AOS Theses

Factors Influencing Career Decisions and Satisfaction Among Newly Practicing Ophthalmologists

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• PURPOSE: To describe the career choices of newly practicing ophthalmologists and explore factors influencing career decisions and satisfaction.

• METHODS: A cross-sectional study was conducted using data from an electronic survey of ophthalmologists who completed training within the prior 5 years. The survey included questions about demographic information, medical education, current practice, factors affecting career choices, and career satisfaction. Statistical comparisons were made based on gender, type of practice, subspecialty training, and practice area.

• RESULTS: Surveys were completed by 696 (32%) newly practicing ophthalmologists, including 276 (40%) women, 179 (29%) academicians, and 465 (67%) subspecialists. A higher proportion of female respondents entered academics than male respondents (36% vs 26%, $P = .009$). Female and male respondents pursued fellowship training with similar frequency (64% vs 68%, $P = .32$), but men were more likely to seek vitreoretinal fellowships (30% vs 11%, $P < .001$) and women were more likely to undertake fellowships in pediatric ophthalmology (21% vs 8%, $P < .001$), uveitis (10% vs 2%, $P = .002$), and neuro-ophthalmology (6% vs 2%, $P = .042$). A total of 514 (83%) respondents reported being happy with work life.

• CONCLUSIONS: The career choices of newly practicing ophthalmologists differ based on gender, type of practice, subspecialty training, and practice area. Many factors affect career decisions, and they have varying influence on subgroups within ophthalmology. Ophthalmologists have high levels of career satisfaction. This information may prove useful when developing workforce strategies to meet future eye care needs.

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PHYSICIANS-IN-TRAINING MAKE A SERIES OF DECISIONS that direct them down a career pathway toward an area of medical practice. Ophthalmology is considered one of the most desirable fields of medicine, and many of the features attracting medical students to the specialty have been previously described.[1-9] Ophthalmology involves a broad range of practice encompassing a mixture of both medicine and surgery, treatment of children and adults, and provision of primary care as well as highly specialized treatment.[1-4] The prevalence and chronic nature of many ocular diseases allow ophthalmologists to provide a continuity of care in which meaningful, long-term relationships with patients can develop.[2,5] In addition to interacting with patients, ophthalmologists have an opportunity to work with other physicians in diagnosing and treating many systemic diseases with ocular manifestations.[4] As a result of technological advances in ophthalmology, diagnostic and therapeutic management can be performed with a high degree of precision that is unavailable to other specialties.[3,4,6,7] Ophthalmologists can positively impact the quality of life of their patients by improving vision.[2,4,6] On-call responsibilities are low and financial compensation is high for ophthalmologists relative to other medical specialists.[1,3,4,6,8,9] Ophthalmologists rarely deal with life-and-death decisions.[3] A high level of intellectual and emotional satisfaction is enjoyed by those who practice in the field.[4-6] Merritt[1] coined the term "Rolls Royce residencies" to describe the specialties that maximize professional pleasures and minimize career displeasures, and ophthalmology was cited as a prototypical residency in this category. It is not surprising that ophthalmology is one of the most competitive surgical specialties for training positions.[10]

Concern has been raised regarding whether an adequate number of ophthalmologists will be available to meet the future eye care needs in the United States. Demand for vision services will increase as a result of an aging population and a growing prevalence of chronic diseases with ocular sequelae, such as diabetes and hypertension.[11-13] The number of ophthalmologists per capita has declined over the past 2 decades.[13] The decrease in density of ophthalmologists contrasts with an increase in the density of total US physicians.[13,14] Although the number of medical school

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graduates and residency positions continue to rise overall, ophthalmology has maintained a relatively fixed number of residency slots producing a reduction in provider density in the context of an expanding population.[13,15-18] The demographic characteristics of ophthalmologists are also changing with a greater subspecialization, increased proportion of women, and aging of eye care providers.[13,19-22] Expectant retirement of ophthalmologists in the Baby Boomer generation and a desire for increased part-time employment by Millennials could have a marked negative impact on the physician workforce in the future.

Achieving a balanced workforce is essential in meeting the ophthalmic needs of patients. However, physician workforce projections in medicine are complex.[13,23-35] Many factors must be evaluated beyond the number of ophthalmologists entering the specialty from training programs and the number exiting the profession because of death, disability, or retirement. Additional important considerations include the number of other eye care providers, practice patterns, shifts in the patient population and disease demographics, new treatments and technologies, improvements in practice efficiency, telemedicine, subspecialization, modifications in practice models, and changes in patient demands and needs. Workforce planning analysis requires not only knowledge of the overall supply and demand for ophthalmic services, but also an understanding of factors influencing ophthalmologists-in-training to pursue various career pathways.

Numerous studies have evaluated factors influencing career choices among physicians.[36-131] These studies have been prompted by concerns about the physician workforce composition, declining applicant pools for some subspecialties, changes in the gender composition of medical graduates, and shifts in priorities affecting career decisions. Previous investigations have largely focused on the selection of specialties by medical students[36-59] and career choices involving areas of medicine outside of ophthalmology.[60-125] Surveys have assessed factors influencing the career choices of ophthalmology residents.[22,126-131] However, data obtained from residents are based on career expectations rather than actual experience. Trainees' perceptions of clinical practice have been shown to differ from those of practicing ophthalmologists.[132] We hypothesize that factors affect the career decisions of subgroups within ophthalmology in different ways. The purpose of this study is to describe the career choices of newly practicing ophthalmologists and explore factors contributing to career decisions and career satisfaction.

METHODS

• **SURVEY DEVELOPMENT:** This cross-sectional study was approved by the institutional review board at the University of Miami. The study adhered to the tenets of the Declaration of Helsinki and the Health Insurance Portability and Accountability Act. A 27-item questionnaire was developed after reviewing the medical literature relating to factors influencing career choices among physicians. The questionnaire was arranged into 4 domains, including demographic information, medical education, current practice, and career satisfaction (Appendix). A 5-point Likert scale was used to assess the quality of rotations during residency, factors influencing the final career choice, and career satisfaction. Discussions with residents, fellows, young faculty, and program directors were used to refine the questionnaire. The questionnaire was pilot tested by a group of 15 ophthalmologists to further establish face validity and content validity.

• **SURVEY DISTRIBUTION:** The study included ophthalmologists who completed residency or fellowship training within the previous 5 years. Ophthalmologists in the military were excluded because they may be restricted in their career choices. Eligible participants were identified using the American Academy of Ophthalmology (AAO) membership database. An online survey tool (SurveyMonkey Inc, Palo Alto, California, USA) was used to distribute the questionnaire and collect responses. After the review and approval of the study protocol by the AAO, an email invitation was sent on April 29, 2013, containing an explanation of the goals of the research and a link to the survey. Reminder emails were sent 2 and 4 weeks later, and the survey was closed after 6 weeks. Survey data were collected anonymously. However, respondents were given the option to provide contact information to be included in an incentive raffle for an iPad. This identifying information was not linked to survey data. Incentive gifts are a standard technique used in survey research to improve response rates, which are typically poor in physician surveys.[133] The IP address was registered during the electronic survey, and additional surveys were not accepted from the same computer.

• **STATISTICAL ANALYSIS:** Data were exported from the SurveyMonkey server and downloaded to a secure, password-protected database. Percentages were calculated from survey responses. In some cases, the sum of percentages exceeded 100% because more than 1 answer choice could have been selected (eg, higher degrees held). Univariable comparisons were made using the 2-sided Student *t* test for continuous variables and the χ^2 test with Yates correction applied for 2×2 tables. Multivariable analysis was performed using logistic regression analysis with forward stepwise inclusion to determine factors that were independently associated with career satisfaction. A *P* value less than .05 was considered statistically significant in our analyses.

The test-retest reliability of the survey was assessed by readministering the survey to a subset of initial respondents. Sample size calculations were performed to determine an appropriate number for retesting. We expected an intraclass correlation coefficient (ICC) of 0.6 based on a prior simi-

TABLE 1. Demographic Characteristics

	Respondents (n = 696)
Age (y)	
Mean ± SD	35.4 ± 3.6
Median [range]	35 [21-55]
Sex, n (%)	
Female	276 (40)
Male	420 (60)
Race/ethnicity, n (%)	
African American/Black	10 (1)
Asian	175 (25)
Caucasian	436 (63)
Hispanic/Latino	36 (5)
Other	33 (5)
Marital status, n (%)	
Married	559 (80)
Not married	136 (20)
Children during training, n (%)	
No	391 (56)
Yes	302 (44)

lar survey[21] and selected a 95% confidence interval width of 0.4 (0.4-0.8). The confidence interval 0.4-0.75 is considered to be a fair to good ICC and is commonly used.[134] For an ICC of 0.6, a sample size of 40 respondents would be needed for a 95% confidence interval width of 0.4 (0.4-0.8).[135] Respondents who provided their email addresses were randomly selected for retesting 3 months after the initial survey. An email invitation was sent, which included an explanation for the repeat testing and a new survey link. Invitations were delivered until a total of 40 respondents completed a second survey, and responses were associated with their original survey using the IP addresses. Personal identifiers were not linked to the survey data. The ICCs ranged from 0.64 to 1.00 for binary questions, 0.61 to 1.00 for multiple choice questions, 0.69 to 0.92 for Likert scale questions, and 0.50 to 0.96 for questions requiring numerical answers.

RESULTS

• **OVERALL GROUP:** The survey was distributed to 2145 newly practicing ophthalmologists, and 696 (32%) responded. Some questions were not answered because they did not apply to the respondent (eg, year fellowship training was completed), and others were skipped. Table 1 presents the demographic characteristics of respondents. The age (mean ± standard deviation [SD]) was 35.4 ± 3.6 years, and 420 (60%) were male.

Table 2 provides information about the medical training of respondents. A Doctor of Medicine (MD) degree was held by 673 (97%) respondents, and 20 (3%) had a Doctor of Osteopathic Medicine (DO) degree. Many respondents had additional higher degrees, including 52 (7%) with a Doctor of Philosophy (PhD), 16 (2%) with a Master of Public Health (MPH), and 8 (1%) with a Master of Business Administration (MBA). The number of full-time faculty in residency (mean ± SD) ranged from 0.8 ± 0.6 for ophthalmic pathology to 4.3 ± 3.0 for retina. The number of cataract procedures (mean ± SD) performed during residency was 159.6 ± 59.8. Scholarly activities during residency included presentation of a paper or poster at a national meeting by 508 (73%) respondents, publication in a peer-reviewed journal by 386 (55%), research as a team member by 379 (54%), research as a primary investigator or project leader by 258 (37%), and publication of a book chapter or non–peer-reviewed article by 205 (29%).

Fellowship training was completed by 465 (67%) respondents. The subspecialty area of fellowship training included 113 (24%) cornea/external disease, 107 (23%) retina, 99 (21%) glaucoma, 79 (17%) anterior segment/refractive surgery, 59 (13%) pediatric ophthalmology, 39 (8%) oculoplastics, 36 (8%) medical retina, 24 (5%) uveitis, 17 (4%) neuro-ophthalmology, and 3 (0.6%) ophthalmic pathology. Other fellowships were pursued by 6 (1%) respondents, including 4 ocular oncology, 1 international, and 1 ophthalmic genetics. Twelve (3%) respondents reported undergoing fellowship training, but the subspecialty area was not provided. The decision to pursue fellowship training was made during PGY (postgraduate year) 2 and 3 by 131 (29%) and 133 (29%) respondents, respectively. The choice of subspecialty area for fellowship training was made in PGY 2 by 125 (27%) respondents and in PGY 3 by 162 (36%).

Table 3 shows data relating to the current practice of respondents. One hundred seventy-nine (29%) respondents were full-time academic ophthalmologists, and 410 (66%) were in private practice. The area of ophthalmic practice included 359 (58%) comprehensive ophthalmology, 189 (30%) cornea/external disease, 166 (27%) anterior segment/refractive surgery, 149 (24%) glaucoma, 108 (17%) vitreoretinal disease and surgery, 92 (15%) medical retina, 80 (13%) oculoplastics, 76 (12%) pediatric ophthalmology, 53 (9%) uveitis, 37 (6%) neuro-ophthalmology, 10 (2%) other, and 3 (0.5%) ophthalmic pathology. The practice area was strongly correlated with the area of subspecialty fellowship training. However, some general ophthalmologists practiced within a subspecialty area, and some subspecialists practiced comprehensive ophthalmology and/or outside their area of fellowship training. There were 304 (49%) respondents who had 1 practice area, 146 (24%) had 2 practice areas, 109 (18%) had 3 practice areas, and 62 (10%) had 4 or more practice areas. The number of work hours per week (mean ± SD) was 38.7 ± 11.4 hours in direct patient care and 9.6 ± 10.7 hours in ophthalmology outside of direct patient care. The location of their clinical practice was urban for 291 (47%) respondents, suburban for 226 (43%), and rural for 65 (10%).

TABLE 2. Medical Training

	Respondents (n = 696)
Degree(s), n (%)	
DO	20 (3)
MBA	8 (1)
MD	673 (97)
MPH	16 (2)
PhD	52 (7)
AOA member, n (%)	
No	492 (71)
Yes	198 (29)
Year residency training completed, n (%)	
<2006	22 (4)
2006	29 (5)
2007	64 (10)
2008	112 (18)
2009	102 (17)
2010	138 (22)
2011	118 (19)
2012	33 (5)
Number of full-time faculty in residency, mean ± SD [range]	
Comprehensive ophthalmology	4.3 ± 3.6 [0-30]
Cornea/external disease	3.2 ± 2.3 [0-15]
Glaucoma	3.0 ± 2.0 [0-15]
Neuro-ophthalmology	1.7 ± 1.0 [0-7]
Oculoplastics	2.0 ± 1.4 [0-14]
Ophthalmic pathology	0.8 ± 0.6 [0-3]
Pediatric ophthalmology	2.9 ± 2.1 [0-15]
Retina	4.3 ± 3.0 [0-25]
Uveitis	1.1 ± 0.9 [0-6]
Number of procedures performed during residency, mean ± SD [range]	
Cataract	159.6 ± 59.8 [25-600]
Strabismus	30.3 ± 22.8 [0-200]
Corneal surgery	11.7 ± 13.0 [0-150]
Glaucoma laser	37.0 ± 48.0 [0-700]
Glaucoma filtering	11.4 ± 9.2 [0-150]
Retina/vitreous	12.3 ± 33.9 [0-500]
Other retinal	72.8 ± 93.8 [0-700]
Oculoplastics and orbit	38.4 ± 37.0 [0-340]
Globe trauma	15.1 ± 13.5 [0-200]
Scholarly activities during residency, n (%)[a]	
Publication in a peer-reviewed journal	386 (55)
Publication of a book chapter or non–peer-reviewed article	205 (29)
Presentation (paper or poster) at a national meeting	508 (73)
Research as primary investigator or project leader	258 (37)
Research as team member	379 (54)
Fellowship training, n (%)	
No	231 (33)
Yes	465 (67)
Subspecialty area of fellowship training, n (%)[b]	
Anterior segment/refractive surgery	79 (17)
Cornea/external disease	113 (24)
Glaucoma	99 (21)
Medical retina	36 (8)
Neuro-ophthalmology	17 (4)
Oculoplastics	39 (8)

(*continued on next page*)

TABLE 2. (*continued*)

	Respondents (n = 696)
Ophthalmic pathology	3 (.6)
Pediatric ophthalmology	59 (13)
Uveitis	24 (5)
Vitreoretinal disease and surgery	107 (23)
Other	6 (1)
Did not answer	12 (3)
Timing of decision to pursue fellowship training, n (%)	
Medical school	82 (18)
PGY 1	59 (13)
PGY 2	131 (29)
PGY 3	133 (29)
PGY 4	46 (10)
Timing of subspecialty fellowship choice, n (%)	
Medical school	50 (11)
PGY 1	42 (9)
PGY 2	125 (27)
PGY 3	162 (36)
PGY 4	76 (17)
Year fellowship training completed, n (%)	
2008	74 (17%)
2009	75 (17%)
2010	74 (17%)
2011	101 (23%)
2012	121 (27%)

AOA = Alpha Omega Alpha, DO = Doctor of Osteopathic Medicine, MBA = Master of Business Administration, MD = Doctor of Medicine, MPH = Master of Public Health, PGY = postgraduate year, PhD = Doctor of Philosophy.

[a]Some respondents participated in more than 1 scholarly activity during residency.

[b]Some respondents completed more than 1 fellowship.

Geographic location based on Census Bureau–designated regions is provided in Table 3. One hundred twenty-five (20%) respondents were located in the Midwest, 130 (21%) in the Northeast, 207 (34%) in the South, and 148 (24%) in the West. Our knowledge of the state in which each invited ophthalmologist was practicing allowed determination of the geographic location of those who did not respond to the survey. Three hundred thirty-six (22%) nonrespondents were located in the Midwest, 339 (22%) in the Northeast, 500 (33%) in the South, and 360 (23%) in the West. No significant difference in geographic distribution was seen between respondents and nonrespondents ($P = .83$), providing some evidence for the generalizability of study results.

Table 4 reviews responses that were made using a 5-point Likert scale. The quality of rotations during residency was rated as very good or excellent by a majority of respondents, with the exception of ophthalmic pathology. Factors that were rated as moderately important or very important in influencing the final career choice by at least half of respondents included types of patient problems in practice (70%), continuity of care (67%), challenging diagnostic problems (64%), role models/mentors (62%), geographic location (59%), rotation(s) in subspecialty area (58%), work hours (57%), income (53%), and job market (51%). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 514 (83%) respondents, and 555 (89%) were happy with life outside of work.

• **GENDER:** Table 5 compares results between female and male ophthalmologists. Female respondents were on average younger than male respondents (34.7 years vs 35.8 years, $P < .001$). The racial/ethnic distribution of respondents showed that proportionally more Caucasian respondents were male (69% vs 54%), and more Asian (33% vs 21%) and African American/Black (3% vs 0.2%) respondents were female. Male respondents were more likely to be married (85% vs 74%, $P = .001$) and have children during training (53% vs 30%, $P < .001$) compared with their female counterparts. A higher proportion of female respondents had an MD degree than male respondents (99% vs 96%, $P = .026$). Male respondents reported a greater number of comprehensive faculty during residency (4.5 vs 3.9, $P = .039$), whereas female respondents had more cornea/external disease faculty (3.4 vs 3.0, $P = .041$). Male respondents performed a larger number of cataract surgeries (163.5 vs 153.7, $P = .044$), retina/vitreous procedures (15.0

TABLE 3. Current Practice

	Respondents (n = 696)
Practice type, n (%)	
Solo private practice	46 (7)
Ophthalmology only group practice	280 (45)
Multispecialty group practice	84 (14)
Full-time academic	179 (29)
Not in clinical practice	1 (.2)
Other	30 (5)
Area of practice, n (%)[a]	
Anterior segment/refractive surgery	166 (27)
Comprehensive ophthalmology	359 (58)
Cornea/external disease	189 (30)
Glaucoma	149 (24)
Medical retina	92 (15)
Neuro-ophthalmology	37 (6)
Oculoplastics	80 (13)
Ophthalmic pathology	3 (.5)
Pediatric ophthalmology	76 (12)
Uveitis	53 (9)
Vitreoretinal disease and surgery	108 (17)
Other	10 (2)
Hours per week, mean ± SD	
Direct patient care	38.7 ± 11.4
Ophthalmology outside of direct patient care	9.6 ± 10.7
Practice location, n (%)	
Rural	65 (10)
Suburban	266 (43)
Urban	291 (47)
Geographic location, n (%)[b]	
Midwest	125 (20)
Northeast	130 (21)
South	207 (34)
West	148 (24)

[a]Some respondents are practicing in more than 1 area.

[b]US Census Bureau-designated regions (Midwest = Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Ohio, Nebraska, North Dakota, South Dakota, and Wisconsin; Northeast = Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; South = Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas, Virginia, Washington DC, and West Virginia; West = Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming).

vs 8.1, $P = .005$), and other retinal procedures (80.0 vs 61.9, $P = .026$) relative to female respondents.

Male respondents were more likely to have completed a vitreoretinal disease and surgery fellowship (30% vs 11%, $P < .001$), whereas female respondents were more likely to have pursued fellowship training in neuro-ophthalmology (6% vs 2%, $P = .042$), pediatric ophthalmology (21% vs 8%, $P < .001$), and uveitis (10% vs 2%, $P = .002$). Male respondents had a higher probability of entering private practice than female respondents (74% vs 64%, $P = .009$). A higher proportion of male respondents focused their clinical practices on vitreoretinal disease and surgery (23% vs 9%, $P < .001$), medical retina (18% vs 10%, $P = .006$), and anterior segment/refractive surgery (28% vs 17%, $P = .002$). A larger percentage of female respondents practiced pediatric ophthalmology (18% vs 9%, $P = .002$). There were 206 (55%) male respondents and 111 (45%) female respondents who practiced in more than 1 specialty area ($P = .026$). Female respondents on average worked fewer hours per week in direct patient care than male respondents (36.9 hours vs 39.9 hours, $P = .001$). Female respondents were more likely to practice in an urban location than male respondents (50% vs 45%). Female respondents were more influenced by several factors when making career decisions, including continuity of care (mean Likert score 4.1 vs 3.7, $P < .001$), types of patient problems in practice (mean Likert score 4.0 vs 3.8, $P = .020$), challenging diagnostic problems (mean Likert score 3.9 vs 3.7, $P = .048$), geographic

TABLE 4. Likert Scale Questions

	Likert Score				
	1	2	3	4	5
Quality of rotations during residency, n (%)[a]					
Cornea/external disease	7 (1)	52 (8)	137 (22)	229 (36)	211 (33)
Glaucoma	8 (1)	30 (5)	121 (19)	244 (38)	235 (37)
Neuro-ophthalmology	14 (2)	37 (6)	117 (18)	214 (34)	256 (40)
Oculoplastics	15 (2)	57 (9)	134 (21)	221 (35)	212 (33)
Ophthalmic pathology	46 (7)	84 (13)	192 (30)	143 (23)	165 (26)
Pediatric ophthalmology	10 (2)	41 (6)	126 (20)	219 (34)	241 (38)
Retina	3 (.5)	17 (3)	85 (13)	247 (39)	285 (45)
Uveitis	27 (4)	73 (12)	208 (33)	187 (30)	133 (21)
Factors influencing final career choice, n (%)[b]					
Challenging diagnostic problems	18 (3)	46 (7)	156 (25)	241 (39)	156 (25)
Continuity of care	19 (3)	42 (7)	140 (23)	244 (40)	171 (28)
Educational debt	247 (40)	113 (18)	128 (21)	97 (16)	32 (5)
Geographic location	91 (15)	50 (8)	113 (18)	140 (23)	223 (36)
Income	52 (8)	62 (10)	174 (28)	251 (41)	79 (13)
Job market	71 (12)	75 (12)	157 (25)	211 (34)	102 (17)
Opportunities to teach	112 (18)	132 (21)	167 (27)	127 (21)	79 (13)
Opportunities for research	230 (37)	125 (20)	113 (18)	86 (14)	64 (10)
Prestige	164 (27)	146 (24)	167 (27)	96 (16)	45 (7)
Research experience	252 (41)	139 (23)	116 (19)	69 (11)	40 (6)
Role models/mentors	46 (7)	55 (9)	134 (22)	179 (29)	205 (33)
Rotation(s) in subspecialty area	68 (11)	54 (9)	134 (22)	191 (31)	165 (27)
Types of patient problems in practice	21 (3)	33 (5)	129 (21)	243 (40)	189 (31)
Work hours	40 (6)	55 (9)	168 (27)	228 (37)	127 (21)
Working with new technology	38 (6)	71 (12)	163 (26)	247 (40)	97 (16)
Job satisfaction, n (%)					
Happiness with work life[c]	4 (.6)	9 (1)	94 (15)	288 (46)	226 (36)
Happiness with life outside of job[d]	4 (.6)	6 (1)	57 (9)	251 (40)	304 (49)

[a]Question: Rate the quality of your rotations in each of the subspecialty areas of ophthalmology during residency. Answers: 1 = poor, 2 = fair, 3 = adequate, 4 = very good, 5 = excellent.

[b]Question: Indicate to what degree each of the following factors influenced your final career choice (specialty area and type of practice). Answers: 1 = not at all important, 2 = slightly important, 3 = somewhat important, 4 = moderately important, 5 = very important.

[c]Question: How happy are you with your work life? Please answer on a scale of 1-5, with 1 being very unhappy and 5 being very happy.

