Exposure of Ophthalmology Residents to Cornea and Keratorefractive Surgeries in the United States

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Abstract

Purpose To describe the cornea and keratorefractive surgeries experience of U.S. ophthalmology residents.

Methods Deidentified case logs of residents graduating in 2018 were collected from ophthalmology residency program directors in the United States. Using Current Procedure Terminology codes, case logs were reviewed in the categories of cornea and keratorefractive surgeries. Accreditation Council for Graduate Medical Education national graduating resident surgical case logs on cornea procedures published from 2010 to 2020 were also analyzed.

Results Case logs were received for 152/488 (31.1%) residents from 36/115 (31.3%) ophthalmology residency programs. The most common procedures logged by residents as primary surgeons were pterygium removal (4.3 ± 4.2) and keratorefractive surgeries (3.6 ± 6.2). Residents logged an average of 2.4 keratoplasties as primary surgeon, performing an average of 1.4 penetrating keratoplasties (PKs) and 0.8 endothelial keratoplasties (EKs). As assistants, the most common procedures logged were keratorefractive surgeries (6.1 ± 4.9), EKs (3.8 ± 3.3), and PKs (3.5 ± 2.3). Medium or large residency class size was associated with higher cornea procedural volumes (odds ratio: 8.9; 95% confidence interval: 1.1–75.6; $p < 0.05$).

Conclusion The most common cornea surgeries performed by residents include keratoplasty, keratorefractive, and pterygium procedures. Larger program size was associated with greater relative cornea surgery volume. More specific guidelines for logging of procedures could provide a more accurate assessment of resident exposure to critical techniques such as suturing as well as reflect trends in current practice such as the overall increase in EKs.

Keywords
- ophthalmology residency
- cornea
- keratorefractive surgery
- surgical techniques

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Tremendous advancements in corneal surgical techniques have been achieved in the past two decades, especially with regard to corneal transplantation. Since 2005, there has been a dramatic increase in the number of endothelial keratoplasties (EKs) performed by cornea surgeons nationally,[1] with EK surpassing penetrating keratoplasty (PK) in popularity due to advantages in visual outcomes and postoperative recovery.[2,3] There has been a similar trend of an increasing volume of surgeries performed using lamellar techniques—such as Descemet's stripping endothelial keratoplasty (DSEK), Descemet's membrane endothelial keratoplasty (DMEK), and deep anterior lamellar keratoplasty (DALK)—with a corresponding decrease in the number of PKs performed.[4–6]

The Accreditation Council for Graduate Medical Education (ACGME) sets a minimum number of procedures that ophthalmology residents in the United States must perform. Residents log each case they perform as either the primary surgeon or assistant, which are used to ensure compliance with these program minima, with the ultimate goal of promoting more consistent surgical exposure for residents nationally. Due to the fact that programs strive to meet these minima for the residents in their program across subspecialty categories, the case log requirements set by the ACGME can impact resident exposure to cornea and keratorefractive surgeries and, consequently, their choices for fellowship. Currently, the ACGME requires residents to log eight corneal and six keratorefractive surgeries as primary surgeon or assistant, a requirement that has remained unchanged since 2013. Although corneal surgery is a diverse field which includes numerous types of procedures—including keratoplasty, pterygium/conjunctival surgeries, and more—it represents only 10% of minimum required procedures for graduating ophthalmology residents.[7] Of note, the current requirement does not distinguish between DMEK, DSEK, and PK, which are significantly different procedures with distinct indications and surgical techniques.[5,8]

The purpose of this study is to describe and assess cornea and keratorefractive surgical experiences of ophthalmology residents throughout the United States by compiling data from program surgical case log records. A previous study reviewing case logs of ophthalmology residents from 2009 to 2015 showed significant changes in surgical experience in cataract, retina, and glaucoma in the ways that paralleled practice pattern shifts and new developments in the respective fields, while experience in other subspecialties including cornea remained stable.[9] Our study provides a follow-up to the previous one by several years and is novel in that it assesses corneal surgical volumes using Current Procedural Terminology (CPT) codes.

