change in the perception of the job market by graduating residents. In the 2005 study, residents entering fellowship training rated perceived favorable job market as more important in their career decision than residents planning to practice comprehensive ophthalmology.<sup>2</sup> The present study, albeit with a lower response rate, did not find a statistical difference in the importance of perceived favorable job market in influencing residents to pursue fellowship training or comprehensive ophthalmology. Furthermore, several residents entering comprehensive ophthalmology commented in the free-text section on job opportunities for comprehensive ophthalmologists as an important factor in their career choice. One resident, who went on interviews for both comprehensive ophthalmology jobs and fellowship positions, realized that another year of training would limit the range of practice and marketability and ended up taking a comprehensive ophthalmology job.

## Limitations

One limitation of our study is the response rate with the potential for selection bias. Residents who participated in our survey likely did so because they had strong feelings about the topic, which introduced voluntary response bias to the study. Although we sent the survey to all residency program directors in the country, only some of them informed us that they had forwarded the survey to their residents. Therefore, residents from the other residency programs may not have received the survey, so the effective response rate may be higher than the calculated response rate. In addition, the survey respondents in our study are a representative group of ophthalmology residents in the United States. The demographics of our survey respondents are similar to the 2014 data from Graduate Medical Education (GME) Track for all ophthalmology residents (female: 52.7 vs. 44.3%, male: 47.3 vs. 55.7%,  $p = 0.087$ ; Non-Hispanic white: 52.7 vs. 55.0%, Asian: 33.0 vs. 31.8%, Hispanic: 5.4 vs. 5.1%, African American: 2.7 vs. 2.4%,  $p = 0.995$ ).<sup>28</sup> Seventy-nine percent of our respondents were pursuing subspecialty training. This number is comparable to the San Francisco Residency and Fellowship Match data (81%) in 2017.<sup>1</sup> Moreover, the geographic distribution of the residency programs of our survey respondents is comparable to the data from Accreditation Council for GME (ACGME) for all U.S. ophthalmology residents (northeast: 32.0 vs. 30.9%, midwest: 28.1 vs. 24.8%, southeast: 17.7 vs. 21.0%, west: 17.0 vs. 13.4%, southwest: 4.6 vs. 9.8%,  $p = 0.515$ ).

There are other limitations of our study. First, our survey determined whether a resident enters fellowship or comprehensive ophthalmology based on the match results, which might not be the resident's original intention. The survey did not ask residents entering comprehensive ophthalmology if they had failed to match for fellowship. According to the SF Match data, 32% of graduating residents failed to match in Ophthalmic Plastic and Reconstructive Surgery Fellowships in the 2017 match, and 10% of graduating residents failed to match in other ophthalmology fellowships in December

2018. However, some residents applied to more than one subspecialty fellowship, complicating the interpretation. Second, with regard to the question of planned geographic location and practice type, residents pursuing fellowships reported their preferences after they finish fellowship training, while those entering comprehensive ophthalmology likely already had job offers at the time of the survey and were thus reporting their known positions. Third, as the survey was distributed after the fellowship match, it is unknown if the match results affected what residents thought about the various factors influencing their career choices.

## Conclusion

In conclusion, this study updates our understanding of the decision-making process of ophthalmology residents regarding their career plans. A desire to acquire special skills and a desire to work with new technology are associated with the decision to seek subspecialty training, while working hours/lifestyles and educational debt are more important considerations in the choice to practice comprehensive ophthalmology. Through multiple logistic regression analysis, our study found that gender, prestige, or perceived favorable job market was not significant factors in the choice to enter fellowship training. This study may provide useful information for the improvement of residency and fellowship education, as well as for the planning of the ophthalmology workforce. Future research can focus on factors influencing choices of specific subspecialties, especially the ones with predicted shortages of supply.

### Conflict of Interest

M.V.B. reports consultancy for Heidelberg and Carl Zeiss Meditec. D.S. reports consultancy for Alcon.

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