[d]Question: How happy are you with your life outside of your job? Please answer on a scale of 1-5, with 1 being very unhappy and 5 being very happy.

location (mean Likert score 3.8 vs 3.4, $P = .004$), and work hours (mean Likert score 3.7 vs 3.5, $P = .002$). Male respondents prioritized working with new technology (mean Likert score 3.6 vs 3.3, $P = .003$) and income (mean Likert score 3.5 vs 3.2, $P = .002$). Male respondents reported a higher level of happiness with work life than female respondents (mean Likert score 4.2 vs 4.1, $P = .007$). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 322 (86%) male ophthalmologists and 192 (77%) female ophthalmologists ($P = .006$). A negative level of happiness (ie, Likert score of 1 or 2) with work life was reported by 6 (2%) male respondents and 7 (3%) female respondents ($P = .39$). There were 336 (90%) male ophthalmologists and 219 (88%) female ophthalmologists who indicated a positive level of happiness with life outside of work ($P = .64$). A negative level of happiness (ie, Likert score of 1 or 2) with life outside of work was reported by 6 (2%) male respondents and 4 (2%) female respondents ($P = 1.00$).

• **PRACTICE TYPE:** Table 6 compares results between ophthalmologists in academics and private practice. Ophthalmologists in academics were on average older than those in private practice (35.8 years vs 34.9 years, $P = .007$). There were proportionally more females in academics than private practice (47% vs 36%, $P = .009$). The racial/ethnic distribution showed a higher percentage of Asians and "Other" respondents in academics (38% vs 26%) and Caucasians in private practice (68% vs 56%). Academic ophthalmologists were more likely to hold a PhD degree (12% vs 5%, $P = .003$), whereas private practitioners were more likely to have a DO degree (3% vs 0%, $P = .035$). Oph-

TABLE 5. Comparison of Women and Men

	Female (n = 276)	Male (n = 420)	*P* Value
Demographic characteristics			
Age (y)			<.001
Mean ± SD	34.7± 3.2	35.8 ± 3.8	
Median [range]	34 [29-49]	35 [21-55]	
Race/ethnicity, n (%)			<.001
African American/Black	9 (3)	1 (.2)	
Asian	89 (33)	86 (21)	
Caucasian	148 (54)	288 (69)	
Hispanic/Latino	11 (4)	25 (6)	
Other	15 (6)	18 (4)	
Marital status, n (%)			.001
Married	204 (74)	355 (85)	
Not married	71 (26)	65 (15)	
Children during training, n (%)			<.001
No	193 (70)	198 (47)	
Yes	83 (30)	219 (53)	
Medical education			
Degree(s), n (%)			
DO	4 (1)	16 (4)	.068
MBA	2 (.7)	6 (1.4)	.39
MD	272 (99)	401 (96)	.026
MPH	8 (3)	8 (2)	.39
PhD	22 (8)	30 (7)	.68
AOA member, n (%)			.78
No	197 (72)	295 (71)	
Yes	77 (28)	121 (29)	
Number of full-time faculty in residency, mean ± SD			
Comprehensive ophthalmology	3.9 ± 3.5	4.5 ± 3.6	.039
Cornea/external disease	3.4 ± 2.5	3.0 ± 2.1	.041
Glaucoma	3.1 ± 2.1	3.0 ± 1.9	.57
Neuro-ophthalmology	1.8 ± 1.1	1.7 ± 0.9	.37
Oculoplastics	1.9 ± 1.5	2.0 ± 1.3	.71
Ophthalmic pathology	0.8 ± 0.7	0.9 ± 0.6	.27
Pediatric ophthalmology	3.0 ± 2.3	2.8 ± 1.9	.37
Retina	4.3 ± 3.0	4.3 ± 3.1	.97
Uveitis	1.1 ± 1.0	1.1 ± 0.9	.84
Number of procedures performed during residency, mean ± SD			
Cataract	153.7 ± 62.6	163.5 ± 57.7	.044
Strabismus	29.8 ± 24.4	30.6 ± 21.7	.67
Corneal surgery	10.5 ± 12.3	12.5 ± 13.4	.053
Glaucoma laser	35.8 ± 36.6	37.7 ± 54.2	.63
Glaucoma filtering	10.5 ± 9.3	11.9 ± 9.2	.071
Retina/vitreous	8.1 ± 17.7	15.0 ± 41.0	.005
Other retinal	61.9 ± 85.9	80.0 ± 98.0	0.26
Oculoplastics and orbit	36.0 ± 37.4	40.0 ± 36.7	.20
Globe trauma	14.2 ± 11.4	15.7 ± 14.8	.19
Quality of rotations during residency, mean Likert score ± SD			
Cornea/external disease	3.9 ± 1.0	3.9 ± 1.0	.38
Glaucoma	4.0 ± 0.9	4.1 ± 0.9	.48
Neuro-ophthalmology	4.0 ± 1.0	4.1 ± 1.0	.41
Oculoplastics	3.8 ± 1.1	3.9 ± 1.0	.37
Ophthalmic pathology	3.6 ± 1.3	3.4 ± 1.2	.069
Pediatric ophthalmology	4.0 ± 1.0	4.0 ± 1.0	.82

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TABLE 5. (*continued*)

	Female (n = 276)	Male (n = 420)	*P* Value
Retina	4.2 ± 0.9	4.3 ± 0.8	.053
Uveitis	3.5 ± 1.1	3.5 ± 1.0	.81
Scholarly activities during residency, n (%)			
Publication in a peer-reviewed journal	154 (56%)	232 (55%)	.89
Publication of a book chapter or non–peer-reviewed article	82 (30%)	123 (29%)	.90
Presentation (paper or poster) at a national meeting	209 (76%)	299 (71%)	.19
Research as primary investigator or project leader	104 (38%)	154 (37%)	.79
Research as team member	151 (55%)	228 (54%)	.91
Fellowship training, n (%)			.32
No	98 (36)	133 (31)	
Yes	178 (64)	287 (68)	
Subspecialty area of fellowship training, n (%)			
Anterior segment/refractive surgery	25 (14)	54 (19)	.23
Cornea/external disease	42 (24)	71 (25)	.87
Glaucoma	36 (20)	63 (22)	.75
Medical retina	14 (8)	22 (8)	1.00
Neuro-ophthalmology	11 (6)	6 (2)	.042
Oculoplastics	15 (8)	24 (8)	.99
Ophthalmic pathology	3 (2)	0	.11
Pediatric ophthalmology	37 (21)	22 (8)	<.001
Uveitis	17 (10)	7 (2)	.002
Vitreoretinal disease and surgery	20 (11)	87 (30)	<.001
Other	2 (1)	4 (1)	1.00
Timing of decision to pursue fellowship training, n (%)			.73
Medical school	32 (19)	50 (18)	
PGY 1	23 (13)	36 (13)	
PGY 2	55 (32)	75 (27)	
PGY 3	45 (26)	88 (32)	
PGY 4	17 (10)	28 (10)	
Timing of subspecialty fellowship choice, n (%)			.67
Medical school	14 (8)	31 (11)	
PGY 1	17 (10)	24 (9)	
PGY 2	44 (26)	81 (29)	
PGY 3	66 (38)	95 (34)	
PGY 4	31 (18)	45 (16)	
Year fellowship training completed, n (%)			.13
2008	27 (16)	47 (17)	
2009	19 (11)	56 (20)	
2010	31 (18)	43 (16)	
2011	42 (25)	59 (21)	
2012	51 (30)	70 (25)	
Current practice			
Practice type, n (%)			.009
Academic	85 (36)	94 (26)	
Private	148 (64)	262 (74)	
Area of practice, n (%)			
Anterior segment/refractive surgery	48 (17)	118 (28)	.002
Comprehensive ophthalmology	148 (54)	211 (50)	.43
Cornea/external disease	48 (17)	97 (23)	.086
Glaucoma	50 (20)	99 (26)	.11
Medical retina	24 (10)	68 (18)	.006
Neuro-ophthalmology	17 (7)	20 (5)	.51
Oculoplastics	24 (10)	56 (15)	.083
Ophthalmic pathology	2 (0.8)	1 (0.3)	.71

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TABLE 5. (*continued*)

	Female (n = 276)	Male (n = 420)	*P* Value
Pediatric ophthalmology	43 (18)	33 (9)	.002
Uveitis	22 (9)	31 (8)	.86
Vitreoretinal disease and surgery	21 (9)	87 (23)	<.001
Other	6 (2)	4 (1)	.31
Hours per week, mean ± SD			
Direct patient care	36.9 ± 10.8	39.9 ± 11.5	.001
Ophthalmology outside of direct patient care	10.2 ± 11.9	9.1 ± 9.8	.24
Practice location, n (%)			.027
Rural	16 (6)	49 (13)	
Suburban	107 (43)	159 (42)	
Urban	124 (50)	167 (45)	
Factors influencing final career choice, mean Likert score ± SD			
Challenging diagnostic problems	3.9 ± 1.04	3.7 ± 0.98	.048
Continuity of care	4.1 ± 1.01	3.7 ± 0.99	<.001
Educational debt	2.2 ± 1.33	2.3 ± 1.24	.33
Geographic location	3.8 ± 1.39	3.4 ± 1.43	.004
Income	3.2 ± 1.15	3.5 ± 1.05	.002
Job market	3.4 ± 1.22	3.3 ± 1.22	.38
Opportunities to teach	3.0 ± 1.34	2.8 ± 1.24	.19
Opportunities for research	2.4 ± 1.39	2.4 ± 1.37	.52
Prestige	2.5 ± 1.23	2.5 ± 1.24	.89
Research experience	2.2 ± 1.25	2.2 ± 1.27	.62
Role models/mentors	3.7 ± 1.22	3.7 ± 1.22	.91
Rotation(s) in subspecialty area	3.6 ± 1.29	3.5 ± 1.27	.67
Types of patient problems in practice	4.0 ± 0.99	3.8 ± 1.02	.020
Work hours	3.7 ± 1.11	3.5 ± 1.09	.002
Working with new technology	3.3 ± 1.15	3.6 ± 1.02	.003
Career satisfaction			
Job satisfaction, mean Likert score ± SD			
Happiness with work life	4.1 ± 0.82	4.2 ± 0.74	.007
Happiness with life outside of job	4.4 ± 0.76	4.4 ± 0.73	.83

AOA = Alpha Omega Alpha, DO = Doctor of Osteopathic Medicine, MBA = Master of Business Administration, MD = Doctor of Medicine, MPH = Master of Public Health, PGY = postgraduate year, PhD = Doctor of Philosophy.

thalmologists in academics reported a greater number of full-time faculty in residency in several subspecialties compared with their counterparts in private practice, including cornea/external disease (3.8 vs 2.9, $P < .001$), glaucoma (3.5 vs 2.8, $P = .001$), neuro-ophthalmology (1.9 vs 1.6, $P = .001$), ophthalmic pathology (1.0 vs 0.8, $P = .001$), pediatric ophthalmology (3.4 vs 2.6, $P < .001$), and retina (5.2 vs 3.9, $P < .001$). Private practitioners performed a larger volume of glaucoma laser (40.9 vs 28.3, $P = .001$) and retina/vitreous (14.2 vs 8.3, $P = .007$) procedures during residency than academic ophthalmologists. Respondents in academics provided a higher rating to the quality of residency rotations in cornea/external disease (mean Likert score 4.1 vs 3.9, $P = .023$) and glaucoma (mean Likert score 4.2 vs 4.0, $P = .015$) relative to those in private practice. Academic ophthalmologists were more likely than private practitioners to have published in a peer-reviewed journal (71% vs 56%, $P = .001$), published a book chapter or non–peer-reviewed article (41% vs 28%, $P = .001$), presented a paper or poster at a national meeting (91% vs 75%, $P < .001$), and participated as a research team member (69% vs 55%, $P = .002$) during residency.

Ophthalmologists in academics pursued fellowship training more frequently than those in private practice (91% vs 67%, $P < .001$). Academic ophthalmologists were more likely to complete fellowships in neuro-ophthalmology (7% vs 2%, $P = .032$), pediatric ophthalmology (19% vs 9%, $P = .004$), and uveitis (9% vs 3%, $P = .008$). A higher proportion of respondents in private practice focused their clinical practices on comprehensive ophthalmology (69% vs 33%, $P < .001$), anterior segment/refractive surgery (30% vs 20%, $P = .017$), and medical retina (18% vs 7%, $P = .001$). In contrast, a higher percentage of academic ophthalmologists practiced pediatric ophthalmology (17% vs 10%, $P = .014$). There were 75 (42%) academic ophthalmologists and 226 (55%) private practice ophthalmologists who practiced in more than 1 specialty area ($P = .004$). Ophthalmologists in private practice spent more hours per

TABLE 6. Comparison of Ophthalmologists in Academics and Private Practice

	Academics (n = 179)	Private Practice (n = 410)	*P* Value
Demographic characteristics			
Age (y)			.007
Mean ± SD	35.8 ± 3.8	34.9 ± 3.1	
Median [range]	35 [30-54]	34 [21-50]	
Sex, n (%)			.009
Female	85 (47)	148 (36)	
Male	94 (53)	262 (64)	
Race/ethnicity, n (%)			<.001
African American/Black	1 (.6)	6 (1)	
Asian	49 (28)	97 (24)	
Caucasian	99 (56)	278 (68)	
Hispanic/Latino	9 (5)	17 (4)	
Other	19 (11)	9 (2)	
Marital status, n (%)			.46
Married	139 (78)	331 (81)	
Not married	39 (22)	79 (19)	
Children during training, n (%)			.096
No	110 (61)	220 (54)	
Yes	69 (39)	187 (46)	
Medical education			
Degree(s), n (%)			
DO	0	13 (3)	.035
MBA	3 (2)	5 (1)	.96
MD	178 (99)	396 (97)	.082
MPH	8 (4)	7 (2)	.094
PhD	21 (12)	19 (5)	.003
AOA member, n (%)			.45
No	128 (72)	280 (48)	
Yes	50 (28)	127 (31)	
Number of full-time faculty in residency, mean ± SD			
Comprehensive ophthalmology	4.6 ± 3.9	4.2 ± 3.5	.25
Cornea/external disease	3.8 ± 2.7	2.9 ± 2.0	<.001
Glaucoma	3.5 ± 2.3	2.8 ± 1.8	.001
Neuro-ophthalmology	1.9 ± 1.0	1.6 ± 0.9	.001
Oculoplastics	2.1 ± 1.4	1.9 ± 1.4	.10
Ophthalmic pathology	1.0 ± 0.7	0.8 ± 0.6	.001
Pediatric ophthalmology	3.4 ± 2.8	2.6 ± 1.6	<.001
Retina	5.2 ± 3.5	3.9 ± 2.9	<.001
Uveitis	1.2 ± 0.91	1.1 ± 0.9	.083
Number of procedures performed during residency, mean ± SD			
Cataract	158.9 ± 57.6	160.2 ± 59.0	.81
Strabismus	30.2 ± 21.6	30.2 ± 22.2	.99
Corneal surgery	12.0 ± 14.8	11.8 ± 12.3	.85
Glaucoma laser	28.5 ± 32.5	40.9 ± 54.8	.001
Glaucoma filtering	12.2 ± 9.4	11.0 ± 9.1	.16
Retina/vitreous	8.3 ± 9.9	14.2 ± 41.1	.007
Other retinal	63.7 ± 81.8	77.2 ± 99.3	.14
Oculoplastics and orbit	39.6 ± 33.7	37.3 ± 34.8	.47
Globe trauma	14.6 ± 10.1	15.4 ± 14.8	.50
Quality of rotations during residency, mean Likert score ± SD			
Cornea/external disease	4.1 ± 1.0	3.9 ± 1.0	.023
Glaucoma	4.2 ± 0.9	4.0 ± 0.9	.015
Neuro-ophthalmology	4.1 ± 1.1	4.0 ± 1.0	.41
Oculoplastics	3.9 ± 1.1	3.9 ± 1.0	.79

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TABLE 6. (*continued*)

	Academics (n = 179)	Private Practice (n = 410)	*P* Value
Ophthalmic pathology	3.6 ± 1.3	3.4 ± 1.2	.16
Pediatric ophthalmology	4.1 ± 1.0	4.0 ± 1.0	.052
Retina	4.3 ± 0.8	4.2 ± 0.8	.11
Uveitis	3.5 ± 1.2	3.5 ± 1.0	.82
Scholarly activities during residency, n (%)			
Publication in a peer-reviewed journal	127 (71)	229 (56)	.001
Publication of a book chapter or non–peer-reviewed article	74 (41)	114 (28)	.001
Presentation (paper or poster) at a national meeting	162 (91)	307 (75)	<.001
Research as primary investigator or project leader	67 (37)	174 (42)	.26
Research as team member	123 (69)	227 (55)	.002
Fellowship training, n (%)			<.001
No	16 (9)	135 (33)	
Yes	162 (91)	275 (67)	
Subspecialty area of fellowship training			
Anterior segment/refractive surgery	22 (14)	53 (19)	.16
Cornea/external disease	35 (22)	71 (26)	.38
Glaucoma	37 (23)	57 (21)	.69
Medical retina	11 (7)	22 (8)	.78
Neuro-ophthalmology	11 (7)	6 (2)	.032
Oculoplastics	14 (9)	24 (9)	1.00
Ophthalmic pathology	3 (2)	0	.096
Pediatric ophthalmology	30 (19)	24 (9)	.004
Uveitis	15 (9)	8 (3)	.008
Vitreoretinal disease and surgery	31 (19)	69 (25)	.18
Other	3 (2)	1 (.4)	.29
Timing of decision to pursue fellowship training, n (%)			.20
Medical school	35 (22)	43 (16)	
PGY 1	25 (16)	31 (12)	
PGY 2	45 (28)	76 (29)	
PGY 3	38 (24)	88 (33)	
PGY 4	16 (10)	28 (11)	
Timing of subspecialty fellowship choice, n (%)			.53
Medical school	18 (11)	29 (11)	
PGY 1	13 (8)	26 (10)	
PGY 2	39 (25)	79 (29)	
PGY 3	55 (35)	97 (36)	
PGY 4	33 (21)	40 (15)	
Year fellowship training completed, n (%)			.91
2008	25 (16)	45 (17)	
2009	29 (19)	41 (16)	
2010	23 (15)	45 (17)	
2011	35 (23)	62 (23)	
2012	43 (28)	71 (27)	
Current practice			
Area of practice, n (%)			
Anterior segment/refractive surgery	36 (20)	123 (30)	.017
Comprehensive ophthalmology	59 (33)	282 (69)	<.001
Cornea/external disease	37 (21)	101 (25)	.35
Glaucoma	38 (21)	104 (25)	.33
Medical retina	13 (7)	74 (18)	.001
Neuro-ophthalmology	13 (7)	23 (6)	.56
Oculoplastics	16 (9)	61 (15)	.067
Ophthalmic pathology	2 (1)	1 (.2)	.46
Pediatric ophthalmology	31 (17)	40 (10)	.014
Uveitis	17 (10)	34 (8)	.75

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TABLE 6. (*continued*)

	Academics (n = 179)	Private Practice (n = 410)	*P* Value
Vitreoretinal disease and surgery	31 (17)	70 (17)	1.00
Other	2 (1)	5 (1)	1.00
Hours per week, mean ± SD			
Direct patient care	35.2 ± 11.4	40.4 ± 10.4	< .001
Ophthalmology outside of direct patient care	15.0 ± 11.8	6.5 ± 6.8	< .001
Practice location, n (%)			<.001
Rural	6 (3)	57 (14)	
Suburban	38 (21)	217 (53)	
Urban	134 (75)	136 (33)	
Factors influencing final career choice, mean Likert score ± SD			
Challenging diagnostic problems	4.1 ± 1.0	3.6 ± 1.0	<.001
Continuity of care	3.9 ± 1.1	3.8 ± 1.0	.47
Educational debt	1.9 ± 1.2	2.5 ± 1.3	<.001
Geographic location	3.1 ± 1.5	3.8 ± 1.3	<.001
Income	3.0 ± 1.2	3.6 ± 1.0	<.001
Job market	3.0 ± 1.3	3.5 ± 1.1	<.001
Opportunities to teach	3.9 ± 1.1	2.4 ± 1.1	<.001
Opportunities for research	3.5 ± 1.3	1.9 ± 1.1	<.001
Prestige	3.0 ± 1.2	2.3 ± 1.2	<.001
Research experience	3.1 ± 1.3	1.8 ± 1.0	<.001
Role models/mentors	4.2 ± 1.0	3.5 ± 1.2	<.001
Rotation(s) in subspecialty area	3.7 ± 1.2	3.5 ± 1.3	.040
Types of patient problems in practice	4.1 ± 1.0	3.8 ± 1.0	.010
Work hours	3.1 ± 1.2	3.8 ± 1.0	<.001
Working with new technology	3.4 ± 1.2	3.5 ± 1.0	.22
Career Satisfaction			
Job satisfaction, mean Likert score ± SD			
Happiness with work life	4.2 ± 0.7	4.2 ± 0.8	.64
Happiness with life outside of job	4.3 ± 0.7	4.4 ± 0.7	.006

AOA = Alpha Omega Alpha, DO = Doctor of Osteopathic Medicine, MBA = Master of Business Administration, MD = Doctor of Medicine, MPH = Master of Public Health, PGY = postgraduate year, PhD = Doctor of Philosophy.

week in direct patient care (40.4 hours vs 35.2 hours, $P < .001$), and those in academics spent more time in ophthalmology outside of direct patient care (15.0 hours vs 6.5 hours, $P < .001$). Academic ophthalmologists were more likely to practice in an urban location than private practitioners (75% vs 33%). Several factors were rated as more important in influencing career choices by respondents in academics relative to those in private practice, including role models/mentors (mean Likert score 4.2 vs 3.5, $P < .001$), challenging diagnostic problems (mean Likert score 4.1 vs 3.6, $P < .001$), types of patient problems in practice (mean Likert score 4.1 vs 3.8, $P = .010$), opportunities to teach (mean Likert score 3.9 vs 2.4, $P < .001$), rotation(s) in subspecialty area (mean Likert score 3.7 vs 3.5, $P = .040$), opportunities for research (mean Likert score 3.5 vs 1.9, $P < .001$), research experience (mean Likert score 3.8 vs 1.8 $P < .001$), and prestige (mean Likert score 3.0 vs 2.3, $P < .001$). Factors motivating career choices that were more important to ophthalmologists in private practice than academics included work hours (mean Likert score 3.8 vs 3.1, $P < .001$), geographic location (mean Likert score 3.8 vs 3.1, $P < .001$), income (mean Likert score 3.6 vs 3.0, $P < .001$), job market (mean Likert score 3.5 vs 3.0, $P < .001$), and educational debt (mean Likert score 2.5 vs 1.9, $P < .001$). Respondents in private practice reported a higher level of happiness with life outside of work compared with those in academics (mean Likert score 4.4 vs 4.3, $P = .006$). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 150 (84%) academic ophthalmologists and 337 (83%) private practitioners ($P = .71$). There were 159 (89%) respondents in academics and 366 (89%) respondents in private practice who indicated a positive level of happiness with life outside of work ($P = 1.00$).