Methods

The study protocol was reviewed by the Institutional Review Board of The Johns Hopkins University and deemed exempt. All study activities adhered to the tenants of the Declaration of Helsinki and complied with regulations outlined in the Health Insurance Portability and Accountability Act.

Program directors from all 118 ophthalmology residency programs in the United States were contacted via e-mail with a request for individual deidentified case logs from residents graduating in 2018. Program participation was voluntary, and programs that did not respond to the initial inquiry were contacted up to two additional times.

The ACGME sorts cornea and keratorefractive procedures into various minimum categories (►**Table 1**). Case logs were reviewed individually to tabulate the number of surgeries performed as primary surgeon and assistant among different cornea and keratorefractive procedures by CPT codes. For further analysis, the category of keratoplasty was separated by CPT codes into EK and PK, and conjunctival procedures were separated from pterygium excisions. Keratomileusis encompassed excimer laser keratorefractive procedures, most commonly, laser in situ keratomileusis (LASIK) and photorefractive keratectomy (PRK).

Program characteristics were collected, including geographic region (Midwest, Northeast, Southeast, Southwest, and West), urban or rural setting, affiliation with a Veterans Affairs (VA) hospital, presence of an on-site medical school, size of graduating class (categorized as small: 1–3 residents per class; medium: 4–6 residents per class; and large: 7 or more residents per class), and presence of cornea fellowship.

Statistical analysis was performed using Stata version 13 (StataCorp, College Station, TX). Multivariate linear and logistical regressions were performed to evaluate associations between various program characteristics and relative cornea surgical volume. Relative corneal surgical volume was defined as the ratio of the total number of corneal surgeries reported per program to the average number of corneal surgeries performed per program among all 36 programs surveyed.

ACGME resident surgical case logs on cornea and keratorefractive procedures published from 2010 to 2020 were also analyzed to evaluate trends in surgical experiences of ophthalmology residents during this time period.

Results

Analysis of Cornea and Keratorefractive Case Logs Collected from Residency Programs

A total of 152/488 (31.1%) resident case logs from 36/115 (31.3%) ophthalmology residency programs were collected. All but two programs were in an urban setting, and nearly all were associated with a VA hospital and had an on-site medical school (►**Table 2**). Approximately one-third of programs were categorized as small, with the remaining two-thirds of programs were considered medium or large. The mean ($\pm$ standard deviation) size of programs in terms of residents per year of training was 4.25 ± 1.35, while the median size was 4 (interquartile range: 3–5). Twenty-one programs (58.3%) offered cornea fellowships, and 15 programs (41.7%) did not.

As primary surgeon or assistant, residents from small, medium, and large programs logged an average number ($\pm$ standard deviation) of total corneal and keratorefractive surgeries of 33.0 ± 15.0, 37.6 ± 22.7, and 37.3 ± 19.3,

Table 1 Cornea and keratorefractive surgery procedures categorized by ACGME minimum categories and CPT codes