• **FELLOWSHIP TRAINING:** Table 7 compares results between ophthalmologists who did and did not pursue fellowship training. Respondents who were general ophthalmologists were more likely to be married (85% vs 78%, $P = .030$) and have children during training (49% vs 41%, $P = .046$) than those who completed fellowship training. Subspecialists more commonly had an MD degree (98% vs 94%, $P = .016$), and general ophthalmologists

TABLE 7. Comparison of Fellowship Trained and General Ophthalmologists

	General Ophthalmologist (n = 231)	Fellowship Trained (n = 465)	*P* Value
Demographic characteristics			
Age (y)			.81
Mean ± SD	35.5 ± 4.0	35.4 ± 3.4	
Median [range]	35 [29-56]	36 [21-54]	
Sex, n (%)			.33
Female	98 (42)	178 (38)	
Male	133 (58)	287 (62)	
Race/ethnicity, n (%)			.084
African American/Black	5 (2)	5 (1)	
Asian	44 (19)	131 (28)	
Caucasian	157 (69)	279 (61)	
Hispanic/Latino	11 (5)	25 (5)	
Other	12 (5)	21 (5)	
Marital status, n (%)			.030
Married	197 (85)	362 (78)	
Not married	34 (15)	102 (22)	
Children during training, n (%)			.046
No	117 (51)	274 (59)	
Yes	113 (49)	189 (41)	
Medical education			
Degree(s), n (%)			
DO	12 (5)	8 (2)	.019
MBA	1 (.4)	7 (2)	.39
MD	217 (94)	456 (98)	.016
MPH	3 (1)	13 (3)	.34
PhD	17 (7)	35 (8)	1.00
AOA member, n (%)			1.00
No	163 (71)	329 (71)	
Yes	65 (29)	133 (29)	
Number of full-time faculty in residency, mean ± SD			
Comprehensive ophthalmology	4.0 ± 3.7	4.4 ± 3.5	.17
Cornea/external disease	2.6 ± 1.6	3.4 ± 2.4	<.001
Glaucoma	2.7 ± 1.7	3.1 ± 2.1	.033
Neuro-ophthalmology	1.6 ± 0.9	1.7 ± 1.0	.25
Oculoplastics	1.9 ± 1.6	2.0 ± 1.3	.66
Ophthalmic pathology	0.7 ± 0.7	0.9 ± 0.6	.001
Pediatric ophthalmology	2.7 ± 1.6	2.9 ± 2.2	.27
Retina	3.9 ± 2.9	4.5 ± 3.1	.026
Uveitis	1.0 ± 0.8	1.2 ± 1.0	.023
Number of procedures performed during residency, mean ± SD			
Cataract	162.6 ± 52.6	158.5 ± 62.4	.44
Strabismus	32.2 ± 21.6	29.6 ± 23.2	.21
Corneal surgery	10.4 ± 12.1	12.2 ± 13.3	.11
Glaucoma laser	39.5 ± 44.3	36.0 ± 49.3	.42
Glaucoma filtering	10.2 ± 8.6	11.8 ± 9.4	.058
Retina/vitreous	11.2 ± 28.0	12.7 ± 35 9	.62
Other retinal	74.0 ± 88.7	72.4 ± 95.7	.87
Oculoplastics and orbit	40.5 ± 41.5	37.5 ± 36.1	.38
Globe trauma	13.8 ± 11.5	15.8 ± 14.1	.12
Quality of rotations during residency, mean Likert score ± SD			
Cornea/external disease	3.7 ± 1.0	4.0 ± 1.0	.001
Glaucoma	3.9 ± 0.9	4.1 ± 0.9	.026
Neuro-ophthalmology	3.9 ± 1.0	4.1 ± 1.0	.008
Oculoplastics	3.8 ± 1.1	3.9 ± 1.0	.082

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TABLE 7. (*continued*)

	General Ophthalmologist (n = 231)	Fellowship Trained (n = 465)	*P* Value
Ophthalmic pathology	3.3 ± 1.2	3.5 ± 1.2	.092
Pediatric ophthalmology	3.9 ± 0.9	4.0 ± 1.0	.22
Retina	4.2 ± 0.7	4.3 ± 0.8	.22
Uveitis	3.5 ± 1.0	3.5 ± 1.1	.46
Scholarly activities during residency, n (%)			
Publication in a peer-reviewed journal	84 (36)	302 (65)	<.001
Publication of a book chapter or non–peer-reviewed article	28 (12)	177 (38)	<.001
Presentation (paper or poster) at a national meeting	114 (49)	394 (85)	<.001
Research as primary investigator or project leader	78 (33)	182 (39)	.13
Research as team member	94 (41)	285 (61)	<.001
Current practice			
Practice type, n (%)			<.001
Academic	17 (11)	162 (37)	
Private	135 (89)	275 (63)	
Hours per week, mean ± SD			
Direct patient care	37.0 ± 8.2	39.3 ± 12.2	.007
Ophthalmology outside of direct patient care	7.3 ± 9.5	10.3 ± 11.0	.005
Practice location, n (%)			<.001
Rural	36 (23)	29 (6)	
Suburban	73 (46)	193 (42)	
Urban	50 (31)	241 (52)	
Factors influencing final career choice, mean Likert score ± SD			
Challenging diagnostic problems	3.2 ± 1.0	4.0 ± 0.9	<.001
Continuity of care	3.7 ± 1.1	3.9 ± 1.0	.21
Educational debt	2.6 ± 1.3	2.2 ± 1.3	.001
Geographic location	3.9 ± 1.3	3.5 ± 1.5	.003
Income	3.5 ± 0.9	3.4 ± 1.1	.13
Job market	3.4 ± 1.1	3.3 ± 1.2	.49
Opportunities to teach	2.3 ± 1.1	3.1 ± 1.3	< .001
Opportunities for research	1.6 ± 0.9	2.7 ± 1.4	<.001
Prestige	2.1 ± 1.1	2.7 ± 1.2	<.001
Research experience	1.5 ± 0.8	2.4 ± 1.3	<.001
Role models/mentors	3.1 ± 1.2	3.9 ± 1.2	<.001
Rotation(s) in subspecialty area	2.8 ± 1.3	3.8 ± 1.2	<.001
Types of patient problems in practice	3.5 ± 1.1	4.0 ± 1.0	<.001
Work hours	4.1 ± 0.8	3.4 ± 1.1	<.001
Working with new technology	3.4 ± 1.0	3.5 ± 1.1	.17
Career satisfaction			
Job satisfaction, mean Likert score ± SD			
Happiness with work life	4.2 ± 0.8	4.2 ± 0.8	.82
Happiness with life outside of job	4.4 ± 0.7	4.3 ± 0.7	.11

AOA = Alpha Omega Alpha, DO = Doctor of Osteopathic Medicine, MBA = Master of Business Administration, MD = Doctor of Medicine, MPH =Master of Public Health, PhD = Doctor of Philosophy.

more commonly had a DO degree (5% vs 2%, $P = .019$). Fellowship-trained respondents reported a larger number of full-time faculty during residency in several subspecialties compared with general ophthalmologists, including cornea/external disease (3.4 vs 2.6, $P < .001$), glaucoma (3.1 vs 2.7, $P = .033$), ophthalmic pathology (0.9 vs 0.7, $P = .001$), retina (4.5 vs 3.9, $P = .026$), and uveitis (1.2 vs 1.0, $P = .023$). Respondents who completed fellowship training provided a higher rating to the quality of residency rotations in cornea/external disease (mean Likert score 4.0 vs 3.7, $P = .001$), glaucoma (mean Likert score 4.1 vs 3.9, $P = .026$), and neuro-ophthalmology (mean Likert score 4.1 vs 3.9, $P = .008$) relative to those who did not seek fellowship training. Ophthalmologists who pursued fellowship training were more likely than general ophthalmologists to publish a peer-reviewed paper (65% vs 36%, $P < .001$), publish a book chapter or non–peer-reviewed publication (38% vs 12%, $P < .001$), present a paper or poster at a national meeting (85% vs 49%, $P < .001$), and participate as a research team member (61% vs 41%, $P < .001$)

during residency. Respondents who received subspecialty training were more likely to be academic ophthalmologists (37% vs 11%, $P < .001$), and general ophthalmologists were more likely to be private practitioners (89% vs 63%, $P < .001$). There were 64 (41%) general ophthalmologists and 253 (55%) fellowship-trained subspecialists who practiced in more than 1 specialty area ($P = .003$). Fellowship-trained ophthalmologists worked more hours per week in direct patient care (39.3 hours vs 37.0 hours, $P = .007$) and in ophthalmology outside of direct patient care (10.3 hours vs 7.3 hours, $P = .005$) relative to general ophthalmologists. Respondents with subspecialty training were more frequently located in urban settings than general ophthalmologists (52% vs 31%). Several factors were more important to fellowship-trained ophthalmologists than general ophthalmologists when making career decisions, including types of patient problems in practice (mean Likert score 4.0 vs 3.5, $P < .001$), challenging diagnostic problems (mean Likert score 4.0 vs 3.2, $P < .001$), role models/mentors (mean Likert score 3.9 vs 3.1, $P < .001$), rotation(s) in subspecialty area (mean Likert score 3.8 vs 2.8, $P < .001$), opportunities to teach (mean Likert score 3.1 vs 2.3, $P < .001$), prestige (mean Likert score 2.7 vs 2.1, $P < .001$), opportunities for research (mean Likert score 2.7 vs 1.6, $P < .001$), and research experience (mean Likert score 2.4 vs 1.5, $P < .001$). Factors that influenced the career choices of general ophthalmologists more than subspecialists included work hours (mean Likert score 4.1 vs 3.4, $P < .001$), geographic location (mean Likert score 3.9 vs 3.5, $P = .003$), and educational debt (mean Likert score 2.6 vs 2.2, $P = .001$). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 381 (82%) specialists and 133 (84%) general ophthalmologists ($P = .67$). A positive level of happiness with life outside of work was indicated by 409 (88%) respondents who completed fellowship training and 146 (92%) respondents who did not pursue fellowship training ($P = .28$).

- **PRACTICE AREA:**

Cornea/external disease

Cornea/external disease was a practice area for 189 (30%) respondents. Supplemental Table 1 compares results between ophthalmologists practicing cornea/external disease and those in other practice areas. Cornea specialists who responded to the survey were on average younger than those practicing in other areas of ophthalmology (34.7 years vs 35.4 years, $P = .015$). The percentage of male respondents who practiced in cornea/external disease was higher than other subspecialty areas (69% vs 57%, $P = .003$). Cornea specialists were less likely to have a PhD degree than other subspecialists (3% vs 9%, $P = .006$). Respondents practicing cornea/external disease reported fewer full-time neuro-ophthalmology faculty in residency compared with those practicing in other areas (1.6 vs 1.8, $P = .027$). Cornea specialists performed a greater number of cataract (166.3 vs 155.9, $P = .047$) and corneal (13.8 vs 10.8, $P = .012$) surgeries during residency than other subspecialists. Among respondents who practiced in the area of cornea/external disease, 112 (59%) had completed fellowship training in cornea/external disease and 77 (41%) had not ($P = .013$). Ophthalmologists who practiced in cornea/external disease had a higher probability of being in private practice relative to those in other practice areas (77% vs 67%, $P = .014$). Cornea specialists were more likely to practice in a rural or suburban location than other practitioners (61% vs 50%). Several factors were rated as more important in motivating career choices by respondents who practiced cornea/external disease compared with those in other practice areas, including working with new technology (mean Likert score 3.8 vs 3.3, $P < .001$), geographic location (mean Likert score 3.8 vs 3.5, $P = .022$), work hours (mean Likert score 3.7 vs 3.5, $P = .022$), income (mean Likert score 3.6 vs 3.3, $P = .006$), and educational debt (mean Likert score 2.4 vs 2.2, $P = .036$). Factors that were less influential in career decisions among corneal specialists than other specialists included types of patient problems in practice (mean Likert score 3.7 vs 4.0, $P = .015$), continuity of care (mean Likert score 3.7 vs 3.9, $P = .015$), challenging diagnostic problems (mean Likert score 3.5 vs 3.9, $P < .001$), rotation(s) in subspecialty area (mean Likert score 3.3 vs 3.6, $P = .004$), opportunities for research (mean Likert score 2.1 vs 2.5, $P < .001$), and research experience (mean Likert score 1.9 vs 2.3, $P < .001$). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 124 (86%) respondents practicing cornea/external disease, and 132 (92%) were happy with life outside of work.

Glaucoma

Glaucoma was a practice area for 149 (24%) respondents. Supplemental Table 2 compares results between ophthalmologists practicing glaucoma and those in other practice areas. Respondents who practiced in glaucoma were more likely to have children during training than other practitioners (53% vs 40%, $P = .006$). Glaucoma specialists performed more glaucoma filtering operations (13.5 vs 10.8, $P = .004$) and fewer other retinal procedures (56.9 vs 79.0, $P = .009$) during residency compared with those practicing in other areas. Glaucoma specialists provided a higher rating to the quality of the glaucoma rotation during residency than other practitioners (mean Likert score 4.2 vs 4.0, $P = .025$). The decision to pursue fellowship training was made later by glaucoma specialists relative to other subspecialists (PGY 3 or 4 in 50% vs 36%). Among respondents who practiced in the area of glaucoma, 98 (66%) had completed fellowship training in glaucoma and 51 (34%) had not ($P < .001$). Glaucoma specialists were more influenced in career decision-making by continuity of care (mean Likert score 4.0 vs 3.8, $P = .002$) compared with other practitioners, and they were less influenced by challenging diagnostic problems (mean Likert score 3.5 vs 3.8, $P < .001$)

and prestige (mean Likert score 2.2 vs 2.6, $P = .001$). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 122 (82%) respondents practicing glaucoma, and 139 (93%) were happy with life outside of work. Glaucoma specialists showed the greatest difference between happiness at home and at work because they had a tendency toward lower levels of happiness with work life and higher levels of happiness with life outside of work compared with other subspecialists.

Medical retina

Medical retina was a practice area for 92 (15%) respondents. Supplemental Table 3 compares results between ophthalmologists practicing medical retina and those in other practice areas. A higher proportion of male respondents were practicing medical retina than in other areas (74% vs 58%, $P = .004$). Medical retina specialists were less likely to have an MD degree compared with other practitioners (93% vs 98%, $P = .016$). Respondents practicing medical retina reported a larger number of full-time faculty during residency in uveitis than other practitioners (1.3 vs 1.1, $P = .046$). Medical retina specialists provided a higher rating to the quality of the retina rotation during residency than other subspecialists (mean Likert score 4.5 vs 4.2, $P = .002$). Among respondents who practiced in the area of medical retina, 32 (35%) had completed fellowship training in medical retina and 60 (65%) had not ($P = .005$). Ophthalmologists who practiced medical retina had a greater probability of being in private practice relative to those in other subspecialties (85% vs 67%, $P = .001$). Medical retina specialists spent more hours per week in direct patient care (42.1 hours vs 38.1 hours, $P = .018$) and were more likely to practice in a rural location (25% vs 8%) compared with other practitioners. Several factors were rated as less important in influencing career choices by respondents in medical retina compared with other subspecialists, including role models/mentors (mean Likert score 3.5 vs 3.8, $P = .041$), opportunities to teach (mean Likert score 2.6 vs 2.9, $P = .015$), prestige (mean Likert score 2.2 vs 2.6, $P = .016$), and opportunities for research (mean Likert score 2.1 vs 2.4, $P = .038$). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 81 (88%) respondents practicing medical retina, and 83 (90%) were happy with life outside of work.

Neuro-ophthalmology

Neuro-ophthalmology was a practice area for 37 (6%) respondents. Supplemental Table 4 compares results between ophthalmologists practicing neuro-ophthalmology and those in other practice areas. Neuro-ophthalmologists reported a larger number of full-time faculty in neuro-ophthalmology during residency compared with other practitioners (2.1 vs 1.7, $P = .016$). Among respondents who practiced in the area of neuro-ophthalmology, 14 (38%) had completed fellowship training in neuro-ophthalmology and 23 (62%) had not ($P = .19$). Neuro-ophthalmologists were more likely to practice in rural (22% vs 10%) or urban (59% vs 46%) locations than other subspecialists. Neuro-ophthalmologists were more influenced in their career choices by challenging diagnostic problems (mean Likert score 4.1 vs 3.7, $P = .045$) and less influenced by job market (mean Likert score 2.9 vs 3.3, $P = .040$) relative to other practitioners. A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 30 (81%) respondents practicing neuro-ophthalmology, and 32 (86%) were happy with life outside of work.

Oculoplastics

Oculoplastics was a practice area for 80 (13%) respondents. Supplemental Table 5 compares results between ophthalmologists practicing oculoplastics and those in other practice areas. A higher proportion of oculoplastic surgeons were Caucasian (73% vs 63%) and Hispanic/Latino (10% vs 4%) compared with other practitioners. Respondents in oculoplastics reported a larger number of full-time faculty during residency in uveitis than those practicing in other areas (1.3 vs 1.1, $P = .043$). Oculoplastics surgeons performed a larger number of procedures in several categories during residency relative to other practitioners, including strabismus surgery (37.5 vs 29.2, $P = .003$), corneal surgery (15.6 vs 11.2, $P = .005$), retina/vitreous procedures (26.7 vs 10.0, $P = .018$), and oculoplastics and orbit procedures (54.5 vs 35.6, $P = .002$). Oculoplastics specialists rated the quality of the oculoplastics rotation during residency higher than other practitioners (mean Likert score 4.2 vs 3.8, $P = .001$). Respondents practicing in oculoplastics were more likely to conduct research as a team member (70% vs 57%, $P = .029$) or primary investigator/project leader (53% vs 38%, $P = .013$) during residency relative to respondents in other practice areas. Oculoplastic surgeons decided earlier to pursue fellowship training (during medical school or PGY 1 in 48% vs 29%) and the subspecialty area (during medical school or PGY 1 in 47% vs 15%) compared with other subspecialists. Among respondents who practiced in the area of oculoplastics, 39 (49%) had completed fellowship training in oculoplastics and 41 (51%) had not ($P = .91$). Ophthalmologists in oculoplastics had a higher probability of being in private practice relative to those in other practice areas (79% vs 68%, $P = .049$). Oculoplastic surgeons were more likely to practice in a rural location than other subspecialists (20% vs 9%). Several factors were rated as less important motivators of career decisions by respondents in oculoplastics compared with other practitioners, including continuity of care (mean Likert score 3.4 vs 3.9, $P = .001$), working with new technology (mean Likert score 3.1 vs 3.5, $P = .002$), prestige (mean Likert score 2.3 vs 2.6, $P = .031$), and research experience (mean Likert score 1.9 vs 2.2, $P = .039$). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 71 (89%) respondents practicing oculoplastics, and 74 (93%) were happy with life outside of work.

Pediatric ophthalmology

Pediatric ophthalmology was a practice area for 76 (12%) respondents. Supplemental Table 6 compares results between ophthalmologists practicing pediatric ophthalmology and those in other practice areas. A higher proportion of female respondents were practicing pediatric ophthalmology than other subspecialty areas (57% vs 37%, $P = .001$). Pediatric ophthalmologists reported fewer full-time faculty during residency in cornea/external disease (2.6 vs 3.3, $P = .004$) and retina (3.6 vs 4.4, $P = .008$) compared with other practitioners. Respondents in pediatric ophthalmology performed more strabismus cases (39.0 vs 29.1, $P = .011$) and fewer other retinal procedures (55.0 vs 76.1, $P = .014$) during residency relative to those practicing in other areas. Pediatric ophthalmologists rated the quality of the pediatric ophthalmology rotation during residency higher (mean Likert score 4.2 vs 4.0, $P = .047$) and rotations in retina (mean Likert score 4.0 vs 4.3, $P = .016$) and uveitis (mean Likert score 3.3 vs 3.5, $P = .038$) lower than other practitioners. Among respondents who practiced in the area of pediatric ophthalmology, 58 (76%) had completed a pediatric ophthalmology fellowship and 18 (24%) had not ($P < .001$). Ophthalmologists who practiced pediatric ophthalmology had a higher probability of entering academics relative to those in other subspecialty areas (44% vs 29%, $P = .009$). Pediatric ophthalmologists were more likely to practice in an urban location (60% vs 45%). Pediatric ophthalmologists were more influenced in their career choices by types of patient problems in practice (mean Likert score 4.2 vs 3.9, $P = .004$), continuity of care (mean Likert score 4.1 vs 3.8, $P = .001$), and opportunities to teach (mean Likert score 3.2 vs 2.8, $P = .028$), and they were less likely to be motivated by working with new technology (mean Likert score 2.8 vs 3.6, $P < .001$), income (mean Likert score 2.8 vs 3.5, $P < .001$), and prestige (mean Likert score 2.3 vs 2.6, $P = .040$) compared with practitioners in other areas. Respondents who practiced pediatric ophthalmology reported a lower level of happiness with life outside of their job than other ophthalmologists (mean Likert score 4.2 vs 4.4, $P = .048$). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 62 (83%) respondents practicing pediatric ophthalmology, and 62 (83%) were happy with life outside of work.

Uveitis

Uveitis was a practice area for 53 (9%) respondents. Supplemental Table 7 compares results between ophthalmologists practicing uveitis and those in other practice areas. Respondents who practiced uveitis reported a larger number of full-time faculty during residency in comprehensive ophthalmology (5.4 vs 4.2, $P = .020$) and uveitis (1.5 vs 1.1, $P = .020$). Uveitis specialists provided a higher rating to the quality of the uveitis rotation in residency than other specialists (mean Likert score 3.8 vs 3.5, $P = .046$). Ophthalmologists practicing uveitis were more likely to participate in research as a primary investigator or project leader during residency (58% vs 38%, $P = .004$). Among respondents who practiced in the area of uveitis, 21 (40%) had completed fellowship training in uveitis and 32 (60%) had not ($P = .17$). Uveitis specialists worked more hours per week in direct patient care than other subspecialists (42.0 hours vs 38.4 hours, $P = .028$). Several factors were rated as more important in influencing career decisions by uveitis specialists compared with other practitioners, including challenging diagnostic problems (mean Likert score 4.3 vs 3.7, $P < .001$), continuity of care (mean Likert score 4.1 vs 3.8, $P = .018$), opportunities to teach (mean Likert score 3.2 vs 2.8, $P = .013$), and opportunities for research (mean Likert score 2.8 vs 2.4, $P = .023$). Work hours were less important in career decision-making for uveitis specialists compared with ophthalmologists practicing in other areas (mean Likert score 3.2 vs 3.6, $P = .015$). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 47 (89%) respondents practicing uveitis, and 47 (89%) were happy with life outside of work.

Vitreoretinal disease and surgery

Vitreoretinal disease and surgery was a practice area for 108 (17%) respondents. Supplemental Table 8 compares results between ophthalmologists practicing vitreoretinal surgery and those in other practice areas. Vitreoretinal surgeons were on average older than ophthalmologists practicing in other areas (36.5 years vs 34.9 years, $P < .001$). A higher proportion of male respondents were practicing vitreoretinal surgery compared with other practitioners (81% vs 56%, $P < .001$). Vitreoretinal specialists were more likely to have a PhD degree than other specialists (13% vs 6%, $P = .021$). Respondents practicing vitreoretinal surgery reported a greater number of full-time faculty during residency in cornea/external disease (3.7 vs 3.1, $P = .017$), neuro-ophthalmology (1.9 vs 1.7, $P = .015$), oculoplastics (2.3 vs 1.8, $P = .001$), and retina (5.0 vs 4.1, $P = .016$) compared with ophthalmologists practicing in other areas. Vitreoretinal surgeons performed more glaucoma filtering procedures (13.3 vs 11.1, $P = .048$), retina/vitreous procedures (18.6 vs 10.8, $P = .033$), other retinal procedures (102.9 vs 67.8, $P = .006$), and globe trauma (18.8 vs 14.3, $P = .040$) during residency than ophthalmologists in other practice areas. Respondents who practiced vitreoretinal surgery provided a higher rating to the quality of several rotations during residency, including cornea/external disease (mean Likert score 4.2 vs 3.9, $P = .008$), neuro-ophthalmology (mean Likert score 4.3 vs 4.0, $P = .006$), oculoplastics (mean Likert score 4.1 vs 3.8, $P = .002$), pediatric ophthalmology (mean Likert score 4.2 vs 4.0, $P = .023$), and retina (mean Likert score 4.5 vs 4.2, $P < .001$) relative to other subspecialists. Vitreoretinal surgery specialists were more likely to have published in a peer-reviewed journal (75% vs 56%, $P < .001$), published a book chapter or non–peer-reviewed article (43% vs 30%, $P = .009$), and presented a paper or poster at a national meeting (93% vs 76%, $P < .001$) compared with other respondents. Vitreoretinal surgeons decided ear-

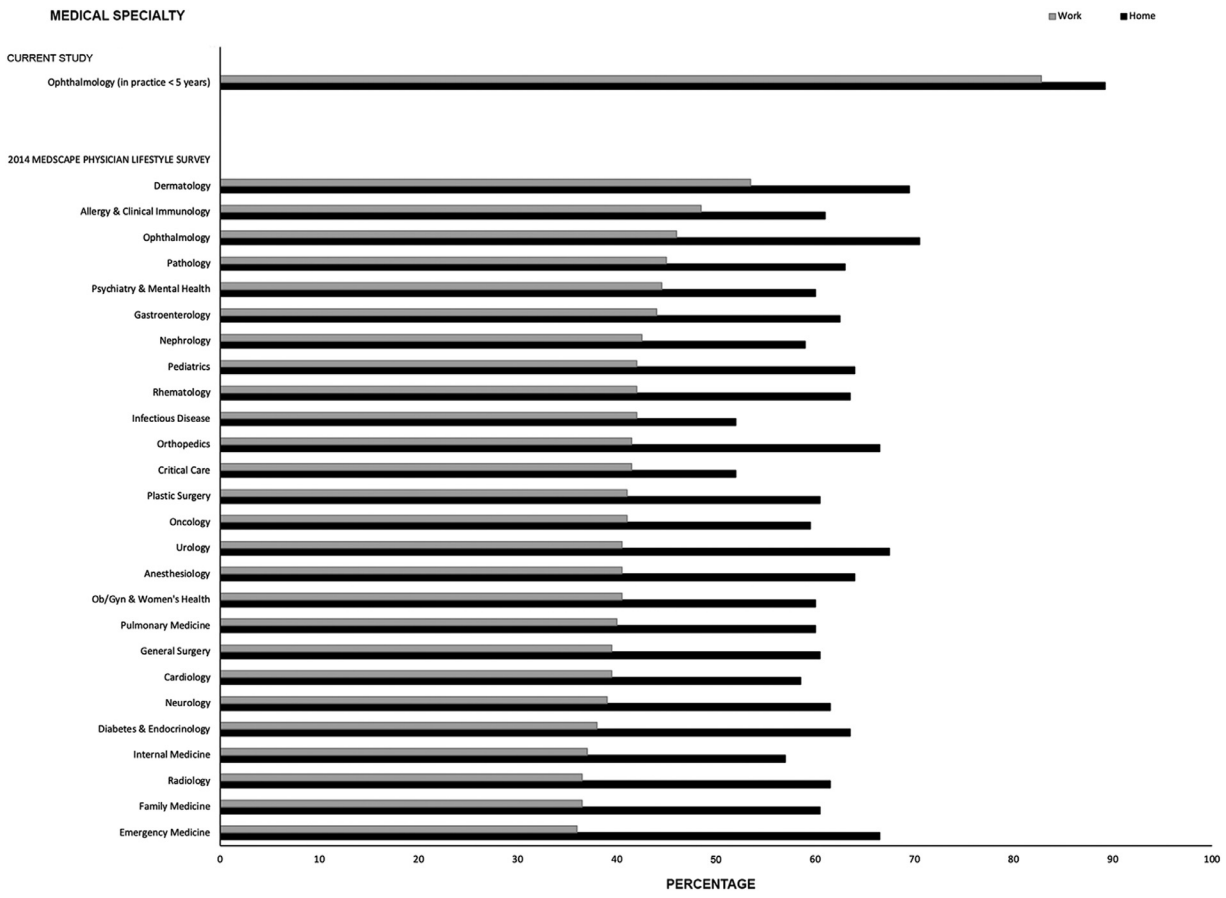

FIGURE 1. Percentage of respondents reporting a happy work life (ie, Likert score of 4 or 5) in the current study and 2014 Medscape Physician Lifestyle Survey.

lier to pursue fellowship training (during medical school 34% vs 13%) and the choice of subspecialty (during medical school or PGY 1 in 31% vs 15%) than other subspecialists. Among respondents who practiced in the area of vitreoretinal surgery, 106 (98%) had completed fellowship training in vitreoretinal disease and surgery and 2 (2%) had not ($P < .001$). Ophthalmologists practicing vitreoretinal surgery spent more hours per week in direct patient care than those in other practice areas (42.0 hours vs 38.4 hours, $P = .028$). Several factors influenced the career choices of vitreoretinal surgeons more than other specialists, including types of patient problems in practice (mean Likert score 4.3 vs 3.8, $P < .001$), challenging diagnostic problems (mean Likert score 4.3 vs 3.6, $P < .001$), role models/mentors (mean Likert score 4.2 vs 3.6, $P < .001$), rotation(s) in subspecialty area (mean Likert score 3.9 vs 3.5, $P < .001$), working with new technology (mean Likert score 3.8 vs 3.4, $P < .001$), income (mean Likert score 3.7 vs 3.3, $P = .005$), prestige (mean Likert score 3.2 vs 2.4, $P < .001$), opportunities for research (mean Likert score 3.1 vs 2.3, $P < .001$), and research experience (mean Likert score 2.9 vs 2.0, $P < .001$). Work hours were less important in career decisions for vitreoretinal specialists compared with other practitioners (mean Likert score 2.9 vs 3.7, $P < .001$). A positive level of happiness (ie, Likert score of 4 or 5) with work life was reported by 95 (88%) respondents practicing vitreoretinal disease and surgery, and 95 (88%) were happy with life outside of work.