ACGME minimum category	CPT code	Name of procedure
Keratoplasty	65730	Keratoplasty (corneal transplant); penetrating (except in aphakia or pseudophakia)
	65750	Keratoplasty (corneal transplant); penetrating (in aphakia)
	65755	Keratoplasty (corneal transplant); penetrating (in pseudophakia)
	65756	Keratoplasty (corneal transplant); endothelial
Conjunctival procedures/ pterygium procedures	0402T	Collagen cross-linking of cornea, including removal of the corneal epithelium and intraoperative pachymetry, when performed
	65400	Excision of lesion, cornea (keratectomy, lamellar, partial), except pterygium
	65410	Biopsy of cornea
	65420	Excision or transposition of pterygium; without graft
	65426	Excision or transposition of pterygium; with graft
	65710	Keratoplasty (corneal transplant); anterior lamellar
	65770	Keratoprosthesis
	65779	Placement of amniotic membrane on the ocular surface; single layer, sutured
	65780	Ocular surface reconstruction; amniotic membrane transplantation, multiple layers
	65800	Paracentesis of anterior chamber of eye (separate procedure); with removal of aqueous
	65865	Severing adhesions of anterior segment of eye, incisional technique (with or without injection of air or liquid) (separate procedure); goniosynechiae
	65870	Severing adhesions of anterior segment of eye, incisional technique (with or without injection of air or liquid) (separate procedure); anterior synechiae, except goniosynechiae
	65875	Severing adhesions of anterior segment of eye, incisional technique (with or without injection of air or liquid) (separate procedure); posterior synechiae
	65880	Severing adhesions of anterior segment of eye, incisional technique (with or without injection of air or liquid) (separate procedure); corneovitreal adhesions
	65900	Removal of epithelial downgrowth, anterior chamber of eye
	66130	Excision of lesion, sclera
	66225	Repair of scleral staphyloma with graft
	66250	Revision or repair of operative wound of anterior segment, any type, early or late, major or minor procedure
	68100	Biopsy of conjunctiva
	68110	Excision of lesion, conjunctiva; up to 1 cm
	68115	Excision of lesion, conjunctiva; over 1 cm
	68130	Excision of lesion, conjunctiva; with adjacent sclera
	68320	Conjunctivoplasty; with conjunctival graft or extensive rearrangement
	68325	Conjunctivoplasty; with buccal mucous membrane graft (includes obtaining graft)
	68326	Conjunctivoplasty, reconstruction cul-de-sac; with conjunctival graft or extensive rearrangement
	68328	Conjunctivoplasty, reconstruction cul-de-sac; with buccal mucous membrane graft (includes obtaining graft)
	68330	Repair of symblepharon; conjunctivoplasty, without graft
	68335	Repair of symblepharon; with free graft conjunctiva or buccal mucous membrane (includes obtaining graft)
	68340	Repair of symblepharon; division of symblepharon, with or without insertion of conformer or contact lens

(*Continued*)

Table 1 (*Continued*)

ACGME minimum category	CPT code	Name of procedure
	68360	Conjunctival flap; bridge or partial (separate procedure)
	68362	Conjunctival flap; total (such as Gunderson thin flap or purse string flap)
	65785	Implantation of intrastromal corneal ring segments
Laser procedures	65760	Keratomileusis
	65767	Epikeratoplasty
Incisional procedures	65771	Radial keratotomy
	65772	Corneal relaxing incision for correction of surgically induced astigmatism
	65775	Corneal wedge resection for correction of surgically induced astigmatism
Other procedures	65778	Placement of amniotic membrane on the ocular surface; without sutures

Abbreviations: ACGME, Accreditation Council for Graduate Medical Education; CPT, Current Procedural Terminology.

Table 2 Characteristics of U.S. residency programs that provided anonymous 2018 case logs

Program characteristic	*N*	%
Size		
Mean (SD)	12.75 (4.04)	
Median (IQR)	12 (9–15)	
Region		
Midwest	8	22.2
Northeast	8	22.2
Southeast	9	25.0
Southwest	4	11.1
West	7	19.4
Veterans Affairs association	31	86.1
Urban training center	34	94.4
On-site medical school	32	88.9
Graduating class size		
Small (1–3 residents/class)	12	33.3
Medium (4–6 residents/class)	22	61.1
Large (7+ residents/class)	2	5.6
Corneal fellowship	21	58.3
Total number of programs	36	100

Abbreviations: IQR, interquartile range; SD, standard deviation.

respectively, for an overall average of 36.6 ± 20.9 among all residents in our cohort. Data on mean, standard deviation, minimum, and maximum cases for each case procedure type are shown in ►**Table 3**. The procedures with the highest logged number of cases (in order of decreasing frequency) included keratorefractive surgery, pterygium procedures, PK, EK, excision of lesion, corneal relaxing incision, and conjunctival procedures. As primary surgeons, the most common procedures residents logged were pterygium (4.3 ± 4.2) and keratorefractive surgeries (3.6 ± 6.2). The most common procedures residents logged as assistants were keratorefractive surgeries (6.1 ± 4.9), EK (3.8 ± 3.3), and PK (3.5 ± 2.3). Of note, PK was the only cornea procedure that every resident in all programs logged as assistants. As primary surgeons or assistants, residents least commonly logged (in order of increasing frequency) amniotic membrane transplantation, ocular surface reconstruction, implantation of intrastromal corneal ring segments, keratoprosthesis, DALK, and epikeratoplasty. Residents in programs with corneal fellowships performed an average of 33.2 total corneal procedures compared with residents in programs without corneal fellowships who performed an average of 32.4 total corneal procedures. There was no statistically significant difference in the total number of corneal procedures or in the total number of EKs and PKs performed by residents in programs with versus without corneal fellowships ($p = 0.80$).

Of the various program characteristics analyzed, only medium or large graduating class size was associated with higher relative cornea surgical volume (odds ratio: 8.9; 95% confidence interval: 1.1–75.6; $p < 0.05$) using multivariate linear regression analysis (►**Table 4**).

Comparison of Our Sample with Programs Nationally

Distribution of program size in our sample is similar to the distribution of program size of 120 residency programs of which 41 (34.2%) are small and 79 (65.8%) are medium or large ($p = 0.93$). As an assistant or primary surgeon, residents in our cohort logged a total number of keratoplasties ($p = 0.09$) and pterygium/conjunctival procedures ($p = 0.69$) that were comparable to the 2018 national resident averages reported by the ACGME.[10] However, as an assistant or surgeon, residents in our cohort performed an average of 9.7 keratorefractive procedures, lower than the national resident average of 16.4 reported by the ACGME in 2018 ($p < 0.001$).[10]

Analysis of National Cornea and Keratorefractive Case Log Averages Reported by the ACGME

As primary surgeon, the number of total corneal surgeries logged has remained relatively stable (►**Fig. 1**). As assistant,

Table 3 Selected corneal procedures performed by graduating U.S. ophthalmology residents

	Surgeon		Assistant		Total	
	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median
Keratomileusis	3.5 ± 8.5	0	6.0 ± 9.1	3	9.6 ± 14.4	6
Pterygium procedures	4.6 ± 4.0	1	0.9 ± 1.0	0	5.5 ± 4.3	1
Keratoplasty, penetrating	1.5 ± 1.0	0	3.6 ± 2.0	1	5.1 ± 2.3	1
Keratoplasty, endothelial (DMEK/DSEK)	0.8 ± 1.8	0	3.8 ± 4.3	3	4.7 ± 4.8	3
Excision of lesion	1.5 ± 0.9	0	0.7 ± 0.5	0	2.2 ± 1.1	0
Corneal relaxing incision	1.1 ± 2.7	0	0.6 ± 2.9	0	1.8 ± 4.4	0
Conjunctival procedures	0.4 ± 0.8	0	0.5 ± 0.9	0	0.8 ± 1.6	0
Other procedures	3.7 ± 2.1	0	3.1 ± 1.2	0	6.7 ± 2.9	0

Abbreviations: DMEK, Descemet's membrane endothelial keratoplasty; DSEK, Descemet's stripping endothelial keratoplasty; SD, standard deviation.