• **CAREER SATISFACTION:** The 2 questions relating to happiness at home and at work were worded the same as those in the Medscape Physician Lifestyle Survey[136] to facilitate comparison. Responses to both questions were made using a 5-point Likert scale. Career satisfaction results are presented in Table 8 as mean Likert score and percentage of respondents who made a positive response (ie, Likert response 4 or 5). Figure 1 shows the overall percentage of respondents who reported a happy work life and home life in the currentstudy and in the 2014 Medscape Physician Lifestyle Survey.[136] Figure 2 presents the percentage of respondents in various practice areas reporting a happy work life and home life in the present study. Only gender was significantly associated with work happiness in univariable ($P = .006$) and multivariable ($P = .008$; odds ratio = 0.55; 95% confidence interval = 0.36-0.86) analyses. Women reported high levels of work happiness but less than men

TABLE 8. Career Satisfaction

	Likert Score		Likert Score of 4 or 5			
	Mean ± SD	Univariable *P* Value	n (%)	Univariable *P* Value	Multivariable OR (95% CI)	*P* Value
Age (y)		.92		.17		.082
≤35	4.2 ± 0.8		310 (85)			
>35	4.2 ± 0.8		198 (80)			
Sex		.007		.006	.55	.008
Female	4.1 ± 0.8		192 (77)		(0.36 to 0.86)	
Male	4.2 ± 0.7		322 (86)			
Ethnicity		.55		.23		.28
African	4.1 ± 0.7		6 (86)			
American/Black	4.1 ± 0.8		121 (77)			
Asian	4.2 ± 0.8					
Caucasian	4.3 ± 0.9		334 (85)			
Hispanic/Latino	4.3 ± 0.7		25 (86)			
Other			25 (89)			
Marital status		.18		.18		.27
Married	4.2 ± 0.8		416 (84)			
Not married	4.1 ± 0.9		97 (78)			
Children during training		.68		.40		.77
No	4.1 ± 0.8		285 (81)			
Yes	4.2 ± 0.8		226 (84)			
Fellowship training		.60		.67		.94
No	4.2 ± 0.8		133 (84)			
Yes	4.2 ± 0.8		381 (82)			
Practice type		.64		.71		.43
Academic	4.2 ± 0.7		150 (84)			
Private	4.2 ± 0.8		337 (83)			
Practice location		.60		.34		.61
Rural	4.2 ± 0.8		57 (89)			
Suburban	4.2 ± 0.7		219 (83)			
Urban	4.2 ± 0.8		237 (81)			
Number of work hours/week combined		.82		.70		.73
≤48	4.2 ± 0.8		301 (82)			
>48	4.2 ± 0.8		208 (84)			
Area of practice						
Anterior segment/refractive surgery	4.3 ± 0.7	.10	144 (88)	.062		.10
Comprehensive ophthalmology	4.1 ± 0.8	.86	287 (80)	.058		.15
Cornea/external disease	4.3 ± 0.8	.10	124 (86)	.28		.21
Glaucoma	4.2 ± 0.7	.50	122 (82)	.80		.61
Medical retina	4.3 ± 0.7	.11	81 (88)	.19		.38
Neuro-ophthalmology	4.2 ± 0.8	.75	30 (81)	.97		.80
Oculoplastics	4.3 ± 0.7	.72	71 (89)	.17		.25
Ophthalmic pathology	4.7 ± 0.6	.26	3 (100)	.98		.39
Pediatric ophthalmology	4.1 ± 0.8	.49	62 (83)	1.00		.97
Uveitis	4.2 ± 0.8	.81	47 (89)	.26		.25
Vitreoretinal disease and surgery	4.3 ± 0.8	.093	95 (88)	.15		.49

DISCUSSION

• **TRENDS IN OPHTHALMOLOGY:** Several interesting trends have emerged in ophthalmology. The characteristics of practicing ophthalmologists are changing with a greater subspecialization, increased proportion of women, and aging of the workforce.[13,19-22] Understanding these trends and the factors influencing them will help optimize workforce planning for eye care services in the future.

The proportion of ophthalmology residents seeking fellowship training has been steadily increasing based on data from the San Francisco Matching Program, National Residency Matching Program, and the North American Neuro-

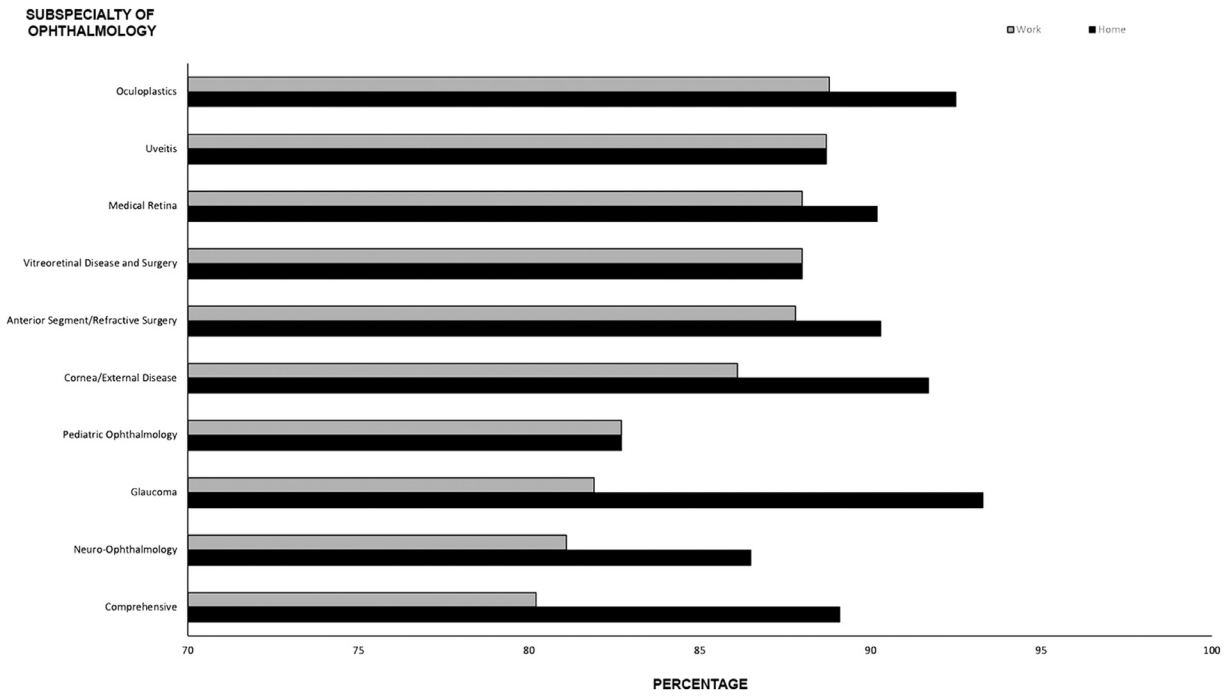

FIGURE 2. Percentage of respondents in each practice area reporting a happy work life and home life (ie, Likert score of 4 or 5).

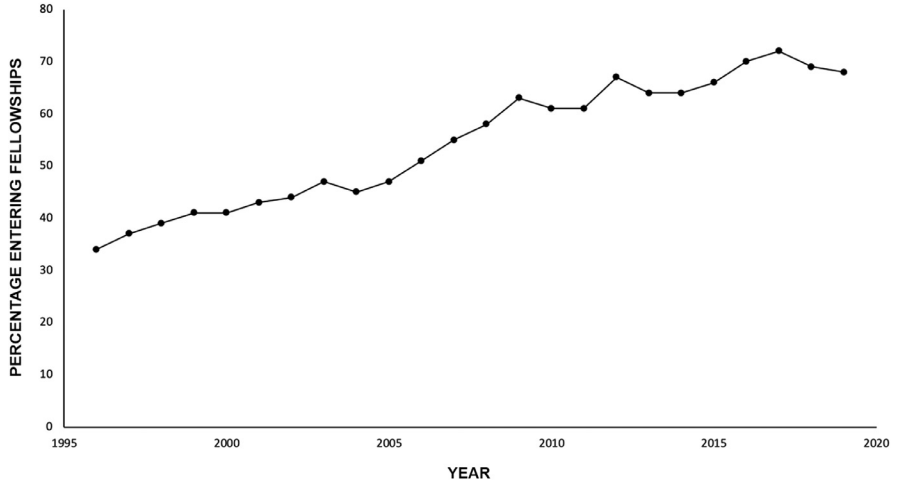

FIGURE 3. Proportion of ophthalmology residents seeking fellowship training.

Ophthalmology Society (Figure 3). In 2019, 68% of graduating ophthalmology residents pursued subspecialty training compared with 34% in 1996. These percentages take into account that the oculoplastics fellowship match was conducted by the National Residency Matching Program prior to 2013, neuro-ophthalmology fellowships have historically been filled outside of the match, and some fellowship positions are filled by international medical graduates rather than US graduates. The overall rise in residents entering fellowships has not been uniform across all subspecialties (Figure 4). The greatest increase in the number of filled fellowship positions has occurred in retina, cornea/external disease, and glaucoma. Fellowship numbers in pediatric ophthalmology and oculoplastics have grown more slowly. The limited growth in pediatric ophthalmology may relate to a decreased attractiveness of this subspecialty as reflected by the number of vacant fellowship positions. However, the minimal increase in oculoplastics is likely a result of restrictions on the number of fellowship positions by the American Society of Ophthalmic Plastic and Reconstructive Surgery.

The increasing specialization of physicians is not exclusive to ophthalmology and has been observed across all fields of medicine. The reason for this trend is likely mul-

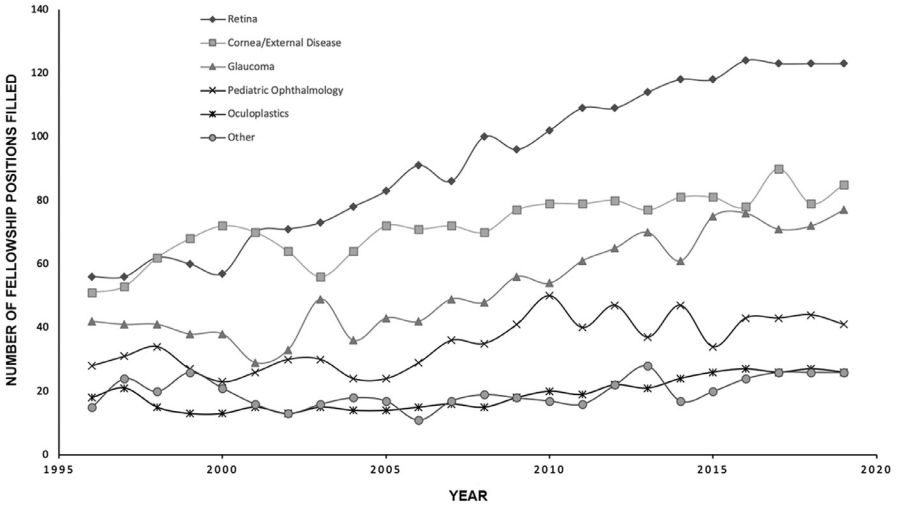

FIGURE 4. Number of fellowship positions filled in each subspecialty of ophthalmology.

tifactorial. Many practitioners want to focus their clinical practice, and fellowship training offers a transition from training to independent practice.[137] An exponential expansion in medical knowledge over the past several decades requires that physicians gain command over a greater body of information than in the past. The public perceives that better care can be delivered by subspecialists, making fellowships attractive. Limitations on duty hours have impacted the clinical experience during residency training. Resident autonomy has diminished because of changes in the legal climate and Medicare mandates involving increasing levels of direct attending supervision. The cumulative effect of these factors is an expectation that fellowship training will be undertaken following graduation from residency.

The proportion of practicing female ophthalmologists increased from 23.8% in 2005 to 27.1% in 2015.[20] The increase in female representation in ophthalmology has been reported to be higher than any other surgical specialty except obstetrics and gynecology.[21] Female ophthalmologists frequently work fewer hours and are more likely to have part-time employment than their male colleagues.[138,139]

Ophthalmologists younger than age 55 years accounted for 54.8% of the workforce in 2017, and the ratio of older to younger ophthalmologists increased from 0.37 in 1995 to 0.82 in 2017.[13] The lack of significant growth in the number of ophthalmology residency positions and a trend toward later retirement of practicing ophthalmologists likely explains the aging of the ophthalmology workforce.[13,19] Physicians may be delaying retirement because of the greater flexibility of self-employment, adjustments for starting practice later because of fellowship training, or insufficient savings and lack of a pension.[140] Increasing age is associated with a decrease in workload and narrowing of the scope of practice.[19] In addition, concern exists about reduced competency with aging.[141,142] The newer generation of physicians place greater value on work-life balance, and they tend to work fewer hours as they establish their families.[143,144] Generation X physicians have been shown to work less than Baby Boomers at the same respective age.[144] The imminent retirement of older ophthalmologists and the reduced work hours of younger ophthalmologists may result in future workforce shortages in eye care delivery.

• **FACTORS INFLUENCING CAREER CHOICES OF OPHTHALMOLOGISTS:** Many factors are considered during the complex decision-making process that ultimately results in the selection of an area of medical practice. In a previous survey of 222 graduating ophthalmology residents, factors rated as important in making career choices by a majority of residents included acquisition of special skills, challenging diagnostic problems, role models/mentors, rotations during residency, and types of problems in practice.[22] A national survey of 405 practicing ophthalmologists and 20,891 nonophthalmologists in Canada found that intellectual stimulation, doctor-patient relationships, flexibility, mentorship, and earning potential were the most important factors influencing the decision to select a career in ophthalmology.[5] Canadian ophthalmologists were more likely than nonophthalmologists to cite flexibility, mentorship, and earning potential as important factors in career decisions. The results of our study are consistent with these prior investigations evaluating factors affecting career choices among ophthalmologists.

Career decision-making is an ongoing process, and residency offers an important window of opportunity to influence physicians-in-training. A study of graduates of an internal medicine residency found that 70% of respondents made changes in their plans regarding fellowship training after medical school, and 41% made a final decision during residency.[60] A survey of graduating ophthalmology residents demonstrated that 74.7% made the decision to pursue or not pursue fellowship training during PGY 2 or PGY 3.[22]

We found that 59% of respondents decided to pursue fellowship training during PGY 2 or PGY 3, and 63% made the choice of subspecialty area during this time period.

Interacting with mentors and positive role models can attract trainees to a medical specialty when enthusiasm and professional satisfaction are demonstrated.[36-38,45-49,145,146] Role models/mentors was one of the most important factors guiding career decisions in our study. A 5-year prospective longitudinal study found that role models strongly predicted specialty choice in ROAD (radiology, ophthalmology, anesthesiology, and dermatology) specialties.[38] Mentoring has also been linked to academic success.[61,146-149] Mentoring relationships formed by free choice are generally more successful than those that are assigned.[149,150] A survey of physical medicine and rehabilitation residents indicated that 97.3% had interest in establishing a relationship with a mentor, but only 28.1% had a mentor.[150] The success of mentoring was correlated with the frequency of communication between the mentor and resident. A 4-month active mentoring program in practice management and advocacy elicited favorable changes in ophthalmology residents' perceptions and attitudes toward medical professional organizations.[151]

Many factors influence the selection of a medical specialty by medical students.[1-9,36-59] However, lifestyle has been recognized as playing an increasing role in career choices.[39,40,43,44,62-65] Schwartz and associates[39] first introduced the term "controllable lifestyle" to describe specialties that have control of work hours and allow adequate personal time for leisure and family. Anesthesiology, dermatology, emergency medicine, neurology, ophthalmology, pathology, psychiatry, and radiology were identified as the controllable lifestyle specialties. Subsequent studies have identified greater competition to enter the E-ROAD (emergency medicine, radiology, ophthalmology, anesthesiology, and dermatology) subspecialties, which has been attributed to their desirable lifestyle and financial security.[65,66] Work hours was identified as an important factor influencing the career choices of a majority of respondents in our study. This finding is consistent with the observation that younger physicians are seeking a better balance between their personal and professional lives.[63]

Recent attention has focused on generational differences that exist in society. Defined as a period lasting approximately 20 years, recent generations have been divided into Baby Boomers (1944-1964), Generation X (1965-1980), and Generation Y or Millennials (1981-2000).[152-158] People within specific generations share defining characteristics because of socio-environmental events that shaped their view of the world during the formative years. Baby Boomers were born into a booming post–World War II economy.[153,154,158] They value work, loyalty, and leadership.[153] Boomers have embraced the mission to make a difference in the world, as evidence by the women's rights movement, civil rights movement, and reaction to the Vietnam War.[158] Boomers live to work, and they define themselves through their work. Generation Xers became self-reliant because of their Boomer workaholic parents, and many raised themselves amid corporate downsizing, high divorce rates, and economic volatility.[152-156,158,159] They are "me-oriented" self-starters who are independent, pragmatic, and skeptical.[155] Generation Xers are seeking a stronger sense of family, and they are less likely to put work ahead of family, friends, and outside interests. Millennials had involved parents who liberally provided praise and packed their schedules with structured activities.[67,152,155-158] They are rule followers who are confident, achieving, team-oriented, community-focused, and respectful.[155] Millennials believe there is a specific right career for them, and their energy is directed toward accumulating the required credentials to attain that career.[158] Their loyalty is to self, and they desire a workplace that respects their interest in family, community, and avocations. Although characterization of the different generations by population theorists has helped guide discussions, it is important to recognize that there are always exceptions. Respondents to our survey were generally born at the end of Generation X or the beginning of the Millennial Generation.

A survey of Brazilian medical students participating in ophthalmology interest groups, ophthalmology residents, and ophthalmologists in private practice evaluated factors influencing the choice of ophthalmology as a career among different generations.[4] Flexible working hours, personal satisfaction from helping people improve vision, and surgical procedures were the main reasons for selecting a career in ophthalmology across all generations. However, short procedures and short-term results were more important to Millennials. A study of Canadian physicians evaluated generational differences in the choice of a work location.[160] A desire to be near family and friends, residency training location, the ability to use their skills and knowledge fully, and the quality of the recruitment efforts were important considerations in choosing a practice location for all generations. Early career physicians placed greater emphasis on work-life balance and spouse employment opportunities, whereas late career physicians were motivated by the medical needs of the community and a desire for adventure and to see new places. It is noteworthy that our study included ophthalmologists who were within 5 years of completing ophthalmic training.