Table 4 Associations between relative cornea surgical volume and program characteristics

	Odds ratio	95% confidence interval	*p*-Value
Region (reference Southeast)			
Midwest	1.2	0.1, 12.1	0.87
Northeast	0.9	0.1, 8.5	0.92
Southwest	1.8	0.1, 25.3	0.67
West	3.6	0.3, 40.7	0.30
Veterans Affairs association (reference no Veterans Affairs)	0.5	0.1, 5.3	0.59
Urban training center (reference not urban)	1.1	0.1, 28.7	0.95
On-site medical school (reference no medical school)	0.3	0.1, 3.3	0.30
Graduating class size (reference small)	**8.9**	**1.1, 75.6**	**0.04**

Note: Statistical significance indicated in bold.

the number of total corneal surgeries logged has decreased from 13 in 2015–2016 to 10.9 in 2019–2020 (►**Table 5**).

The number of total keratorefractive surgeries logged has decreased over the past several years regardless of residents' role in the surgery (►**Fig. 2**). As primary surgeon, the number of total keratorefractive surgeries logged decreased from 6.5 in 2017–2018 to 4.5 in 2019–2020. As assistant, the number of total keratorefractive surgeries logged decreased from 9.8 in 2017–2018 to 7.4 in 2019–2020.

Discussion

Among our sample of residents from programs throughout the United States, the most commonly performed procedure types included keratoplasty, keratorefractive surgeries, and pterygium procedures. Program size was the only factor associated with relative cornea surgery volume in a given program in our multivariate regression analysis, which may reflect the referral base and overall volume of the respective institution. One limitation of this finding is that programs with medium or large graduating class size could result in higher relative cornea surgical volume compared with programs with smaller graduating class size simply by virtue of having more residents, even if each resident performs the

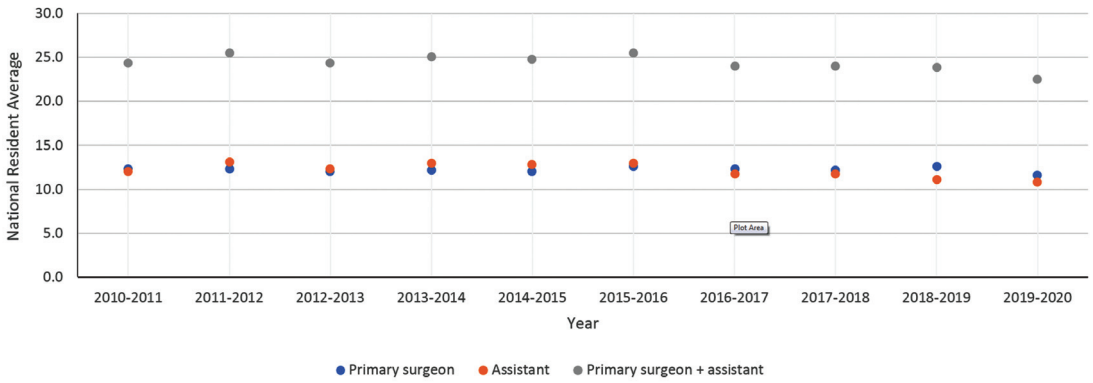

Fig. 1 Mean number of corneal surgeries logged per ophthalmology resident in the United States according to the Accreditation Council for Graduate Medical Education national data from 2010 to 2020. The *x*-axis displays the years through which data were collected. The *y*-axis displays the mean number of corneal surgeries logged per resident.

Table 5 ACGME ophthalmology residents' average corneal and keratorefractive surgery procedures from 2010 to 2020