• **GENDER:** During the past several decades, women have been entering the field of medicine in greater numbers.[20,21,68,161-163] Women have traditionally avoided surgical specialties because of perceived incompatibility with personal and family goals.[138,161,162] Despite this concern, the proportion of women entering surgical fields has steadily increased, including ophthalmology.[20,21] Among the 23 surgical specialties listed in a survey of members of the American College of Surgeons, the 4 specialties viewed as most receptive to women included breast surgery, obstetrics/gynecology, plastic surgery, and ophthalmology.[68]

However, 2014 and 2015 data from the Association of American Colleges, American Medical Association, and US Census showed that women are underrepresented as practicing ophthalmologists (22.7%), ophthalmology faculty (35.1%), and ophthalmology residents (44.3%) compared with the US population (50.8%).[20] But there was a 14% increase in practicing female ophthalmologists and a 25% increase in female ophthalmology residents between 2005 and 2015.[20]

We found that female ophthalmologists were more likely to select a career in academics than male ophthalmologists. Women frequently prioritize family and home life more than men. Academics may be an attractive option because physicians-in-training are generally available to assist in patient care, especially outside of office hours. In contrast to our study, no significant difference was observed in the proportion of men and women entering academic practice among graduates of a university general surgery program.[69] Despite progress toward gender equity, female academic ophthalmologists continue to face challenges. An evaluation of trends in authorship in ophthalmology journals over the past 18 years has shown that women on average publish fewer articles than men, although there has been a steady increase in the proportion of female first and last authorship in recent years.[164-166] Editor-in-chief and society president positions in ophthalmology are predominantly held by males.[167] The proportion of women presenting at ophthalmology conferences between 2015 and 2017 exceeded the estimates of female ophthalmologists, especially for general conferences.[168] However, gender gaps were still noted at subspecialty conferences. Female ophthalmologists have had limited advancement through the ranks of academic medicine to leadership positions.[169] Recent studies have demonstrated that 72% of US residency program directors and 90% of departmental chairs in ophthalmology are male.[170,171]

Female respondents in our study were less likely to have children during training compared with male respondents. Female residents have previously been reported to have greater concern than males about accommodating work-life balance, especially child rearing.[132] Raising children during residency can be demanding, both physically and emotionally.[172] We found male respondents were more often married than female respondents. Female ophthalmologists in Australia and New Zealand were also less likely be married compared with male ophthalmologists.[139] This finding of gender differences in marital status has been observed in other specialties.[173,174] Female primary care physicians were more frequently in dual-career families compared with males.[175] A higher percentage of female surgeons have spouses who work full-time outside the home than male colleagues.[176] Surveys of Canadian ophthalmologists reported that female ophthalmologists were more likely to have partners who worked full-time, and male ophthalmologists were more likely to have partners working part-time or not at all outside the home.[162,177] In addition, female ophthalmologists were more commonly married to physicians, whereas male ophthalmologists were more frequently married to allied health care workers.[162,177]

Female ophthalmologists appear to prioritize lifestyle more than their male counterparts. Female respondents in our study were more influenced in career decision-making by geographic location and work hours compared with male respondents. Female respondents averaged fewer hours in direct patient care. The societal expectation that women principally handle the responsibilities of raising children is deeply engrained. Female surgeons report spending more than twice the number of hours on parenting duties compared with male colleagues.[176] Several studies have found that female physicians work fewer hours than male colleagues across many specialties of medicine.[173,174,178-183] A national survey of women surgeons in Canada found that female ophthalmologists were more likely to have children and be responsible for running the household than other female surgeons.[138] Ophthalmologists also reported greater satisfaction with time management between career and personal responsibilities. In surveys of Canadian ophthalmologists, women reported spending more hours as primary caregiver for their children than men.[162,177] In contrast to our study, female and male Canadian ophthalmologists were found to have comparable work hours.[138,162,177] However, female ophthalmologists in Australia and New Zealand worked fewer hours than male ophthalmologists.[139] This study also confirmed our finding that female ophthalmologists prefer to live in urban locations. Time for nonwork activities and family were more important in career decisions for female internal medicine residents than male residents.[118] In a survey of general surgeons, lifestyle was the only factor rated as significantly more important by women compared with men when choosing a future career.[69] Research outside of medicine has also demonstrated gender differences in career goals. A study of MBA entrepreneurs showed that women were more likely to value lifestyle in career decisions, whereas men were motivated by income and advancement in career status.[184] We found that male respondents prioritized income and working with new technology, and female respondents were more influenced by continuity of care and patient problems when making career choices. The greater interest in working with new technology among males in our study is consistent with the higher proportion of males practicing in the areas of vitreoretinal disease and surgery, medical retina, and anterior segment/refractive surgery, as these are all technology-driven specialties. Concordant with our results, female internal medicine residents were more motivated by long-term patient relationships, and male residents rated financial considerations as more important in influencing career decisions.[118] Male general surgery residents were also more likely to consider future income as more important in career planning compared with female residents.[67]

We found that female and male respondents were equally likely to complete fellowship training. This finding aligns

with results from a study of Canadian ophthalmology programs noting that female and male graduates pursued fellowship training with similar frequency.[185] In contrast, female residents in general surgery,[69] internal medicine,[70,71] and pediatrics[62,72,73] were less likely to seek subspecialty training. Although a similar percentage of male and female ophthalmologists completed fellowship training in our study, we observed gender differences in the subspecialty areas that were selected. Men were more likely to complete a fellowship in vitreoretinal disease and surgery, and women were more likely to pursue fellowships in pediatric ophthalmology, neuro-ophthalmology, and uveitis. A higher proportion of female respondents practiced pediatric ophthalmology, and males more often focused on vitreoretinal disease and surgery, medical retina, and anterior segment. A study examining data from the Ophthalmology Match Program and the AAO membership files similarly found that the most popular fellowship choices were pediatric ophthalmology for female ophthalmologists and vitreoretinal disease and surgery for male ophthalmologists.[186] Also aligning with our results, studies of Canadian ophthalmologists demonstrated that men were more likely than women to enter surgical retina[185,187] and refractive surgery.[187] Surgical retina specialists have a relatively heavy on-call burden and perform a disproportionately high number of cases after hours relative to other subspecialists. Avoidance of a career in vitreoretinal surgery by women may reflect the greater need for protection of time to allow balancing of family commitments. Gender differences have also been described in the selection of subspecialty fellowships in internal medicine.[70,71] One study found that cardiology, gastroenterology, and pulmonary/critical care were preferred by men, whereas endocrinology, rheumatology, hematology/oncology, infectious diseases, and geriatrics were more popular among women.[71] Another study reported that men selected cardiology and pulmonary/critical care fellowships more frequently, and women chose endocrinology and rheumatology more often.[70]

We found that female ophthalmologists performed significantly fewer cataract procedures during residency than male ophthalmologists. This finding is consistent with a recent study also showing that female residents performed fewer cataract operations and total procedures than male residents, even taking into consideration parental leave.[188] Gender bias may exist in the surgical training of ophthalmology residents. A study evaluating operative autonomy revealed a significant bias against female thoracic surgery residents.[189] Female ophthalmologists in Florida had approximately half the annual rate of cataract surgery as male ophthalmologists from 2005 through 2012, and this difference was not explained by greater time in clinical practice by men.[190] In 2017, male ophthalmologists performed a larger number of cataract procedures in Medicare beneficiaries than female ophthalmologists, even after controlling for clinical productivity and number of years in practice.[191] There was greater parity among recently graduated ophthalmologists; however, the underlying cause for gender differences in cataract surgery volume is not clear.[191] Primary care physician referrals to female surgeons were lower than to male surgeons after an adverse event, and a single bad experience with a female surgeon was more likely to dictate their level of confidence in the surgeon's abilities.[192] In a survey of the Canadian Ophthalmological Society membership, female refractive surgeons had less operating room time despite similar work hours and clinical volume.[177]

Discrepancies in compensation have been reported between practicing male and female physicians.[193-196] Female physicians had smaller average total Medicare payments and fewer beneficiary visits than male physicians in 2013, and these differences persisted across specialty types and years in practice.[196] Review of the Centers for Medicare and Medicaid Services database revealed that female ophthalmologists earned 56% as much in total collections in 2012 and 2013 compared with male ophthlamologists.[197] Between 2012 and 2015, female ophthalmologists had 42% lower Medicare collections compared with male ophthalmologists after adjusting for age, geography, and subspecialty.[163] This gender gap was largely driven by differences in the number of patient visits,[163] and similar observations have been made in other medical specialties.[198] Potential explanations for the lower patient volume by women could involve limitations in work hours due to family obligations, spending more time per patient, or electing a lighter schedule.[163] A survey of practicing ophthalmologists found that women reported a similar number of working hours to men, but they saw fewer patients and had lower compensation.[199] Female physicians spend an average of 2 minutes more with patients than men in the primary care setting.[200] This behavioral difference could result in a substantial reduction in patient numbers in a volume-driven specialty like ophthalmology, but might also explain the lower rate of malpractice claims against women in ophthalmology relative to men.[201]

• **ACADEMIC OPHTHALMOLOGY:** Academic medicine and private practice are both popular pathways for physicians to pursue their vocation. Academics provides opportunities for research, care of patients with complex medical problems, and education of physicians-in-training. Private practice generally offers greater financial rewards, more autonomy, and the opportunity to become a practice owner. There have been growing concerns about a perceived diminished workforce in academic medicine.[202] Therefore, it is particularly important to understand factors that influence physicians to choose or reject a career in academic medicine. We identified differences in the characteristics and drivers of career decisions of newly practicing ophthalmologists in academics and private practice.

We found that the career choices of academic ophthalmologists were more strongly influenced by opportunities for research than their counterparts in private practice. In addition, ophthalmologists in academics had a higher probability of publishing in a peer-reviewed journal, publishing

a book chapter or non–peer-reviewed article, presenting a paper or poster at a national meeting, and participating as a research team member as a resident. Completion of scholarly activities during training has also been associated with an academic career in other areas of medicine. Emergency medicine residents who conducted research during medical school and residency were more likely to express an interest in academics.[74] Vascular surgery residents pursuing academics were more likely to have previous research experience and publication/presentation at a national meeting than those planning nonacademic careers.[75] Radiologists who published during residency were 26.4 times more likely to choose an academic position as a first job.[76] A separate study found that academic radiologists published research articles during medical school 1.4 times more often than did private practitioners.[77] Furthermore, the greater the number of articles, the higher the likelihood that an individual would choose a career in academics. It is unclear whether exposure to research and publishing results during training fostered an interest in a career in academic medicine, or whether these scholarly activities were performed to fulfill an established career goal of securing a position in academics.

We found that academic ophthalmologists were more likely to hold a PhD degree than private practitioners. Training as an MD-PhD is a common pathway for individuals who are interested in a career as a clinician-scientist. Several other studies have also demonstrated that completion of an MD-PhD program was associated with a subsequent faculty appointment.[203-206] Pediatric residents with MD-PhD or MD-MPH degrees were more likely to enter academics.[78] A survey of neurology residents found that those with an MD-PhD degree were more likely to express interest in academic medicine than their colleagues with other degrees.[79] In a survey of dermatology residents completing MD-PhD training, 77% anticipated a career in academic medicine.[80] Over 90% of graduates of MD-PhD programs at 2 prominent institutions entered academics.[203,204] A survey of gastroenterology fellows noted that attainment of a PhD degree was associated with selection of an academic career.[81]

The clinician-scientist plays a unique role in academic medicine. These highly trained physicians frequently serve as a bridge between basic scientists and clinicians to translate discoveries into new developments.[207,208] There has been a decline in the number of clinician-scientists in medicine overall, but particularly in ophthalmology.[209] The viability of this career pathway has been questioned given the protracted training course, intense competition for research funding, lack of departmental support and protected time, and decreased financial renumeration compared with private practice.[207-214] The medical scientist training program for MD-PhD students and the K series grants are the main programs that promote clinician-scientist development. Ophthalmology attracts a disproportionately high number of MD-PhD graduates relative to other specialties, but it also has the highest percentage of MD-PhD.s who choose private practice.[209,214-216]

A higher proportion of academic ophthalmologists completed fellowship training compared with private practitioners in our study. In addition, ophthalmologists in academics were more likely to pursue fellowships in neuro-ophthalmology, pediatric ophthalmology, and uveitis. Ophthalmology residents who anticipated an academic career were more likely to seek fellowship training in previous studies.[22,128] Only subspecialty fellowship training was significantly associated with the choice of an academic career by plastic surgery residents.[82] Pediatricians in academics completed fellowship training more frequently than their counterparts in private practice.[78]

We found that academic ophthalmologists were more likely to practice in an urban location, whereas private practitioners were more commonly in suburban and rural locations. This is not surprising, as most academic medical centers are found in major metropolitan cities. Although the total number of work hours was similar for ophthalmologists in academics and private practice, those in private practice spent more time in direct patient care, whereas those in academics spent more time in ophthalmology outside of direct patient care. Academic ophthalmologists are frequently involved in teaching, research, and other administrative responsibilities separate from patient care activities. Ophthalmologists in private practice were more likely to practice in multiple specialty areas compared with academic ophthalmologists. Specialty areas that had a greater proportion of private practitioners than academicians included comprehensive ophthalmology, medical retina, and anterior segment/refractive surgery. Care of pediatric patients was provided by a lower percentage of ophthalmologists in private practice compared with academics.

Role models in medical education are not only important in enhancing learning, but they have also been shown to affect career choices.[36-38,45-49,145,146,217] Trainees frequently select traits from many role models and develop internal values that are an amalgam from multiple sources.[36] Our study found that role models/mentors were among the most influential factors in career choices by ophthalmologists in both academics and private practice. However, role models/mentors were rated as significantly more important by academic ophthalmologists compared with their counterparts in private practice. This finding has been observed in other specialties of medicine. Academic radiologists were also more influenced by role models than those in private practice.[76,83] A significant correlation was noted between the presence of a mentor and plans to enter academics among neonatal-perinatal[84] fellows and maternal-fetal medicine fellows.[85] However, having a clinical or research mentor was not associated with expectations about future practice type among gynecologic oncology fellows.[61]

We found that the career decisions of academic ophthalmologists were more influenced by opportunities to teach than those in private practice. A desire to teach was also

cited as a more important motivator in career decisions by emergency medicine residents[86] and gastroenterology fellows[81] pursuing academics compared with their counterparts seeking nonacademic positions. Radiology residents planning an academic career identified an interest in teaching more often than those expecting to enter private practice.[76] Experienced family practice educators reported being driven by a desire to pass along a legacy to future physicians, and they were energized by interactions with learners, colleagues, and patients.[218]

Several studies have described deterrents to pursuing a career in academic medicine, and lower financial rewards is most frequently cited.[75,76,78,79,87-90,176] A survey of radiology and internal medicine residents found that a lack of autonomy and financial rewards were disincentives to academic medicine.[88] A study of dermatologists found that income, politics, and lack of autonomy were the major deterrents to an academic career.[89] Salary expectations, funding, academic competitiveness, and administrative and family responsibilities were factors dissuading pediatric residents from entering academics.[78] Radiologists who left academic medicine for private practice reported inadequate financial rewards, low efficiency in academic institutions, and family influence as the major factors involved in their decision to leave academics.[76] Bureaucracy and low salary were the primary motivators for obstetricians/gynecologists to leave academic medicine.[90] The principal reasons for leaving academic surgery included salary, uncertainty of external funding of research, sense of isolation, unsupportive atmosphere, stress, conflicts with family responsibilities, and excessive clinical workloads.[176] We found that income and job market more strongly influenced the career choices of ophthalmologists in private practice than academics, which is consistent with observations in other medical specialties. Debt was another factor that was rated as more important in making career decisions among ophthalmologists in private practice compared with academics in our study. Ophthalmologists with substantial educational debt may be more attracted to positions in private practice, which traditionally offer higher levels of compensation than academics. Neurology residents with a large debt burden were also deterred from seeking an academic career.[79] However, financial debt was not significantly associated with the choice of an academic or nonacademic career among vascular surgery residents.[75]

In our study, ophthalmologists in private practice rated work hours and geographic location as more important in influencing career decisions than those in academics. Lifestyle considerations appear to be major motivators for ophthalmologists in private practice. Residents in radiology,[88] radiation oncology,[91] and emergency medicine[86] anticipating careers in private practice were also more influenced by lifestyle considerations compared with those planning to enter academics. We found that academic ophthalmologists were more likely to be influenced by challenging diagnostic problems, type of patient problems in practice, prestige, and subspecialty rotation(s) during residency. Intellectual challenge and intellectual stimulation were reported as more important in career decisions among academic primary care physicians[92] and radiologists[76] compared with those in private practice.

• **FELLOWSHIP TRAINING:** Fellowship training focuses on the development of clinical and surgical skills within a subspecialty area beyond the competencies achieved during residency. Attainment of this goal is consistent with the greater importance of challenging diagnostic problems and types of patient problems in practice reported by respondents who completed fellowship training in our study. Technological advances, such as laser in situ keratomileusis and minimally invasive glaucoma surgery, have revolutionized multiple ophthalmic subspecialties. Previous studies have shown that ophthalmology residents seeking fellowship training were more influenced by working with new technology than those planning general ophthalmology careers.[22,128] However, we found that general ophthalmologists and subspecialists were similarly motivated in their career decisions by working with new technology.

Educational debt was a more important consideration in making career choices among general ophthalmologists than subspecialists in our study. A recent survey of graduating ophthalmology residents noted that those choosing general ophthalmology careers had higher levels of educational debt relative to those seeking fellowship training.[128] Residents in pediatrics[62] and internal medicine[93-95] with greater educational debt similarly were less likely to pursue fellowship training. Medical student tuition and student educational debt have continued to rise.[95,96,219] Although many subspecialties of ophthalmology offer a higher income than general ophthalmology, fellowship involves 1 or 2 years of additional training before these financial gains are realized. Residents with substantial debt may feel pressure to enter clinical practice immediately after residency to facilitate loan repayment, rather than receive lower compensation during fellowship with interest from debts accruing. General ophthalmologists were more likely to be married than those who pursued fellowship training in our study. A study noted that pediatric residents who were married were less likely to enter fellowship training.[62] However, marital status was not associated with the decision to pursue fellowship training among internal medicine residents.[93,94]

Factors relating to lifestyle influenced the career choices of general ophthalmologists more than subspecialists in our study. Work hours and geographic location were rated as more important by general ophthalmologists than by those who completed fellowship training, consistent with prior studies evaluating factors influencing career decisions among ophthalmology residents.[22,128] We found that general ophthalmologists worked fewer hours in direct patient care and in ophthalmology outside of patient care compared with subspecialists. Lifestyle considerations have

been shown to influence career choices in many other medical and surgical specialties.[71,73,97-105] Women are affected more by family factors when making career decisions than men,[132,138,161,162] and several studies have reported that women were less likely to pursue fellowship training.[62,69-73] In our study, female and male ophthalmologists completed fellowship training with similar frequency. We found that ophthalmologists who completed fellowship training were more likely to enter academics than general ophthalmologists. This finding aligns with previous studies showing an association between fellowship training and an academic career in ophthalmology,[22,128] pediatrics,[78] and plastic surgery.[82] Most full-time faculty members in departments of ophthalmology have obtained subspecialty training, and general ophthalmologists are less commonly seen in academic ophthalmology.

Prestige, opportunities for research, and research experience were rated as more important factors in guiding career decisions for subspecialists compared with general ophthalmologists in our study, confirming results from a previous study evaluating factors influencing career choices among graduating ophthalmology residents.[22] We found that fellowship-trained ophthalmologists were more motivated by exposure to mentors and rotation(s) in the subspecialty area than general ophthalmologists, and they also reported more full-time faculty during residency in several subspecialty areas to serve as potential mentors/role models. Studies have shown that exposure to role models during clinical rotations is strongly associated with medical students' choice of a clinical field for residency training.[36-38,145] Mentors were similarly more important in influencing the career choices of internal medicine residents pursuing fellowship training compared with those entering general medicine.[106] A survey of residents and recent graduates in urology found that mentoring was the most important factor guiding the decision to pursue fellowship training.[107] Urology residents with a mentor were 20 times more likely to seek fellowship training. In our study, ophthalmologists who completed fellowship training were more likely to have published in a peer-reviewed journal, published a book chapter or non–peer-reviewed article, presented a paper or poster at a national meeting, and participated as a research team member during resident relative to general ophthalmologists. Publication of a manuscript during residency predicted subsequent fellowship training in urology.[107,220] We found that subspecialist ophthalmologists were more likely to practice in an urban location than general ophthalmologists, which is concordant with prior studies in ophthalmology.[22,128,139]

• **PRACTICE AREA:** The need for more generalists and fewer specialists in medicine has received much attention.[221-224] In the 1990s, the Eye Care Workforce Study commissioned by the American Academy of Ophthalmology predicted an excess of subspecialists in ophthalmology if trends in fellowship training continued.[30] However, Adelman and Nwanze[34] reported in 2011 a consistently growing demand for ophthalmologists with fellowship training. Current and future shortages have recently been noted in certain subspecialties of ophthalmology. Frohman[129,225] calculated that the demand for neuro-ophthalmologists was exceeding the supply from training programs using data from the AAO and North American Neuro-Ophthalmology Society. In a survey evaluating the adequacy of subspecialty care, 42% of primary care pediatricians in the United States reported a shortage of pediatric ophthalmologists to meet the need for patient care.[226] It has been estimated that 7.32 million persons in the United States will have primary open-angle glaucoma in 2050,[227] and concern has been raised that an inadequate number of glaucoma specialists are being trained to meet the future needs of an expanding glaucoma population.[126]

Previous studies have explored factors influencing the decision to pursue careers in various subspecialties of ophthalmology.[22,127,129-131,228] Graduating ophthalmology residents seeking fellowship training in glaucoma performed more filtering procedures during residency and made the decision to pursue fellowship training later than residents entering other subspecialties.[126] Residents pursuing glaucoma were less influenced in career choices by diagnostic problems, types of patient problems, interest in an academic career, and working with new technology compared with residents entering other subspecialties. Graduating ophthalmology residents entering vitreoretinal fellowships performed more retina/vitreous procedures and were more likely to publish a paper during residency than graduates seeking other fellowships.[127] Residents pursuing vitreoretinal fellowships were more likely to be male and plan to practice in a university setting, and they made the decision to pursue fellowship training earlier relative to residents entering other subspecialties. Challenging diagnostic problems, peer interactions, working with new technology, earning potential, and research experience were rated as more important and working hours were rated as less important in making career decisions by residents seeking vitreoretinal fellowships than those choosing other subspecialty fellowships. Attributes of pediatric ophthalmology and strabismus that attracted residents to the field included prestige, intellectual stimulation, research interest, and job opportunities.[131] Factors that dissuaded ophthalmology residents from pursuing pediatric ophthalmology and strabismus fellowships were difficulty examining children,[130,131,228] inadequate exposure to pediatric ophthalmology,[131] income,[130,228,229] fewer surgeries,[230] and lower prevalence of ocular pathology.[230] A survey of ophthalmology residents revealed that reasons for not choosing a fellowship in neuro-ophthalmology included lack of surgery, perceived lack of jobs, difficulty of the specialty, time required to practice the discipline, and salary.[129]

Several factors were noted to similarly influence the career choices of ophthalmologists practicing in different subspecialties in our study. Respondents who were practicing

in cornea, glaucoma, oculoplastics, pediatric ophthalmology, and vitreoretinal surgery performed more procedures during residency in their respective subspecialty areas compared with other respondents. Ophthalmologists practicing in glaucoma, medical retina, oculoplastics, pediatric ophthalmology, uveitis, and vitreoretinal surgery provided higher ratings for the rotations during residency in their subspecialty areas relative to those outside their practice areas. Previous studies have shown that exposure to role models during clinical rotations is strongly associated with medical students' choice of a clinical field for residency training.[36-38,145] It is unclear whether high-quality rotations during residency stimulated interest in a subspecialty, or whether a pre-existing interest in a subspecialty resulted in a higher assessment of the rotation. Similarly, additional surgical experience may have produced greater interest in a subspecialty, or occurred as a consequence of an established interest and a desire to gain more experience with procedures in the chosen field.

We found that ophthalmologists practicing in oculoplastics, vitreoretinal surgery, and uveitis were more likely than other practitioners to participate in scholarly activities during residency, such as publishing a paper or serving as a project leader in research. Oculoplastics and vitreoretinal surgery are among the most competitive subspecialties in ophthalmology, and scholarly activity is an important criterion used in fellow selection.[231-232] Respondents practicing in oculoplastics and vitreoretinal surgery also made the decisions to pursue fellowship training and the subspecialty area earlier compared with those practicing in other areas. The fellowship match in oculoplastics occurs sooner than other fellowships in ophthalmology, requiring a commitment to this subspecialty earlier during training. Ophthalmologists practicing medical retina, uveitis, and vitreoretinal surgery spent more hours per week in direct patient care than other subspecialists. It is noteworthy that work hours were less influential in the career decisions of uveitis and vitreoretinal specialists relative to practitioners in other areas. Income was more important in motivating the career choices of cornea and vitreoretinal specialists, and less important to pediatric ophthalmologists. This correlates with higher average salaries among cornea and vitreoretinal specialists and lower average compensation for pediatric ophthalmologists. Working with new technology was more important in influencing the career choices of ophthalmologists in cornea and vitreoretinal surgery than other subspecialists. Cornea and retina are areas that have seen the greatest diagnostic and therapeutic innovations in ophthalmology, such as the introduction of optical coherence tomography and laser in situ keratomileusis. Challenging diagnostic problems were more important to the careers of ophthalmologists practicing neuro-ophthalmology, uveitis, and vitreoretinal surgery compared with other subspecialists. Continuity of care was a stronger motivator in the career choices of glaucoma and uveitis specialists than other practitioners, and ophthalmologists in these subspecialties routinely manage chronic ocular diseases.

We chose to explore factors influencing ophthalmologists' choice of areas of subspecialty practice rather than fellowship training. As expected, there was a strong correlation between areas of subspecialty practice and fellowship training. However, some general ophthalmologists practiced within a subspecialty area, and some subspecialists practiced comprehensive ophthalmology and/or outside their area of fellowship training. Practice area is more relevant than training area when developing workforce strategies to meet further eye care needs. We found that ophthalmologists who completed fellowship training had a greater chance of practicing in more than 1 practice area compared with general ophthalmologists. Private practitioners were more likely to practice in multiple subspecialty areas than those in academics. Departments of ophthalmology are typically organized into subspecialty services, and faculty members usually practice in a single designated subspecialty area. In our study, men had a higher probability of practicing in more than 1 practice area relative to women.

Several population-based studies evaluated practice patterns among ophthalmologists in Ontario, Canada.[233-235] The proportion of Canadian ophthalmologists performing strabismus surgery decreased from 37.7% in 1994 to 12.5% in 2011, and the mean number of strabismus procedures per surgeon increased from 16.2 to 55.3 per year during the same period.[235] These same investigators evaluated trends in surgical and clinic-based glaucoma care.[233,234] The percentage of Canadian ophthalmologists performing incisional glaucoma surgery dropped from 35% in 1995 to 19% in 2010, and the mean number of incisional glaucoma procedures per surgeon concurrently doubled with the percentage of glaucoma operations performed by high-volume surgeons rising from 23% to 59%.[233] In contrast, glaucoma specialists played a declining role in the provision of clinic-based glaucoma care between 2000 and 2010.[234] In particular, the rate of glaucoma consultations and follow-up visits by glaucoma surgeons decreased by 1.6% per year, and their rate of laser trabeculoplasty procedures decreased by 19.3% annually.