			2019–2020	2018–2019	2017–2018	2016–2017	2015–2016	2014–2015	2013–2014	2012–2013	2011–2012	2010–2011
Primary surgeon	Corneal surgery	Keratoplasty	2.1	2.5	2.5	2.6	2.6	2.5	2.5	2.1	2.3	2.4
		Conjunctival/ pterygium	4.9	5.4	5.8	5.7	6.0	5.4	5.6	5.5	5.7	5.9
		Other	4.6	4.8	3.9	3.9	4.0	4.0	4.2	4.4	4.5	4.2
		Total	11.6	12.7	12.2	12.3	12.6	12.0	12.2	12.0	12.4	12.4
	Keratorefractive surgery	Incisional procedures	1.1	1.3	1.6	1.3	1.5	1.5	1.6	1.3	1.5	NA
		Laser procedures	3.4	4.4	4.9	5.0	4.8	4.3	4.4	3.8	4.2	NA
		Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA
		Total	4.5	5.7	6.5	6.3	6.3	5.8	6.0	5.1	5.7	6.5
Assistant	Corneal surgery	Keratoplasty	7.4	7.6	8.0	7.8	8.3	7.8	7.9	7.0	7.7	6.8
		Conjunctival/ pterygium	1.0	1.1	1.1	1.2	1.5	1.4	1.3	1.4	1.7	1.5
		Other	2.5	2.4	2.6	2.7	3.2	3.5	3.7	3.9	3.8	3.7
		Total	10.9	11.2	11.8	11.7	13.0	12.8	12.9	12.3	13.1	12.0
	Keratorefractive surgery	Incisional procedures	0.7	0.7	0.9	0.9	1.1	0.9	0.9	0.8	0.7	NA
		Laser procedures	6.7	7.7	8.9	9.0	8.8	7.5	8.1	9.4	7.4	NA
		Other	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	NA
		Total	7.4	8.4	9.8	9.9	9.9	8.5	9.1	10.3	8.1	6.1
Primary surgeon + assistant	Corneal surgery	Keratoplasty	9.5	10.1	10.5	10.5	11.0	10.4	10.4	9.2	9.9	9.2
		Conjunctival/ pterygium	5.8	6.5	6.9	6.9	7.4	6.8	6.9	6.9	7.3	7.3
		Other	7.2	7.3	6.5	6.6	7.2	7.6	7.8	8.3	8.3	7.9
		Total	22.5	23.9	24.0	24.0	25.6	24.8	25.1	24.3	25.5	24.4
	Keratorefractive surgery	Incisional procedures	1.8	2.0	2.5	2.2	2.6	2.4	2.5	2.1	2.1	NA
		Laser procedures	10.1	12.0	13.8	14.0	13.6	11.8	12.6	13.1	11.6	NA
		Other	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	NA
		Total	11.9	14.1	16.4	16.2	16.2	14.3	15.2	15.4	13.8	12.6

Abbreviations: ACGME, Accreditation Council for Graduate Medical Education; NA, not available.