Many areas of medicine are becoming more subspecialized, including ophthalmology. Incisional glaucoma surgery and strabismus surgery are increasingly becoming the purview of a shrinking number of high-volume subspecialists.[233,235] Many factors may be driving these procedures, and potentially others, into the domain of subspecialty ophthalmologists. With a steady rise in the proportion of graduating ophthalmology residents seeking fellowship training, general ophthalmologists may have easier access to subspecialists. Ophthalmologists may be shifting practice focus to less time intensive procedures, such as cataract surgery and intravitreal injections. Greater patient demands and medicolegal risks may also influence the decision to refer procedures to subspecialists for surgery.

As opposed to surgical care, clinic-based glaucoma care remains dependent on ophthalmologists who are not glau-

coma surgeons.[234] Prior survey-based studies have shown that most general ophthalmologists provide glaucoma care.[236,237] However, our study found that glaucoma care more likely involved an ophthalmologist who completed subspecialty training in glaucoma. Differences in glaucoma care processes between general ophthalmologists and glaucoma specialists have been observed.[238-241] Although evidence suggests that physician specialization improves outcomes in some clinical scenarios, the magnitude of this effect is highly variable and the relative contributions of the provider and the provider's environment are not well known.[242,243]

• **CAREER SATISFACTION:** Career satisfaction has become an important area of focus in medicine. Career satisfaction has helped to understand workforce trends in medicine,[244] the attractiveness of medical specialties to medical students,[50,51] and antiemployer actions like forming unions[245] or striking.[246] Higher physician satisfaction has been associated with better health care outcomes,[247,248] more satisfied patients,[247,248] and fewer medical errors.[249] Lower levels of career satisfaction that persist may produce health problems for physicians themselves.[250] Decisions to reduce work hours, leave a clinical practice, or quit medicine entirely are related to physician career satisfaction.[251-254]

A number of key factors have been reported to influence career satisfaction in medicine. Income has consistently been identified as a predictor of career satisfaction.[255-260] Several work-related factors have been shown to impact the career satisfaction of physicians. Career satisfaction is negatively affected by poorer access to adequate resources and perceived limitations on the capacity to provide high-quality care, including less cooperative working relationships and excessive workload.[258-264] Higher job stress and longer working hours have been identified as contributors to lower levels of job satisfaction in medicine.[252,256,265-270] On the other hand, perceived autonomy or work control are associated with higher levels of satisfaction in medicine.[257,263,271-274] Patient-related factors that have been linked to lower physician satisfaction relate to the complexity of care needs, perceived degree of emotional burden, threat of malpractice, and underinsurance.[263,275-277]

In our study, female ophthalmologists reported a lower level of happiness with work life compared with their male counterparts. There are many gender-related issues that may exist as barriers to career satisfaction, including sexual and gender-based harassment,[278,279] salary inequity,[193-196] isolation and poor gender climate,[280] lack of academic advancement despite comparable work,[280-282] and stress related to multiple roles.[283] There is conflicting information in the medical literature about the relationship between gender and career satisfaction. Female physicians in the Physician Work Life Study were 1.6 times more likely to report burnout than male physicians.[284] In contrast, other studies have found similar levels of career satisfaction between female and male physicians.[139,162,177,221,244,280,285] The Women Physicians' Health Study found that high levels of career satisfaction were reported by 84% of US female physicians, although 38% expressed interest in changing their specialty.[286] Ophthalmologists were among the most satisfied female physicians and least likely to change specialty. A national survey of female surgeons in Canada demonstrated that ophthalmologists were more satisfied in how they balanced time between career and personal life compared with other surgeons.[138] Despite having more responsibilities as family caregivers, female ophthalmologists in Canada reported similar levels of career satisfaction and work hours as their male counterparts.[162,177] There was no significant difference in overall career satisfaction between female and male ophthalmologists in Australia and New Zealand.[139] However, female ophthalmologists experienced greater frustration with unequal career opportunities and managing professional and family commitments.

We found that ophthalmologists in private practice and academics had similar levels of work happiness. Similar job satisfaction was also observed among obstetrician-gynecologists in academics and private practice.[273] However, teaching, research, and patient variety contributed more to academic satisfaction, whereas autonomy, physician-patient relationships, and coworkers contributed more to the satisfaction of private practitioners. Contrasting results have been reported in other studies. Using data from the 2008 Health Tracking Physician Survey, surgical specialists who were medical school based reported higher career satisfaction than those who were hospital based.[260] A study using data from the 2004-2005 Community Tracking Study Physician Survey showed that medical school employment was associated with higher physician career satisfaction.[244] It was suggested that medical schools may provide more intellectual stimulation to physicians because they handle patients with more complex medical issues.[244,260] Medical schools offer a collaborative academic environment, highly qualified staff, and rapid access to specialized physicians.[260] In addition, physicians in medical school frequently work with physicians-in-training who assist in patient care and provide opportunities to teach future colleagues. Another study found that physicians working in health maintenance organizations generally had lower job satisfaction and were more likely to intend to leave practice than physicians in other practice types.[287]

Previous studies have addressed career satisfaction within specific specialties, including internal medicine,[247,288] family medicine,[248,289] emergency medicine,[257,290] anesthesiology,[272] obstetrics and gynecology,[273] rheumatology,[274] psychiatry,[276] and dermatology.[291] A study using the 1996-1997 Community Tracking Study Physician Survey ranked ophthalmology as the third most "dissatisfied" specialty among 33 medical specialties.[255] Ophthalmology's ranking improved in a follow-up study by the same author group using data from the 2004-2005 Community Tracking Study

Physician Survey; ophthalmology was ranked 13 of 42 medical specialties based on career satisfaction.[244] These results markedly contrast with the 2014 Medscape Physician Lifestyle Survey involving 31,399 US physicians across 25 specialty areas.[136] In this survey, dermatology and allergy-clinical immunology were the only specialties that ranked higher than ophthalmology in career satisfaction. The assessment of physician career satisfaction is generally undertaken using self-reported responses to a survey. Different domains of career satisfaction may be measured depending on the content of specific questions and their interpretation. Single-item measures of global career satisfaction, as was used in our study and the Medscape survey, will often overestimate levels of satisfaction by avoiding specific items that may reveal undesirable characteristics of the career.[292] Our survey was conducted around the same time as the 2014 Medscape Physician Lifestyle Survey, and we formatted the 2 questions relating to happiness at home and at work to exactly match those in the Medscape survey to facilitate comparison. Ophthalmologists in our survey reported a higher level of happiness at work and at home than ophthalmologists who responded to the Medscape survey.[136] The Community Tracking Study Physician Survey demonstrated that age less than 35 years and age more than 65 years were associated with higher physician career satisfaction.[244,255] This bimodal distribution in career satisfaction based on age may help to explain the higher level of career satisfaction observed in our study of newly practicing ophthalmologists relative to a Medscape survey involving ophthalmologists of all ages. Younger physicians have been noted to have higher career satisfaction than older colleagues possibly related to the idealism of youth.[244,255]

Pediatric ophthalmology was the subspecialty with the lowest mean job satisfaction score in our study, although no significant differences were seen across subspecialties in univariable and multivariable analyses. In a survey of the American Association of Pediatric Ophthalmology and Strabismus membership, pediatric ophthalmologists reported high levels of satisfaction in the areas of intellectual stimulation, diversity of patient pathology, lifestyle, and amount of respect received from colleagues.[228] However, there were higher levels of dissatisfaction with financial compensation. Median compensation for pediatric ophthalmologists was noted to be the lowest of all subspecialties of ophthalmology.[228]

• **FUTURE STRATEGIES:** The future demand for ophthalmologists was evaluated in the Ophthalmology Manpower Studies[23-27] and the Graduate Medical Education National Advisory Committee Report on Ophthalmology[28] during the 1980s, and the Eye Care Workforce Study[29-33] commissioned by the AAO in the 1990s. The Eye Care Workforce Study estimated an oversupply of eye care providers,[29] and an excess of subspecialist ophthalmologists was predicted if trends in fellowship training continued.[31] However, this model was based on a number of assumptions, including the role and work effort of ophthalmologists and optometrists. A subsequent projection incorporating new optometric data suggested that there would be near equilibrium between the demand and supply for ophthalmic care.[32] There are inherent uncertainties associated with the assumptions that are required for workforce forecasts. The challenges involved in making manpower projections are highlighted by the discrepancy between the Ophthalmology Manpower Studies and the Graduate Medical Education National Advisory Committee Report on Ophthalmology, despite the fact that both studies were conducted concurrently.[23-28,34] The US Department of Health and Human Services has projected that ophthalmology will be the surgical specialty with the greatest workforce shortage by 2025.[13,293] The increasing prevalence of chronic diseases and an aging population has contributed to a rapidly growing patient population that is predicted to exceed the supply of ophthalmologists.[11-13,293] Adelman and Nwanze[34] assessed marketplace demand for ophthalmologists using a help-wanted index, which was based on the number of physician recruitment advertisements appearing in major ophthalmic journals. The need for academic ophthalmologists was correlated with national research expenditure and stock market gains, and the demand for private practice ophthalmologists was correlated with national economic well-being as measured by gross national product.

Although the total number of medical school graduates has continued to increase in recent years, the number of residency positions in ophthalmology has remained fairly stable.[13,15-17] Increasing the number of ophthalmology residency slots is a logical step to address the projected shortage of ophthalmologists, but the effect would be delayed. Lee and associates[32] point out that a decision to raise the number of residency positions by 20% would take more than 2 decades to effect a 10% change in the number of ophthalmologists in clinical practice. Moreover, prior approval by the Accreditation Council for Graduate Medical Education and institutional funding would be required.

Several changes should be considered to accommodate a workforce that is increasingly female. Trainees should be educated on balancing personal and professional roles with continued mentored guidance. Greater flexibility could be provided in training and practicing options, such as shared residencies and part-time employment. Reorganization of expected work hours with use of physician extenders and telemedicine could allow for continued productivity while working part-time. Expansion of part-time practice should be supported by concurrent changes in health care benefits, on-call responsibilities, and promotion requirements such as tenure "clocks." These changes would be expected to optimize recruitment and retention of the new generation of ophthalmologists who view lifestyle as a priority in specialty choice and career satisfaction, irrespective of gender.

Underrepresented in medicine (URM) refers to minority groups that are underrepresented in the field of medicine relative to their number in the general population, which

currently includes individuals who are Black, Hispanic, or Native American (American Indian, Alaskan Native, Native Hawaiian, and Pacific Islander). A relatively low number of URM ophthalmologists responded to our study. Data from the Association of Medical Colleges, American Medical Association, and US Census Bureau in 2014 and 2015 showed that URM groups were underrepresented as practicing ophthalmologists (6%), ophthalmology faculty (5.7%), and ophthalmology residents (7.7%) compared with the US population (30.7%).[20] Between 2005 and 2015, the proportion of URM ophthalmologists remained static. Significant ethnoracial disparities are present in vision health and eye care delivery.[294-296] Increasing the level of diversity among ophthalmologists may help to reduce these disparities.[20,297] The likelihood of practicing in underserved areas was found to be higher for URM physicians, including ophthalmologists.[20,298] Patients treated by a physician who shares the same race/ethnicity reported greater satisfaction with their care and more communication with their health care provider.[299,300] Students from medical schools with more diverse student bodies described feeling more confident in managing patients from different cultural backgrounds.[301,302] A cross-sectional study evaluating medical students' perception of an ophthalmology career found that URM students more frequently reported insufficient same race or same gender role models or mentorship in the field as a reason for not pursuing ophthalmology compared with non-URM students.[303]

The field of ophthalmology should create an environment that supports diversity. Academic institutions and private practices should ensure that all staff receive training to become competent in addressing gender, ethnic, and cultural issues among health care providers and patients. Exposing URM students to the field of ophthalmology as early as possible will help inform them about the appeal of ophthalmology as a career pursuit. The Minority Ophthalmology Mentoring program is a collaboration between the AAO and Association of University Professors of Ophthalmology designed to increase diversity in ophthalmology by helping URM students become competitive ophthalmology residency applicants. Academic institutions can also establish formal programs to provide active mentoring of URM trainees by individuals who can provide encouragement and serve as positive role models.

Studies have demonstrated waning interest in academics as a career pathway.[304-306] There are growing concerns about the viability of academic medicine for future physicians, especially clinician-scientists. Departmental administrators can work toward making an academic career more attractive by enhancing autonomy and career flexibility. Clinicians should be allowed to choose what duties they wish to assume rather than mandating that all faculty participate in teaching, research, and clinical care.[202] Intellectual stimulation and a desire to teach and conduct research have been shown to influence the choice of an academic career, but they may be prioritized in different ways.[74-77,81,86,202,218] Conversely, the pressure to be a "triple threat" with productivity in research, education, and clinical care was seen as a disincentive to enter academics.[202]

Several strategies could be adopted to support academic ophthalmologists interested in research. Loan repayment programs could be created to exchange debt for a specified number of years in academic service, as has been done with military medicine programs.[209] Formal mentoring programs pairing junior and senior researchers could be established. Education in technology transfer, intellectual property, grant writing, and responsible conduct of research could be provided.[213] Interdisciplinary workshops could be developed to connect clinical and research interests. Ambati and Cahoon[209] recommended a restructuring of residency training with integration of additional research experience and the option of extending training for interested candidates. The Specialty Training and Advanced Research (STAR) Program at the University of California Los Angeles has the suggested features, and an advanced degree (MS or PhD) is earned. An academic career has been selected by 77% of graduates of this program.[214]

Achieving a balanced workforce is an essential element of meeting the future eye care needs in the United States. Maldistribution of ophthalmologists by specialty can limit patient access to quality care. Pediatric ophthalmology[226] and neuro-ophthalmology[129,225] are specialties where shortages currently exist. The time during residency allocated to rotations in these areas of need could be expanded, either at the parent teaching institution or through rotations in group practices in the community. Role models/mentors and rotation(s) in subspecialty areas were rated as important factors in career decision-making by most respondents in our study. Hasan and associates[130] found that ophthalmology residents were dissuaded from pursuing a career in pediatric ophthalmology because examining children was considered too difficult and income levels were believed to be low. Working toward reducing income disparity and improving residents' ability to examine children were suggested as steps to improve interest in pediatric ophthalmology. Frohman[129,225] noted that poor compensation was the major reason for the decline in the number of ophthalmologists entering neuro-ophthalmology, and he offered several recommendations to ensure the future viability of the subspecialty. Interest in neuro-ophthalmology could be stimulated by sponsoring residents to attend the North American Neuro-Ophthalmology Society Meeting. Educational resources could be expanded to decrease the time required for neuro-ophthalmologists to discharge teaching duties. Teaching activities and "downstream revenue generation" of neuro-ophthalmology could be incorporated into a compensation plan, and ample support staff could be provided to optimize the practice efficiency of neuro-ophthalmologists.

Strong consideration should be given to formal subspecialty certification or recognition. The American Board of

Ophthalmology is one of the few member boards of the American Board of Medical Specialties that does not offer subspecialty certification. Patients are interested in knowing whether their doctor treats their condition or performs a specific procedure, and a certificate of competence in general ophthalmic practice is not helpful in providing guidance. The establishment of subspecialty recognition could be an effective way to promote the unique skills of subspecialists and assure the public of the quality of specialty care delivered. Ophthalmologists would likely be supportive of this initiative, given the trend toward increasing subspecialization. Specialty societies would need to be involved in determining the qualifications required to earn this credential.

A free market perspective would suggest that supply will change to meet demand.[307,308] Perhaps workforce planning is best approached by simply informing ophthalmologists-in-training of projected eye care requirements and areas of need. The number of applicants to ophthalmology fellowship programs and residency programs was noted to correlate with the number of advertisements for hiring ophthalmologists in major ophthalmic journals.[34] This finding provides evidence that ophthalmology trainees respond to market demands, an observation also made in gastroenterology[309] and neuroradiology[310] fellowships.

• **LIMITATIONS:** This study has several limitations inherent to survey-based research. The survey relied on self-reported data and was subject to recall bias. Only 32% of newly practicing ophthalmologists completed the survey, and nonresponse could have introduced selection bias. Because of the anonymous nature of the survey, we were limited in our ability to compare respondents and nonrespondents. The geographic distribution of ophthalmologists who did and did not complete the survey was found to be similar, and this provides some evidence supporting the generalizability of results. The survey was distributed to ophthalmologists who completed training within the prior 5 years, and the results may not be representative of the entire specialty of ophthalmology spanning all age groups. Some terms, such as "happy" and "mentor," are subject to interpretation. The list of factors influencing career choices was not exhaustive, and important determinants may not have been included. The data are cross-sectional describing associations with career choices and career satisfaction, but they may not reflect causation. The large number of significance tests that were performed increases the probability of finding statistically significant differences by chance alone. Despite these potential drawbacks, the large number of respondents argues for the generalizability of results and increased the power to detect significant differences between subgroups in ophthalmology.

CONCLUSION

In summary, this cross-sectional study described the career choices of newly practicing ophthalmologists and identified significant differences between the career choices of women and men, academicians and private practitioners, subspecialists and general ophthalmologists, and based on practice area. Female and male ophthalmologists pursued fellowship training with similar frequency, but men were more likely to seek vitreoretinal fellowships and women were more likely to undertake fellowships in pediatric ophthalmology, uveitis, and neuro-ophthalmology. Male ophthalmologists placed greater importance on income during career planning, whereas female ophthalmologists were more influenced by lifestyle considerations including work hours and geographic location. A higher proportion of ophthalmologists in academics completed fellowship training than those in private practice. Female ophthalmologists had a higher probability of entering academics than their male counterparts. Scholarly activity during residency was associated with the selection of an academic career. Although the total number of work hours were similar for ophthalmologists in private practice and academics, private practitioners spent more time in direct patient care and academicians devoted more time to ophthalmology outside of patient care. Ophthalmologists in private practice and academics had similar levels of work happiness. The career choices of ophthalmologists in private practice were more strongly motivated by income and job market, whereas academic ophthalmologists placed greater importance on opportunities to teach and conduct research, role models/mentors, rotation(s) during residency, research experience, and prestige. Educational debt was a more important consideration in making career decisions among general ophthalmologist than subspecialists. Ophthalmologists were more likely to practice in subspecialty areas with higher quality rotations and larger surgical volume during residency. Both female and male ophthalmologists had a high degree of career satisfaction, but women reported lower levels of happiness with work life compared with men. Many factors influence career decisions, and they are weighed differently by subgroups within ophthalmology. This information may prove useful in shaping an appropriate physician workforce to meet future eye care needs.

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REFERENCES

1. Merritt JC. "Rolls Royce residencies": the ophthalmology experience with minority medical students. *J Natl Med Assoc*. 1984;76:339–342.
2. Pankratz M, Helveston EM. Ophthalmology. The resident's perspective. *Arch Ophthalmol*. 1992;110:37–43.
3. Nissman SA, Kudrick NT, Piccone MR. Motivations and perceptions of US medical students pursuing a career in ophthalmology. *Ann Ophthalmol*. 2002;34:223–229.
4. Gameiro GR, Darcie ALF, Hazaki D, Gameiro GR, Carricondo PC. Why ophthalmology? Analysis of the motivating factors influencing the choice of ophthalmology as a career among different generations in Brazil. *Clinics (Sao Paulo)*. 2019;74:e1101.
5. Noble J. Factors influencing career choice in ophthalmology. *Can J Ophthalmol*. 2006;41:596–599.
6. Spivey BE. An ophthalmologist's definition of ophthalmology. *Ophthalmology*. 1991;98:1877–1881.
7. Anderson D, Romanchuk K. Why choose ophthalmology? *CMAJ*. 2003;168:1396.
8. Lambert TW, Goldacre MJ, Bron AJ. Career choices for ophthalmology made by newly qualified doctors in the United Kingdom, 1974–2005. *BMC Ophthalmol*. 2008;8:3.
9. Lambert TW, Barat A, Goldacre MJ. Junior doctors' aspirations for careers in ophthalmology: 40 years of surveys of UK medical graduates. *JRSM Open*. 2020;11 2054270419892155.
10. Andriole DA, Schechtman KB, Ryan K, Whelan A, Diemer K. How competitive is my surgical specialty? *Am J Surg*. 2002;184:1–5.
11. Lago RM, Singh PP, Nesto RW. Diabetes and hypertension. *Nat Clin Pract Endocrinol Metab*. 2007;3:66.
12. Willis JR, Doan QV, Gleeson M, et al. Vision-related functional burden of diabetic retinopathy across severity levels in the United States. *JAMA Ophthalmol*. 2017;135:926–932.
13. Feng PW, Ahluwalia A, Feng H, Adelman RA. National trends in the United States eye care workforce from 1995 to 2017. *Am J Ophthalmol*. 2020;218:128–135.
14. Feng H, Berk-Krauss J, Feng PW, Stein JA. Comparison of dermatologist density between urban and rural counties in the United States. *JAMA Dermatol*. 2018;154:1265–1271.
15. Jayakumar KL, Samimi SS. Trends in US dermatology residency and fellowship programs and positions, 2006 to 2016. *J Am Acad Dermatol*. 2018;78:813–815.
16. Hayek S, Lane S, Fluck M, Hunsinger M, Blansfield J, Shabahang M. Ten year projections for US residency positions: will there be enough positions to accommodate the growing number of U.S. medical school graduates? *J Surg Educ*. 2018;75:546–551.
17. SF Match Residency and Fellowship Matching Services. Ophthalmology residency match summary report; 2020. https://www.sfmatch.org/PDFFilesDisplay/Ophthalmology_Residency_Stats_2020.pdf. Accessed October 24, 2020.
18. United States Census Bureau. Population projections. https://www.census.gov/programs-surveys/popproj.html. Accessed October 24, 2020.
19. Buys YM. Aging and feminization of the physician workforce in Canada: comparing ophthalmologists to all other physicians. *Can J Ophthalmol*. 2014;49:291–296.
20. Xierali IM, Nivet MA, Wilson MR. Current and future status of diversity in ophthalmologist workforce. *JAMA Ophthalmol*. 2016;134:1016–1023.
21. Blakemore LC, Hall JM, Biermann JS. Women in surgical residency training programs. *J Bone Joint Surg Am*. 2003;85:2477–2480.
22. Gedde SJ, Budenz DL, Haft P, Tielsch JM, Lee Y, Quigley HA. Factors influencing career choices among graduating ophthalmology residents. *Ophthalmology*. 2005;112:1247–1254.
23. Reinecke RD. Ophthalmology (eye physician and surgeon) manpower studies for the United States. *Ophthalmology*. 1978;85:1055–1138.
24. Reinecke RD, Steinberg T. Manpower studies for the United States. Part II. Demand for eye care. A public opinion poll based upon a Gallop poll survey. *Ophthalmology*. 1981;88:34A–47A.
25. Worthen DM, Luxemberg MN, Gutman FH, et al. Ophthalmology (eye physician and surgeon) manpower studies for the United States. Part III. A survey of ophthalmologists' viewpoints and practice characteristics. *Ophthalmology*. 1981;88:45A–51A.
26. Gamble L, Mash AJ, Burdan T, Ruiz RS, Spivey BA. Ophthalmology (eye physician and surgeon) manpower studies for the United States. Part IV. Ophthalmology manpower distribution in 1983. *Ophthalmology*. 1983;90:47A–64A.
27. Ruiz RS. American academy of ophthalmology manpower studies. Part V. *Ophthalmology*. 1984;91:47A–57A.
28. Boyd HH. GMENAC report on ophthalmology. *Ophthalmology*. 1982;89:49A–50A.