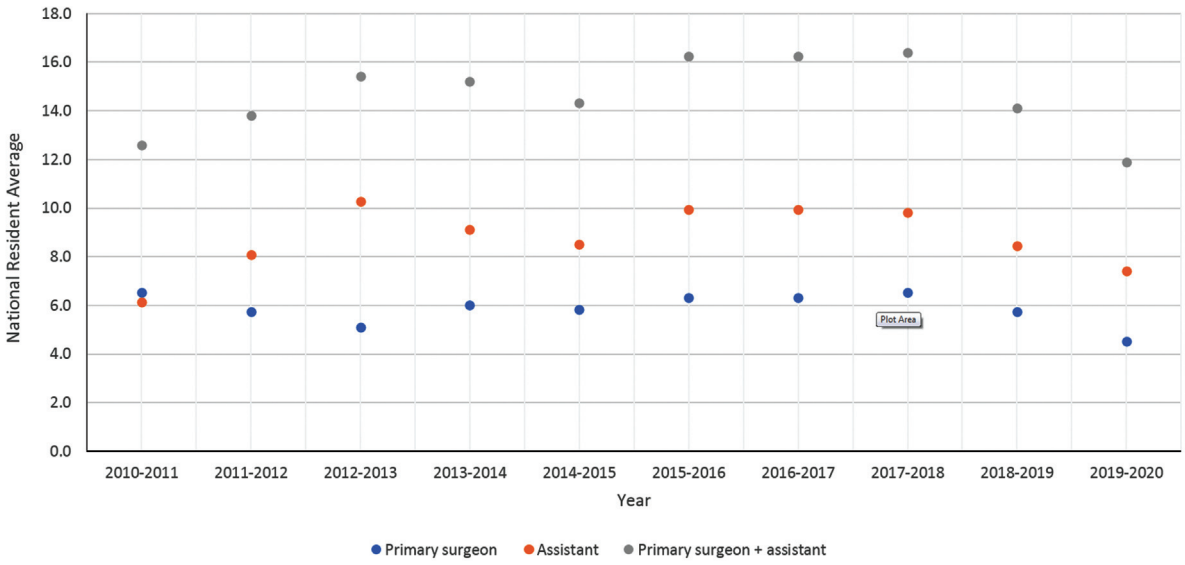

Fig. 2 Mean number of keratorefractive surgeries logged per ophthalmology resident in the United States according to the Accreditation Council for Graduate Medical Education national data from 2010 to 2020. The *x*-axis displays the years through which data were collected. The *y*-axis displays the mean number of keratorefractive surgeries logged per resident.

same number of surgeries. However, analysis of the average total corneal surgical experience per resident grouped by program size shows that residents in medium and large programs performed more total surgeries than residents in small programs.

Our results do not demonstrate a substantial change in the number of keratoplasties residents performed as primary surgeon compared with a previous study of surgical case logs from 2009 to 2015 by Chadha et al. In that study, the authors found that the annual yearly average number of keratoplasties performed as primary surgeon ranged from 2.1 to 2.5 over the 6-year period.[2] Analysis of ACGME resident surgical case logs on cornea procedures after 2015 showed that this average remained relatively stable at 2.5 until 2019. In our study, residents similarly performed an average of 2.4 keratoplasties as primary surgeon.

The lack of change of corneal surgical procedures logged in residency training in the context of changing surgical techniques in practice suggests that exposure to corneal procedures during residency may not be representative of those seen by ophthalmologists in practice. For example, according to the 2019 Eye Banking Statistical Report, EK numbers increased largely due to a 23% increase in DMEK procedures and increases in DSEK procedures.[6] Given the increasing number of EKs performed nationally, it might be expected that resident exposure to EK would be increased. However, residents in the study cohort actually had exposure to more PKs than EKs, with an average of 1.4 PKs compared with an average of 0.8 EK procedures. This finding is inconsistent with trends more broadly in ophthalmology practice, where EK has surpassed PK as the most common type of cornea transplant surgery.[8] This discrepancy may be explained by residents being involved in more complex cases, such as traumatic eye injuries which require PK, or in the care of patients with advanced disease such as keratoconus or corneal degeneration. The current ACGME case minimum requirement does not outline separate, distinct categories for DMEK, DSEK, and PK; rather, it simply states that five keratoplasties be logged as primary surgeon or assistant, six keratorefractive surgeries as primary surgeon or assistant, and three pterygium/conjunctival and other cornea procedures as primary surgeon.

While these ACGME requirements can influence the number and types of procedures to which residents are exposed because programs must ensure their residents meet these minimum requirements for program accreditation, they are not used to evaluate resident competency. In fact, residents may not achieve competency even after meeting ACGME minimum requirements. As such, there has been a shift toward competency-based medical education and assessment using rubrics such as the Objective Assessment of Skills in Intraocular Surgery, the Global Rating Assessment of Skills in Intraocular Surgery, and Ophthalmology Surgical Competency Assessment Rubric. These standardized rubrics have been used to assess cataract surgical competency and can be used similarly to assess competency in cornea and keratorefractive surgeries.

In the 2019 application cycle, 483 residents applied for an ophthalmology fellowship across all subspecialties; 98 positions were offered in cornea and external disease that year.[10] Since cornea procedures are highly specialized, resident exposure to these procedures may influence the number of residents who choose to go into this subspecialty. This concept is reinforced by a previous study which identified factors influencing pursuit of glaucoma fellowship training by graduating ophthalmology residents. That survey demonstrated that residents entering glaucoma fellowships performed more glaucoma filtering procedures than residents seeking fellowships in other subspecialties and performed other ocular procedures such as cataract and globe trauma procedures with similar frequency as residents seeking fellowships in other subspecialties.[11] In addition, that study

found that the majority of residents entering glaucoma fellowships made their career decision during the second year of ophthalmology residency. This means that the residents who eventually chose to pursue glaucoma fellowship made their decisions about specialty choice prior to the third year of residency, when residents typically gain the most subspecialty surgical experience. Taken together, these findings suggest that while residents may proactively seek to complete subspecialty rotations and acquire special skills later in residency to prepare for fellowship, exposure to subspecialty procedures such as cornea and keratorefractive surgeries during the early formative years of residency training may have an effect on future fellowship choices.

For programs with lower cornea surgical numbers, there are several ways to increase exposure to and interest in pursuing subspecialty training in cornea. For example, providing opportunities for residents to engage in dedicated cornea wet laboratory activities or other didactics at the program level may enhance resident learning including corneal suturing, a fundamental residency skill, and interest in the field. Some programs in other subspecialties also follow a structured teaching curriculum. For example, a structured glaucoma surgical curriculum at Massachusetts Eye and Ear in Boston, MA led by two dedicated preceptors instead of a rotation with multiple attending physicians resulted in increased glaucoma surgical volume, improvement in suturing according to self-assessment, and improved handling of adverse events.[12] Similarly, a structured cornea and keratorefractive surgical curriculum may help enhance resident learning and expand exposure to surgical techniques. This curriculum could include structured didactics on surgical techniques and dedicated wet laboratory sessions. Implementation of a structured program for cornea may help enhance resident learning or expand residents' experience with newer surgical techniques.

Limitations of this study include a small sample size, with only 31% of ophthalmology residency programs represented and two responses received from programs in nonurban settings. Our study participants donated their time to anonymize surgical case logs, and the time-intensive process may have been a barrier to participation. As a result, findings from this study may not necessarily be generalizable. Additionally, there may be errors in the accuracy of CPT codes with case logging by residents, a phenomenon that has been described previously with regard to glaucoma surgery.[13] Finally, although residents are asked to continue to log beyond the minimum ACGME numbers, it is possible that they may not log every single case, such as cases where they were the assistant once they had already reached the minimum number to graduate. This phenomenon has been demonstrated previously in other fields such as general surgery.[14] Consequently, this may underestimate the true volume of surgical procedures performed.

Despite the small sample size, our cohort is representative of the larger population of ophthalmology residency programs nationally. Distribution of program size in our sample is similar to the distribution of program size of 120 residency programs. As an assistant or primary surgeon, residents in our cohort logged a total number of keratoplasties and pterygium/conjunctival procedures that were comparable to the 2017–2018 national resident averages reported by the ACGME. Although residents in our cohort logged fewer keratorefractive surgeries than the national average, residents often observe these cases.

Conclusion

Keratoplasty, keratorefractive, and pterygium procedures are the most common cornea surgeries residents perform during their training. Creating distinctions for ACGME requirements, such as distinguishing between EK and PK minimum numbers and between LASIK and PRK numbers, may inform further understanding of trends in this subspecialty field in the context of new advancements in techniques, such as DMEK, and the increased incidence of EK overall. In addition, increasing residents' awareness regarding different CPT codes to ensure accurate logging of cases and the importance of logging all cases can better reflect exposure to subspecialties during residency training. Within the field of cornea, future studies should focus on the role that surgical exposure plays in influencing a trainee's subspecialty choice. Further studies can also expand to other areas such as cataract and investigate the exposure of ophthalmology residents to cataract surgery during residency.

Presentations

Data from this manuscript were accepted for a poster presentation at the American University Professors of Ophthalmology Educating the Educators Meeting in January 2020 in Rancho Mirage, CA.

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Conflict of Interest

None declared.

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