29. Lee PP, Jackson CA, Relles DA. Estimating eye care workforce supply and requirements. *Ophthalmology*. 1995;102:1964–1972.
30. Lee PP, Relles DA, Jackson CA. Subspecialty distributions of ophthalmologists in the workforce. *Arch Ophthalmol*. 1998;116:917–920.
31. Jackson CA, Brown JA, Relles DA, Lee PP. Work time estimates for ophthalmic diagnoses and procedures. Results from the Eye Care Workforce Study. *Arch Ophthalmol*. 1998;116:922–928.
32. Lee PP, Hoskins HD, Smith RE, Hutchinson BT. Access to eye care: response of the American Academy of Ophthalmology and its members to societal needs now and in the future. *Arch Ophthalmol*. 2007;125:403–405.
33. Lee PP, Hoskins HD, Parke DW. Access to care: eye care provider workforce considerations in 2020. *Arch Ophthalmol*. 2007;125:406–410.
34. Adelman RA, Nwanze CC. The impact of the economy and recessions on the marketplace demand for ophthalmologists (an American Ophthalmological Society thesis). *Tran Am Ophthalmol Soc*. 2011;109:49–65.
35. Parke DW. The changing eye care workforce. *EyeNet*. 2016;20:14.
36. Wright S, Wong A, Newill C. The impact of role models on medical students. *J Gen Intern Med*. 1997;12:53–56.
37. Erzurum VZ, Obermeyer RJ, Fecher A, et al. What influences medical students' choice of surgical careers. *Surgery*. 2000;128:253–256.
38. Yoon JD, Ham SA, Reddy ST, Curlin FA. Role models' influence on specialty choice for residency training: a national longitudinal study. *J Grad Med Educ*. 2018;10:149–154.
39. Schwartz RW, Simposon WG, Strodel WE, Jarecky RK, Griffen WO, Young AB. Career change: in quest of a controllable lifestyle. *J Surg Res*. 1989;47:189–192.
40. Schwartz RW, Haley JV, Williams C, et al. The controllable lifestyle factor and students' attitudes about specialty selection. *Acad Med*. 1990;65:207–210.
41. Jarecky RK, Schwartz RW, Haley JV, Donnelly MB. Stability of medical specialty selection at the University of Kentucky. *Acad Med*. 1991;66:756–761.
42. Gelfand DV, Podnos YD, Wilson SE, Cooke J, Williams RA. Choosing general surgery: insights into career choices of current medical students. *Arch Surg*. 2002;137:941–947.
43. Dorsey ER, Jarjoura D, Rutecki GW. Influence of controllable lifestyle on recent trends in specialty choice by US medical students. *JAMA*. 2003;290:1173–1178.
44. Dorsey ER, Jarjoura D, Rutecki GW. The influence of controllable lifestyle and sex on the specialty choices of graduating U.S. medical students, 1996–2003. *Acad Med*. 2005;80:791–796.
45. Lieu T, Schroder S, Altman D. Specialty choices at one medical school: recent trends and analysis of predictive factors. *Acad Med*. 1989;64:622–629.
46. Babbott D, Levey G, Wever S, Killian C. Medical student attitudes about internal medicine: a study of U.S. medical school seniors in 1988. *Ann Intern Med*. 1991;114:16–22.
47. Colwill J. Where have all the primary care applicants gone? *N Engl J Med*. 1992;326:387–393.
48. Osborn EH. Factors influencing students' choices of primary care or other specialties. *Acad Med*. 1993;68:572–574.
49. Linzer M, Slavin T, Mutha S, et al. Admission, recruitment, and retention: finding and keeping the generalist-oriented student. *J Gen Int Med*. 1994;9(Suppl 1):S14–S23.
50. Pugno PA, Schmittling GT, McGaha AL, Kahn NB. Entry of US medical school graduates into family medicine residencies: 2005–2006 and 3-year summary. *Fam Med*. 2006;38:626–636.
51. Lambert TW, Davidson JM, Evans J, Goldacre MJ. Doctors reasons for rejecting initial choices of specialties as long-term careers. *Med Educ*. 2003;37:312–318.
52. Azizzadeh A, McCollum CH, Miller CC, Holliday KM, Shilstone HC, Lucci A. Factors influencing career choice among medical students interested in surgery. *Curr Surg*. 2003;60:210–213.
53. Hauer KE, Durning SJ, Kernan WN, et al. Factors associated with medical students' career choices regarding internal medicine. *JAMA*. 2008;300:1154–1164.
54. Borges NJ, Stratton TD, Wagner PJ, Elam CL. Emotional intelligence and medical specialty choice: findings from three empirical studies. *Med Educ*. 2009;43:565–572.
55. Indyk D, Deen D, Fornari A, Santos MT, Lu WH, Rucker L. The influence of longitudinal mentoring on medical student selection of primary care residencies. *BMC Med Educ*. 2011;11:27.
56. Grayson MS, Newton DA, Thompson LF. Payback time: the associations of debt and income with medical student career choice. *Med Educ*. 2012;46:983–991.
57. Kim YY, Kim UN, Kim YS, Lee JS. Factors associated with the specialty choice of Korean medical students: a cross-sectional survey. *Hum Resour Helath*. 2016;14:45.
58. Yang Y, Li J, Wu X, et al. Factors influencing subspecialty choice among medical students: a systematic review and meta-analysis. *BMJ Open*. 2019;9:e022097.
59. Abdulrahman M, Makki M, Shaaban S, et al. Specialty preferences and motivating factors: a national survey on medical students from five UAE medical schools. *Educ Health*. 2016;29:231–243.
60. Ramsdell JW. The timing of career decisions in internal medicine. *J Med Educ*. 1983;58:547–554.
61. Ramondetta LM, Bodurka DC, Tortolero-Luna G, et al. Mentorship and productivity among gynecologic oncology fellows. *J Cancer Educ*. 2003;18:15–19.
62. Pan RJ, Cull WL, Brotherton SE. Pediatric residents' career intentions: data from the leading edge of the pediatrician workforce. *Pediatrics*. 2002;109:182–188.
63. Jewett EA, Anderson MR, Gilchrist GS. The pediatric subspecialty workforce: public policy and forces for change. *Pediatrics*. 2005;116:1192–1202.
64. Newton DA, Grayson MS, Thompson LF. The variable influence of lifestyle and income on medical students' career specialty choices: data from two U.S. medical schools. *Acad Med*. 2005;80:809–814.
65. Takeda Y, Morio K, Snell L, Otaki J, Takahashi M, Kai I. Characteristic profiles among students and junior doctors with specific career preferences. *BMC Med Educ*. 2013;13:125.
66. Van der Horst K, Siegrist M, Orlow P, Giger M. Residents' reasons for specialty choice: influence of gender, time, patient and career. *Med Educ*. 2010;44 5959–602.

67. Reed CE, Vaporciyan AA, Erikson C, et al. Factors dominating choice of surgical specialty. *J Am Coll Surg*. 2010;210:319–324.
68. Altieri MA, Price KL, Yang J, Jones DB, Pryor AD. What are women being advised by mentors when applying to surgery? *Am Surg*. 2020;86:266–272.
69. McCord JH, McDonald R, Leverson G, et al. Motivation to pursue a surgical subspecialty training: is there a gender difference? *J Am Coll Surg*. 2007;205:698–703.
70. West CP, Popkave C, Schultz HJ, Weinberger SE, Kilars JC. Changes in career decisions of internal medicine residents during training. *Ann Intern Med*. 2006;145:774–779.
71. Garibaldi RA, Popkave C, Bylsma W. Career plans for trainees in internal medicine. *Acad Med*. 2005;80:507–512.
72. Brotherton SE. The relationship of indebtedness, race, and gender to the choice of general or subspecialty pediatrics. *Acad Med*. 1995;70:149–151.
73. Freed GL, Dunham KM, Jones MD, McGuinness GA, Althouse L. Research Advisory Committee of the American Board of Pediatrics. General pediatrics resident perspective on training decisions and career choice. *Pediatrics*. 2009;123(Suppl 1):S26–S30.
74. Neacy K, Stern SA, Kim HM, Dronen SC. Resident perception of academic skills training and impact on academic career choice. *Acad Emerg Med*. 2000;7:1408–1415.
75. Danczyk RC, Sevdalis N, Woo K, et al. Factors affecting career choice among the next generation of academic vascular surgeons. *J Vasc Surg*. 2012;55:1509–1514.
76. Feng L, Ruzal-Shapiro C. Factors that influence radiologists' career choices. *Acad Radiol*. 2003;10:45–51.
77. Hillman BJ, Fajardo LL, Witzke DB, Cardenas D, Irion M, Fulginiti JV. Influences affecting radiologists' choices of academic or private practice careers. *Radiology*. 1990;174:561–564.
78. Ledley FD, Lovejoy FH. Factors influencing the interests, career paths, and research activities of recent graduates from an academic, pediatric residency program. *Pediatrics*. 1993;92:436–441.
79. Doherty MJ, Schneider AT, Tirschwell DL. Will neurology residents with large student loan debts become academicians? *Neurology*. 2002;58:495–497.
80. Prystowsky JH. Factors influencing the pursuit of careers in academic medicine: a survey of MD-PhD residents in dermatology programs in the United States. *J Invest Dermatol*. 1992;98:125–127.
81. Adler DG, Hilden K, Wills JC, Quinney E, Fang JC. What drives US gastroenterology fellows to pursue academic vs. non-academic careers? Results of a national survey. *Am J Gastroenterol*. 2010;105:1220–1223.
82. Imahara SD, Scott JR, Neligan PC. Career plans of graduating plastic surgery trainees in 2009: the impact of an uncertain economic climate. *Plast Reconstr Surg*. 2009;124:2173–2178.
83. Bilbey JH, Fache JS, Burhenne HJ. Are there predictors for future academic radiologists? A Canadian survey. *Can Assoc Radiol J*. 1992;43:369–373.
84. Pearlman SA, Leef KH, Sciscione AC. Factors that affect satisfaction of neonatal-perinatal fellowship training. *Am J Perinatol*. 2004;21:371–375.
85. Sciscione AC, Colomorgen GH, D'Alton ME. Factors affecting fellowship satisfaction, thesis completion, and career direction among maternal-fetal medicine fellows. *Obstet Gynecol*. 1998;91:1023–1026.
86. Sanders AB, Fulginiti JV, Witzke DB. Factors influencing resident career choices in emergency medicine. *Ann Emerg Med*. 1992;21:47–52.
87. Borges NJ, Navarro AM, Grover A, Hoban JD. How, when, and why do physicians choose careers in academic medicine? A literature review. *Acad Med*. 2010;85:680–686.
88. Wood PS, Altmaier EM, Franken EA, Evens RG, Schlechte JA. Factors influencing choice of academic or practice careers in radiology. *Invest Radiol*. 1990;25:675–677.
89. Bergstrasser PR. Perceptions of the academic environment: a national survey. *J Am Acad Dermatol*. 1991;25:1092–1096.
90. Cain JM, Schulkin J, Parisi V, Power ML, Holzman GB, Williams S. Effects of perceptions and mentorship on pursuing a career in academic medicine in obstetrics and gynecology. *Acad Med*. 2001;76:628–634.
91. Wilson LD, Flynn DF, Haffty BG. Radiation oncology career decision variables for graduating trainees seeking positions in 2003-2004. *Int J Radiat Oncol Biol Phys*. 2005;62:519–525.
92. Rubeck RF, Donnelly MB, Jarecky RM, Murphy-Spencer AE, Harrell PL, Schwartz RW. Demographic, educational, and psychosocial factors influencing the choices of primary care and academic medical careers. *Acad Med*. 1995;70:318–320.
93. Weil PA, Schleiter MK, Tarlov AR. National study of internal medicine manpower: V. Comparison of residents in internal medicine—future generalists and subspecialists. *Ann Intern Med*. 1981;94:678–690.
94. Diehl AK, Kumar V, Gateley A, Appleby JL, O'Keefe ME. Predictors of final specialty choice by internal medicine residents. *J Gen Intern Med*. 2006;21:1045–1049.
95. McDonald FS, West CP, Popkave C, Kolars JC. Educational debt and reported career plans among internal medicine residents. *Ann Intern Med*. 2008;149:416–420.
96. Frinter MP, Mulvey HJ, Pletcher BA, Olson LM. Pediatric resident debt and career intentions. *Pediatrics*. 2013;131:312–318.
97. Lorin S, Heffner J, Carson S. Attitudes and perceptions of internal medicine residents regarding pulmonary and critical care subspecialty training. *Chest*. 2005;127:630–636.
98. Harris MC, Marx J, Gallagher PR, Ludwig S. General vs subspecialty pediatrics: factors leading to residents' career decisions over a 12-year period. *Arch Pediatr Adolesc Med*. 2005;159:212–216.
99. Fang YM, Egan JF, Rombro T, Morris B, Zelop CM. A comparison of reasons for choosing obstetrician/gynecologist subspecialty training. *Conn Med*. 2009;73:165–170.
100. Hudkins JR, Helmer SD, Smith RS. General surgery resident practice plans: a workforce for the future? *Am J Surg*. 2009;198:798–803.
101. Viola KV, Bucholz E, Yeo H, Piper CL, Bell RH, Sosa JA. Impact of family and gender on career goals: results of a national survey of 4586 surgery residents. *Arch Surg*. 2010;145:418–424.
102. Ellis MC, Dhungel B, Weerasinghe R, Vetto JT, Deveney K. Trends in research time, fellowship training, and practice patterns among general surgery graduates. *J Surg Educ*. 2011;68:309–312.

103. Mok PS, Probyn L, Finlay K. Factors influencing radiology residents' fellowship training and practice preferences in Canada. *Can Assoc Radiol J*. 2016;67:99–104.
104. Matson AP, Kavolus JJ, Byrd WA, Leversedge FJ, Brigman BE. Influence of trainee experience on choice of orthopaedic subspecialty fellowship. *J Am Acad Orthop Surg*. 2018;26:e62–e67.
105. Palisoul M, Greenwade M, Massad LS, et al. Factors influencing residents' interest in gynecologic oncology fellowship. *Gynecol Oncol Rep*. 2019;30:100504.
106. DeWitt DE, Curtis JR, Burke W. What influences career choices among graduates of a primary care training program? *J Gen Intern Med*. 1998;13:257–261.
107. Freilich DA, Nguyen HT, Phillips JL. Factors influencing residents' pursuit of urology fellowships. *Urology*. 2011;78:986–992.
108. Xu G, Rattner SL, Veloski JJ, Hojat M, Fields SK, Barzansky B. A national survey of the factors influencing men and women physicians' choices of primary care specialties. *Acad Med*. 1995;70:398–404.
109. Krol D, Morris V, Betz J, Cadman E. Factors influencing the career choices of physicians trained at Yale-New Haven Hospital from 1929 through 1994. *Acad Med*. 1998;73:313–317.
110. Woodworth PA, Chang FC, Helmer SD. Debt and other influences on career choices among surgical and primary care residents in a community-based hospital system. *Am J Surg*. 2000;180:570–575.
111. Heiligers PJ, Hingstman L. Career preferences and the work–family balance in medicine: gender differences among medical specialists. *Soc Sci Med*. 2000;50:1235–1246.
112. Chung KC, Lau FH, Kotsis SV, Kim HM. Factors influencing residents' decisions to pursue a career in hand surgery: a national survey. *J Hand Surg Am*. 2004;29:738–747.
113. Incorvaia AN, Ringley CD, Boysen DA. Factors influencing surgical career decisions. *Curr Surg*. 2005;62:429–435.
114. Schmitz CC, Rothenberger DA, Trudel JL, Wolff BG. Career decisions and the structure of training: an American Board of Colon and Rectal Surgery survey of colorectal residents. *Ann Surg*. 2009;250:62–67.
115. Tabaee A, Luong A, Fried MP. Fellowship training in rhinology: a survey of fellow from the past 6 years. *Arch Otolaryngol Head Neck Surg*. 2009;135:571–574.
116. Arnold RW, Goske MJ, Bulas DI, Benya EC, Ying J, Sunshine JH. Factors influencing subspecialty choice among radiology residents: a case study of pediatric radiology. *J Am Coll Radiol*. 2009;6:635–642.
117. Lagwinski N, Hunt JL. Fellowship trends of pathology residents. *Arch Pathol Lab Med*. 2009;133:1431–1436.
118. West CP, Drefahl MM, Popkave C, Kolars JC. Internal medicine resident self-report of factors associated with career decisions. *J Gen Intern Med*. 2009;24:946–949.
119. Borman KB, Biester TW, Rhodes RS. Motivations to pursue fellowships are gender neutral. *Arch Surg*. 2010;145:671–678.
120. Weinstein AR, Reidy K, Norwood VF, Mahan JD. Factors influencing pediatric nephrology trainee entry into the workforce. *Clin J Am Soc Nephrol*. 2010;5:1770–1774.
121. Scott I, Gowans M, Wright B, Brenneis F, Banner S, Boone J. Determinants of choosing a career in family medicine. *CMAJ*. 2011;183:E1–E8.
122. Daniels VJ, Kassam N. Determinants of internal medicine residents' choice in the Canadian R4 fellowship match: a qualitative study. *BMC Med Educ*. 2011;11:44.
123. Scott I, Gowans M, Wright B, Brenneis F. Determinants of choosing a career in surgery. *Med Teach*. 2011;33:1011–1017.
124. Macdonald C, Cawood T. Factors influencing career decisions in internal medicine. *Intern Med J*. 2012;42:918–923.
125. Bonura EM, Lee ES, Ramsey K, Armstrong WS. Factors influencing internal medicine resident choice of infectious disease or other specialties: a national cross-sectional study. *Clin Infect Dis*. 2016;63:155–163.
126. Gedde SJ, Budenz DL, Haft P, Lee Y, Quigley HA. Factors affecting the decision to purse glaucoma fellowship training. *J Glaucoma*. 2007;16:81–87.
127. Haft P, Gedde SJ, Budenz DL, Schiffman JC, Lee Y. Factors affecting the decision to pursue vitreoretinal fellowship training. *J Acad Ophthalmol*. 2008;1:11–19.
128. Chen X, Zafar S, Srikumaran D, et al. Factors influencing postgraduate career decisions of ophthalmology residents. *J Acad Ophthalmol*. 2020;12:e124–e133.
129. Frohman LP. How can we assure that neuro-ophthalmology will survive? *Ophthalmology*. 2005;112:741–743.
130. Hasan SJ, Castanes MS, Coats DK. A survey of ophthalmology residents' attitudes toward pediatric ophthalmology. *J Pediatr Ophthalmol Strabismus*. 2009;46:25–29.
131. Parija S, Mahajan P. Is pediatric ophthalmology a popular subspecialty in India: present scenario and future remedies. *Indian J Ophthalmol*. 2017;65:1187–1191.
132. Scott JR, Gunderson CA. A study of prospective ophthalmology residents' career perceptions. *Med Educ Online*. 2003;8:4332.
133. Cummings SM, Savitz LA, Konrad TR. Reported response rates to mailed physician questionnaires. *Health Serv Res*. 2001;35:1347–1355.
134. Fleiss JL. *The measurement of interrater agreement*. New York: John Wiley & Sons; 1981:223.
135. Bonett DG. Sample size requirements for estimating intraclass correlations with desired precision. *Stat Med*. 2003;21:1331–1335.
136. Medscape. Physician lifestyle report; 2014. Available at: https://www.medscape.com/sites/public/lifestyle/2014. Accessed October 24, 2020.
137. Grover BT, Kothari SN. Fellowship training: Need and contributions. *Surg Clin North Am*. 2016;96:47–57.
138. Mackinnon SE, Mizgala CL, McNeill IY, Walters BC, Ferris LE. Women surgeons: career and lifestyle comparisons among surgical subspecialties. *Plast Reconstr Surg*. 1995;95:321–329.
139. Danesh-Meyer HV, Deva NC, Ku JY, Carroll SC, Tan YW, Gamble G. Differences in practice and personal profiles between male and female ophthalmologists. *Clin Exp Ophthalmol*. 2007;35:318–323.
140. Grauer H, Campbell NM. The aging physician and retirement. *Can J Psychiatry*. 1983;28:552–554.
141. Norman GR, Davis DA, Lamb S, Hanna E, Caulford P, Kaigas T. Competency assessment of primary care physicians as part of a peer-review program. *JAMA*. 1993;270:1046–1051.
142. Choudhry NK, Fletcher RH, Soumerai SB. Systematic review: the relationship between clinical experience and quality of health care. *Ann Intern Med*. 2005;142:260–273.

143. Mitchell DA. Generation Z—Striking the balance: healthy doctors for a healthy community. *Aust Fam Physician*. 2008;37:665–667.
144. Schofield D, Beard J. Baby boomer doctors and nurses: demographic change and transitions to retirement. *Med J Aust*. 2005;183:80–83.
145. Passi V, Johnson N. The impact of positive doctor role modeling. *Med Teach*. 2016;38:1139–1145.
146. Illes J, Glover GH, Wexler L, Leung AN, Glazer GM. A model for faculty mentoring in academic radiology. *Acad Radiol*. 2000;7:717–724.
147. Curtis P, Dickinson P, Steiner J, Lanphear B, Vu K. Building capacity for research in family medicine: is the blueprint faculty? *Fam Med*. 2003;35:124–130.
148. Steiner JF, Curtis P, Lanphear BP, Vu KO, Main DS. Assessing the role of influential mentors in research development in primary care fellows. *Acad Med*. 2004;79:865–872.
149. Sambunjak D, Straus SE, Marusic A. Mentoring in academic medicine: a systematic review. *JAMA*. 2006;296:1103–1105.
150. Galicia AR, Klima RR, Date ES. Mentorship in physical medicine and rehabilitation residencies. *Am J Phys Med Rehabil*. 1997;76:268–275.
151. Tsai JC, Lee PP, Chasteen S, Taylor RJ, Brennan MW, Schmidt GE. Resident physician mentoring program in ophthalmology: the Tennessee experience. *Arch Ophthalmol*. 2006;124:264–267.
152. Howe N, Strauss W. *Millennials Rising: The Next Generation*. New York: Vintage Books; 2000.
153. Sidawy AN. Presidential address: Generations apart—bridging the generational divide in vascular surgery. *J Vasc Surg*. 2003;38:1147–1153.
154. Bickel J, Brown AJ. Generation X: implications for faculty recruitment and development in academic health centers. *Acad Med*. 2005;80:205–210.
155. Borges NJ, Manuel RS, Elam CL, Jones BJ. Comparing Millennial and Generation X medical students at one medical school. *Acad Med*. 2006;81:571–576.
156. Borges NJ, Manuel RS, Elam CL, Jones BJ. Differences in motives between Millennial and Generation X medical students. *Med Educ*. 2010;44:570–576.
157. DiLullo C, McGee P, Kribel RM. Demystifying the Millennial student: a reassessment in measures of character and engagement in professional education. *Anat Sci Educ*. 2011;4:214–226.
158. Mets MB, Brown A, Doan AP, et al. The ophthalmologist of the future. *Arch Ophthalmol*. 2012;130:1190–1194.
159. Twenge JM. Generational changes and their impact in the classroom: teaching generation me. *Med Educ*. 2009;43:398–405.
160. Mathews M, Seguin M, Chowdhury N, Card RT. Generational differences in factors influencing physicians to choose a work location. *Rural Remote Health*. 2012;12:1864.
161. Mizgala CL, Mackinnon SE, Walters BC, Ferris LE, McNeill IY, Knighton T. Women surgeons: results of the Canadian population study. *Ann Surg*. 1993;218:37–46.
162. Jinapriya D, Cockerill R, Trope GE. Career satisfaction and surgical practice patterns among female ophthalmologists. *Can J Ophthalmol*. 2003;38:373–378.
163. Ahmad S, Ramulu P, Akpek E, Deobhakta A, Klawe J. Gender-specific trends in ophthalmologist Medicare collections. *Am J Ophthalmol*. 2020;214:32–39.
164. Mimouni M, Zayit-Soudry S, Segal O, et al. Trends in authorship of articles in major ophthalmology journals by gender, 2002–2014. *Ophthalmology*. 2016;123:1824–1828.
165. Kramer PW, Kohnen T, Groneberg DA, Bendels MHK. Sex disparities in ophthalmic research: a descriptive bibliometric study on scientific authorships. *JAMA Ophthalmol*. 2019;137:1223–1231.
166. Kalavar M, Watane A, Balaji N, et al. Authorship gender composition in the ophthalmology literature from 2015 through 2019. *Ophthalmology*. 2021;128:617–619.
167. Camacci ML, Lu A, Lehman EB, Scott IU, Bowie E, Pantanelli SM. Association between sex composition and publication productivity of journal editorial and professional society board members in ophthalmology. *JAMA Ophthalmol*. 2020;138:451–458.
168. Patel SH, Truong T, Tsui I, Moon JY, Rosenberg JB. Gender of presenters at ophthalmology conferences between 2015 and 2017. *Am J Ophthalmol*. 2020;213:120–124.
169. Shah DN, Volpe NJ, Abbuhl SB, Pietrobon R, Shah A. Gender characteristics among academic ophthalmology leadership, faculty, and residents: results from a cross-sectional survey. *Ophthalmic Epidemiol*. 2010;17:1–6.
170. Dotan G, Qureshi HM, Gaton DD. Chairs of United States academic ophthalmology departments: a descriptive analysis and trends. *Am J Ophthalmol*. 2018;196:26–33.
171. Kloosterboer A, Yannuzzi NA, Gedde SJ, Sridhar J. Residency program directors of United States ophthalmology programs: a descriptive analysis. *Am J Ophthalmol*. 2020;209:71–76.
172. Bergus GR, Randall CS, Winniford MD, Mueller CW, Johnson SR. Job satisfaction and workplace characteristics of primary and specialty care physicians at a bimodal medical school. *Acad Med*. 2001;76:1148–1152.
173. Burke CA, Sastri SV, Jacobsen G, Arlow FL, Karlstadt RD, Raymond P. Gender disparity in the practice of gastroenterology: the first 5 years of a career. *Am J Gastroneterol*. 2005;100:259–264.
174. Uhlenberg P, Cooney TM. Male and female physicians: family and career comparisons. *Soc Sci Med*. 1990;30:373–378.
175. Commonwealth Fund. Training tomorrow's doctors: the medical education mission of academic health centers. Available at: https://www.commonwealthfund.org/publications/fund-reports/2002/apr/training-tomorrows-doctors-medical-education-mission-academic. (Accessed 24 October 2020)
176. Sonnad SS, Colletti LM. Issues in the recruitment and success of women in academic surgery. *Surgery*. 2002;132:415–419.
177. McAlister C, Jin YP, Braga-Mele R, DesMarchais BF, Buys YM. Comparison of lifestyle and practice patterns between male and female Canadian ophthalmologists. *Can J Ophthalmol*. 2014;49:287–290.
178. Williams AP, Domnick-Pierre K, Vayda E, Stevenson HM, Burke M. Women in medicine: practice patterns and attitudes. *CMAJ*. 1990;143:194–201.
179. Woodward CA, Cohen ML, Ferrier BM. Career interruptions and hours practiced: comparison between young men and women physicians. *Can J Public Health*. 1990;81:16–20.
180. Dedobbeleer N, Contandriopoulos AP, Desjardins S. Con-

vergence or divergence of male and female physicians' hours of work and income. *Med Care*. 1995;33:796–805.
181. Woodward CA, Williams AP, Ferrier B, Cohen M. Time spent on professional activities and unwaged domestic work. Is it different for male and female primary care physicians who have children at home? *Can Fam Physician*. 1996;42:1928–1935.
182. McMurray JE, Cohen M, Angus G, et al. Women in medicine: a four-nation comparison. *J Am Med Womens Assoc*. 2002;57:185–190.
183. Yutzie JD, Shellito JL, Helmer SD, Chang FC. Gender differences in general surgical careers: results of a post-residency survey. *Am J Surg*. 2005;190:955–999.
184. DeMartino R, Barbato R. Differences between women and men MBA entrepreneurs: exploring family flexibility and wealth creation as career motivators. *J Bus Venturing*. 2003;18:815–832.
185. Sivachandran N, Noble J, Dollin M, O'Connor MD, Gupta RR. Trends in subspecialty training by Canadian ophthalmology graduates. *Can J Ophthalmol*. 2016;51:201–206.
186. Gable MS, Mohr JD, O'Brien TP, Lee P, Colenbrander A, Singh K. The subspecialty training, practice type, and geographical distribution of recently training ophthalmologists: a study of male and female physicians. *J Am Med Womens Assoc*. 2000;55:20–26.
187. Noble J, Schendel S, Daniel S, Baerlocher MO. Motivations and future trends: a survey of Canadian ophthalmology residents. *Can J Ophthalmol*. 2007;42:821–825.
188. Gong D, Winn BJ, Beal CJ, et al. Gender differences in case volume among ophthalmology residents. *JAMA Ophthalmol*. 2019;137:1015–1020.
189. Myerson SL, Sternbach JM, Zwischenberger JB, Bender EM. The effect of gender on resident autonomy in the operating room. *J Surg Educ*. 2017;74:e111–e118.
190. French DD, Margo CE, Campbell RR, Greenberg PB. Volume of cataract surgery and surgeon gender: the Florida ambulatory surgery center experience 2005 through 2012. *J Med Pract Manage*. 2016;31:297–302.
191. Feng PW, Ahluwalia A, Adelman RA, Chow JH. Gender differences in surgical volume among cataract surgeons. *Ophthalmology*. 2021;128:795–796.
192. Sarsons H. *Interpreting signals in the labor market: evidence from medical referrals*. Harvard University; 2017 *https://scholar.harvard.edu/sarsons/publications/interpreting-signals-evidence-medical-referrals*.
193. Baker LC. Differences in earnings between male and female physicians. *N Engl J Med*. 1996;334:960–964.
194. Esteves-Sorenson C, Snyder J. The gender earnings gap for physicians and its increase over time. *Econ Lett*. 2012;116:37–41.
195. Jena AB, Lenski AR, Blumenthal DM. Sex differences in physician salary in US public medical schools. *JAMA Intern Med*. 2016;176:1294–1304.
196. Mahr MA, Hayes SN, Shanafelt TD, Sloan JA, Erie JC. Gender differences in physician services provision using Medicare claims data. *Mayo Clin Proc*. 2017;92:870–880.
197. Reddy AK, Bounds GW, Bakri SJ, et al. Differences in clinical activity and Medicare payments for female vs male ophthalmologists. *JAMA Ophthalmol*. 2017;135:205–213.
198. Holliday EB, Brady C, Pipkin WC, Somerson JS. Equal pay for equal work: Medicare procedure volume and reimbursement for male and female surgeons performing total knee and total hip arthroplasty. *J Bone Joint Surg Am*. 2018;100:e21.
199. Weeks WB, Wallace AE. Gender differences in ophthalmologists' annual incomes. *Ophthalmology*. 2007;114:1696–1701.
200. Roter DL, Hall JA, Aoki Y. Physician gender effects in medical communication: a meta-analytic review. *JAMA*. 2002;288:756–764.
201. Fountain TR. Ophthalmic malpractice and physician gender: a claims data analysis (an American Ophthalmological Society thesis). *Trans Am Ophthalmol Soc*. 2014;112:38–49.
202. Straus SE, Straus C, Tzanetos K. International Campaign to Revitalise Academic Medicine. Career choice in academic medicine: systematic review. *J Gen Intern Med*. 2006;21:1222–1229.
203. Frieden C, Fox BJ. Career choices of graduates from Washington University's Medical Scientist Training Program. *Acad Med*. 1991;66:162–164.
204. McClellan DA, Talalay PM. D.-PhD training at the Johns Hopkins University School of Medicine, 1962–1991. *Acad Med*. 1992;67:36–41.
205. Abelmann WH, Nave BC, Wilkerson L. Generation of physician-scientists manpower: a follow-up study of the first 294 graduates of the Harvard-MIT Program of Health Sciences and Technology. *J Invest Med*. 1997;45:272–275.
206. Fang D, Meyer RE. Effect of two Howard Hughes Medical Institute research training programs for medical students on the likelihood of pursuing research careers. *Acad Med*. 2003;78:1271–1280.
207. Chao DL, Schiffman JC, Gedde SJ. Characterization of a clinician-scientist cohort in ophthalmology: a demographic analysis of K grant awardees in ophthalmology. *Ophthalmology*. 2013;120:2146–2150.
208. Protopsaltis NJ, Chen AJ, Hwang V, Gedde SJ, Chao DL. Success in attaining independent funding among National Institutes of Health K grant awardees in ophthalmology. *JAMA Ophthalmol*. 2018;136:1335–1340.
209. Ambati BK, Cahoon J. Rejuvenating clinician-scientist training. *Invest Ophthalmol Vis Sci*. 2014;55:1853–1855.
210. Epstein DL. Is the ophthalmologist as a clinician-scientist still viable? *Arch Ophthalmol*. 1991;109:1523–1524.
211. Rosenberg LE. The physician-scientist: an essential—and fragile—link in the medical research chain. *J Clin Invest*. 1999;103:1621–1626.
212. Weinreb RN, Goldberg JL. Clinician-scientists in ophthalmology revisited. *Ophthalmology*. 2013;120:2146–2150.
213. Dana R, Miller JW. On the Edge: The clinician-scientist in ophthalmology. *JAMA Ophthalmol*. 2013;131:1401–1402.
214. Culican SM, Rupp JD, Margolis TP. Retaining clinician–scientists: nature versus nurture. *Invest Ophthalmol Vis Sci*. 2014;55:3219–3222.
215. Paik JC, Howard G, Lorenz RG. Postgraduate choices of graduates from medical scientist training programs, 2004–2008. *JAMA*. 2009;302:1271–1273.
216. Brass LF, Akabas MH, Burnley LD, Engman DM, Wiley CA, Anderson OS. Are MD-PhD programs meeting their goals? An analysis of career choices made by graduates of 24 MD-PhD programs. *Acad Med*. 2010;85:692–701.

217. Wright S. Examining what residents look for in their role models. *Acad Med*. 1996;71:290–292.
218. Simpson DE, Rediske VA, Beecher A, et al. Understanding the careers of physician educators in family medicine. *Acad Med*. 2001;76:259–265.
219. Jolly P. Medical student tuition and younger physicians' indebtedness. *Health Aff (Millwood)*. 2005;24:527–535.
220. Hellenthal NJ, Ramirez ML, Yap SA, Kurzrock EA. Manuscript publication by urology residents and predictive factors. *J Urol*. 2009;181:281–286.
221. Pratt LW. Specialization vs. fragmentation: views from a former Regent. *Bull Am Coll Surg*. 1990;75:6–11.
222. Anderson RJ. Subspecialization in internal medicine: a historical view, an analysis, and proposals for change. *Am J Med*. 1995;99:74–81.
223. Stitzenberg KB, Sheldon GF. Progressive specialization within general surgery: adding to the complexity of workforce planning. *J Am Coll Surg*. 2005;201:925–932.
224. Cassel CK, Reuben DB. Specialization, subspecialization, and subsubspecialization in internal medicine. *N Engl J Med*. 2011;364:11169–11173.
225. Frohman LP. The human resource crisis in neuro-ophthalmology. *J Neuroophthalmol*. 2008;28:231–234.
226. Pletcher BA, Rimsza ME, Cull WL, Shipman SA, Shugerman RP, O'Connor KG. Primary care pediatricians' satisfaction with subspecialty care, perceived supply, and barriers to care. *J Pediatr*. 2010;156:1011–1015.
227. Vajaranant TS, Wu S, Torres M, Varma RA. 40-year forecast of the demographic shift in primary open-angle glaucoma. *Invest Ophthalmol Vis Sci*. 2012;53:2464–2466.
228. Simon JW, Bradfield Y, Smith J, Ahn E, France TD. Recruitment and manpower in pediatric ophthalmology and strabismus. *J AAPOS*. 2007;11:336–340.
229. Nelson LB. Declining field of pediatric ophthalmology. *J Pediatr Ophthalmol Strabismus*. 2009;46:11.
230. Kothari M, Mody K. A survey of ophthalmology residents' attitudes toward pediatric ophthalmology [comment]. *J Pediatr Ophthalmol Strabismus*. 2011;48:126.
231. Kempton JE, Shields MB, Afshari NA, Dou W, Adelman RA. Fellow selection criteria. *Ophthalmology*. 2009;116:1020.
232. Meyer DR, Dewan MA. Fellowship selection criteria in ophthalmic plastic and reconstructive surgery. *Ophthal Plast Recons*. 2010;26:357–359.
233. Campbell RJ, Bell CM, Gill SS, et al. Subspecialization in glaucoma surgery. *Ophthalmology*. 2012;119:2270–2273.
234. Campbell RJ, Bell CM, Gill SS, et al. Clinic-based glaucoma care in the era of surgical subspecialization. *Am J Ophthalmol*. 2014;157:631–639.
235. Campbell RJ, Gill SS, Ten Hove M, et al. Strabismus surgical subspecialization: a population-based analysis. *JAMA Ophthalmol*. 2015;133:555–559.
236. Shingleton BJ, Crandall A, Johnstone M, Robin A, Brown R. Medical treatment patterns of ASCRS members for primary open-angle glaucoma—1998 survey. *J Cataract Refract Surg*. 1999;25:118–127.
237. Brown RH, Shingleton BJ, Johnstone M, Crandall A, Robin A. Glaucoma laser treatment parameters and practices of ASCRS members—1999 survey. *J Cataract Refract Surg*. 2000;26:755–765.
238. Albrecht KG, Lee PP. Conformance with preferred practice patterns in caring for patients with glaucoma. *Ophthalmology*. 1994;101:1668–1671.
239. Hertzog LH, Albrecht KG, LaBree L, Lee PP. Glaucoma care and conformance with preferred practice patterns. Examination of the private, community-based ophthalmologist. *Ophthalmology*. 1996;103:1009–1013.
240. Gordon-Bennett PSC, Ionnidis AS, Papageorgiou K, Andreou PS. A survey of investigations used for the management of glaucoma in hospital service in the United Kingdom. *Eye*. 2008;22:1410–1418.
241. Boland MV, Quigley HA, Lehmann HP. The impact of physician subspecialty training, risk calculation, and patient age on treatment recommendations in ocular hypertension. *Am J Ophthalmol*. 2011;152:638–645.
242. Halm EA, Lee C, Chassin MR. Is volume related to outcome in health care? A systematic review and methodologic critique of the literature. *Ann Intern Med*. 2002;137:511–520.
243. Smetana GW, Landon BE, Bindman AB, et al. A comparison of outcomes resulting from generalist vs specialist care for a single discrete medical condition: a systematic review and methodologic critique. *Arch Intern Med*. 2007;167:10–20.
244. Leigh JP, Tancredi DJ, Kravitz RL. Physician career satisfaction within specialties. *BMC Health Serv Res*. 2009;9:166.
245. Burke RJ. Stress, satisfaction and militancy among Canadian physicians: a longitudinal investigation. *Soc Sci Med*. 1996;43:517–524.
246. Kravitz RL, Shapiro MF, Linn LS, Froelicher ES. Risk factors associated with participation in the Ontario, Canada doctors' strike. *Am J Public Health*. 1989;79:1227–1233.
247. Haas JS, Cook EF, Puopolo RL, Burstin HR, Cleary PD, Brennan TA. Is the professional satisfaction of general internists associated with patient satisfaction? *J Gen Intern Med*. 2000;15:122–128.
248. DeVoe J, Fryer GE, Hargraves JL, Phillips RL, Green LA. Does career dissatisfaction affect the ability of family physicians to deliver high-quality care? *J Fam Pract*. 2002;51:223–228.
249. Fahrenkopf AM, Sectish TL, Burger LK, et al. Rates of medication errors among depressed and burnt out residents. Prospective cohort study. *Br Med J*. 2008;336:488–491.
250. Sundquist J, Johannsson SE. High demand, low control, and impaired general health: working conditions in a sample Swedish general practitioners. *Scan J Public Health*. 2000;28:123–131.
251. Williams ES, Konrad TR, Scheckler WE, et al. Understanding physicians' intentions to withdraw from practice: the role of job satisfaction, job stress, mental and physical health. *Health Care Manage Rev*. 2001;26:7–19.
252. Simoens S, Scott A, Sibbald B. Job satisfaction, work-related stress and intentions to quit of Scottish GPs. *Scott Med J*. 2002;47:80–86.
253. Rittenhouse DR, Mertz E, Keane D, Grumbach K. No exit: an evaluation of measures of physician attrition. *Health Serv Res*. 2004;39:1571–1588.
254. Landon BE, Reschovsky JD, Pham HH, Blumenthal D. Leaving medicine: the consequences of physician dissatisfaction. *Med Care*. 2006;44:234–242.
255. Leigh JP, Kravitz RL, Schembri M, Samuels SJ, Mobley S. Physician career satisfaction across specialties. *Arch Intern Med*. 2002;162:1577–1584.
256. French FH, Andrew JE, Awramenko M, et al. Consultants

in NHS Scotland: a survey of work commitments, renumeration, job satisfaction and retirement plans. *Scott Med J*. 2004;49:47–52.
257. Cydulka RK, Korte R. Career satisfaction in emergency medicine: the ABEM Longitudinal Study of Emergency Physicians. *Ann Emerg Med*. 2008;51:714–722.
258. Janus K, Amelung VE, Baker LC, Gaitanides M, Schwartz FW, Rundall TG. Job satisfaction and motivation among physicians in academic medical centers: insights from a cross-national survey. *J Health Polit Policy Law*. 2008;33:1133–1167.
259. Pratt WR. Physician career satisfaction: examining perspectives of the working environment. *Hosp Top*. 2010;88:43–52.
260. Deshpande SP, Deshpande SS. Career satisfaction in surgical specialties. *Ann Surg*. 2011;253:1011–1016.
261. Whalley D, Bjoke C, Bravelle H, Sibbald B. GP job satisfaction in view of contract reform: a national survey. *Br J Gen Pract*. 2006;56:87–92.
262. Bogue R, Guarneri JG, Reed M, Bradley K, Hughes J. Secrets of physician satisfaction: study identifies pressure points and reveals life practices of highly satisfied doctors. *Physician Exec*. 2006;32:30–39.
263. Katerndahl D, Parchman M, Wood R. Perceived complexity of care, perceived autonomy, and career satisfaction among primary care physicians. *J Am Board Fam Med*. 2009;22:24–33.
264. Linzer M, Manwell LB, Williams ES, et al. Working conditions in primary care: physician reactions and care quality. *Ann Intern Med*. 2009;151:28–36.
265. Newbury-Birch D, Kamali F. Psychological stress, anxiety, depression, job satisfaction, and personality characteristics in preregistration house officers. *Postgrad Med J*. 2001;77:109–111.
266. Ulmer B, Harris M. Australian GPs are satisfied with their job: even more so in rural areas. *Fam Pract*. 2002;19:300–303.
267. Grant P. Physician job satisfaction in New Zealand versus the United Kingdom. *N Z Med J*. 2004;117:U1123.
268. O'Sullivan B, Keane AM, Murphy AW. Job stressors and coping strategies as predictors of mental health and job satisfaction among Irish general practitioners. *Ir Med J*. 2005;98:199–202.
269. Williams ES, Manwell LB, Konrad TR, Linzer M. The relationship of organizational culture, stress, satisfaction and burnout with physician-reported error and suboptimal patient care: results from the MEMO study. *Health Care Manage Rev*. 2007;32:203–212.
270. Hills D, Joyce C, Humphreys J. Validation of a job satisfaction scale in the Australian clinical medical workforce. *Eval Health Prof*. 2012;35:47–76.
271. McGlone SJ, Chenoweth IG. Job demands and control as predictors of occupational satisfaction in general practice. *Med J Aust*. 2001;175:88–91.
272. Kinzl JF, Knotzer H, Traweger C, Lederer W, Heidegger T, Benzer A. Influence of working conditions on job satisfaction in anaesthetists. *Br J Anaesth*. 2005;94:211–215.
273. Bell D, Bringman J, Bush A, Phillips OP. Job satisfaction among obstetrician-gynecologists: a comparison between private practice physicians and academic physicians. *Am J Obstet Gynecol*. 2006;195:1474–1478.
274. McNearney TA, Hunnicutt SE, Maganti R, Rice J. What factors relate to job satisfaction among rheumatologists? *J Clin Rheumatol*. 2008;14:133–137.
275. Mello MM, Studdert DM, DesRoches CM, et al. Caring for patients in a malpractice crisis: physician satisfaction and quality of care. *Health Aff*. 2004;23:42–53.
276. Garfinkel PE, Bagby RM, Schuller DR, Dickens SE, Schulte FS. Predictors of professional and personal satisfaction with a career in psychiatry. *Can J Psychiatry*. 2005;50:333–341.
277. Pagan JA, Balasubramanian L, Pauly MV. Physicians' career satisfaction, quality of care and patients' trust: The role of community uninsurance. *Health Econ Policy Law*. 2007;2(Pt 4):347–362.
278. Komaromy M, Bindman AB, Haber RJ, Sande MA. Sexual harassment in medical training. *N Engl J Med*. 1993;328:352–358.
279. Frank E, Brogan D, Schiffman M. Prevalence and correlates of harassment among US women physicians. *Arch Intern Med*. 1998;158:352–358.
280. Fried LP, Francomano CA, MacDonald SM, et al. Career development for women in academic medicine: Multiple interventions in a department of medicine. *JAMA*. 1996;276:898–905.
281. Tesch BJ, Wood HM, Helwig AL, Nattinger AB. Promotion of women physicians in academic medicine: glass ceiling or sticky floor? *JAMA*. 1995;273:1022–1025.
282. Kaplan SH, Sullivan LM, Dukes KA, Phillips CF, Kelch RP, Schaller JG. Sex differences in academic advancement: results of a national study of pediatricians. *N Engl J Med*. 1996;335:1282–1289.
283. Ducker D. Research on women physicians with multiple roles: a feminist perspective. *J Am Med Womens Assoc*. 1994;49:78–84.
284. McMurray JE, Linzer M, Konrad TR, et al. The work lives of women physicians: results from the Physician Work Life Study. *J Gen Intern Med*. 2000;15:372–380.
285. Rosta J, Nylenna M, Aasland OG. Job satisfaction among hospital doctors in Norway and Germany. A comparative study on national samples. *Scand J Public Health*. 2009;37:503–508.
286. Frank E, McMurray JE, Linzer M, Elon L. Society of Internal Medicine Career Satisfaction Study Group. Career satisfaction of US women physicians. Results from the Women Physicians' Health Study. *Arch Intern Med*. 1999;159:1417–1426.
287. Linzer M, Kongrad TR, Douglas J, et al. Managed care, time pressure, and physician job satisfaction: results from the Physician Worklife Study. *J Gen Intern Med*. 2000;15:441–450.
288. Haas JS, Cleary PD, Puopolo AL, Burstin HR, Cook EF, Brennan TA. Differences in the professional satisfaction of general internists in academically affiliated practices in the greater Boston area. *J Gen Intern Med*. 1998;13:127–130.
289. Garner JG, Scherger JE, Beasley JW, et al. Responses to questions about specialty of family practice as a career. *Am Fam Physician*. 1999;60:167–174.
290. Gallery ME, Whitley TW, Klonis LK, Anzinger RK, Reyicki DA. A study of occupational stress and depression among emergency physicians. *Ann Emerg Med*. 1992;21:58–64.

291. Weinberg DJ, Engasser PG. Dermatologists in Kaiser Permanente—northern California: satisfaction, perceived constraints, and policy options. *Arch Dermatol*. 1996;132:1057–1063.
292. Rose M. Good deal, bad deal? Job satisfaction in occupations. *Work Employ Soc*. 2003;17:503–530.
293. U.S. Department of Health and Human Services Health Resources and Services Administration. National and Regional Projections of Supply and Demand for Surgical Specialty Practitioners: 2013–2025. Available at https://bhw.hrsa.gov/sites/default/files/bhw/health-workforce-analysis/research/projections/surgical-specialty-report.pdf. Accessed October 24, 2020.
294. Lam BL, Lee DJ, Zheng DD, Davila EP, Christ SK, Arheart KL. Disparity of prevalence of self-reported visual impairment in older adults among U.S. race-ethnic subgroups. *Ophthalmic Epidemiol*. 2009;16:144–150.
295. Zhang X, Cotch MF, Ryskulova A, et al. Vision health disparities in the United States by race/ethnicity, education, and economic status: Findings from two nationally representative surveys. *Am J Ophthalmol*. 2012;154(Suppl):S53–S62.
296. Qiu M, Wang SY, Singh K, Lin SC. Racial disparities in uncorrected and undercorrected refractive error in the United States. *Invest Ophthalmol Vis Sci*. 2014;55:6996–7005.
297. Marrast LM, Zallman L, Woolhandler S, Bor DH, McCormick D. Minority physicians' role in the care of underserved patients: diversifying the physician workforce may be key in addressing health disparities. *JAMA Intern Med*. 2014;174:289–291.
298. Walker KO, Moreno G, Grumbach K. The association among specialty, race, ethnicity, and practice location among California physicians in diverse specialties. *J Natl Med Assoc*. 2012;104:46–52.
299. Reede JY. A recurring theme: the need for minority physicians. *Health Aff (Millwood)*. 2003;22:91–93.
300. Simon AE, Marsteller JA, Lin SX. Physician-patient race concordance from the physician perspective. *J Natl Med Assoc*. 2013;105:150–156.
301. Saha S, Guiton G, Wimmers PF, Wilkerson L. Student body racial and ethnic composition and diversity-related outcomes in US medical schools. *JAMA*. 2008;300:1135–1145.
302. Morrison E, Grbic D. Dimensions of diversity and perception of having learned from individuals from different backgrounds: the particular importance of racial diversity. *Acad Med*. 2015;90:937–945.
303. Linz MO, Jun AS, Lever SL. Evaluation of medical students' perception of an ophthalmology career. *Ophthalmology*. 2018;125:461–462.
304. Abelson HT, Bowden RA. Women and the future of academic pediatrics. *J Pediatr*. 1990;116:829–833.
305. Watanabe M. How to attract candidates to academic medicine. *Clin Invest Med*. 1992;15:204–215.
306. Savill J. More in expectation than in hope: a new attitude to training in clinical academic medicine. *BMJ*. 2000;320:630–633.
307. Smith A. *Of the natural and market price of commodities*. New York: Bantam Books; 2003:78–90.
308. Friedman M, Friedman R. *Free to Choose: A Personal Statement*. New York: Harcourt Brace Jovanovich; 1990.
309. McKinney CN, Niederle M, Roth AE. The collapse of a medical labor clearinghouse (and why such failures are rare). *Am Econ Rev*. 2005;95:878–889.
310. Friedman DP, Pramanik BK. Fellowship and practice trends in neuroradiology training programs in the United States. *AJNR Am J Neuroradiol*. 2001;22:1650–1653.