

The Ophthalmology Chief Resident: Does Surgical Volume Correlate With Likelihood of Selection?

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ABSTRACT

PURPOSE: Investigate whether number of logged Accreditation Council for Graduate Medical Education (ACGME) surgical cases correlates with likelihood of Virginia Commonwealth University Health System (VCUHS) ophthalmology residents being selected as the chief resident.

DESIGN: Retrospective study.

PARTICIPANTS: VCUHS ophthalmology residents from 2006 to 2016.

METHODS: Analyze association between chief resident selection and logged cases.

MAIN OUTCOME MEASURES: Review number of archived logged ACGME surgical cases of all residents between the years 2006 and 2017. Review chief resident selected each year 2006-2016.

RESULTS: Our analysis correctly predicted the chief resident in 2 of the 10 years analyzed.

CONCLUSION: Those residents performing the most surgical procedures in each respective class were not more likely to be selected as chief resident.

KEYWORDS: Chief, resident, ophthalmology

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Purpose

Ever since Dr. William S. Halsted coined the term “chief resident” in 1899, the position has been held in high regard.¹⁻³ Despite such respect, the role has not been well defined¹ and the way the position is garnered is even less well understood.^{1,2,4-8} Divisions such as emergency medicine, psychiatry, family medicine, pediatrics, and radiology have examined the chief resident role and provided good insight.^{1,2,4-11} To date, there has been no published literature on the chief resident within a surgical specialty, including ophthalmology. Moreover, the selection process has been rather vague and mostly inundated with bias. Methods of selection vary among training centers with either peers, faculty, program directors, or chairpersons serving as the main voice.^{1,2,4-8} In an effort to provide a guide for an unbiased selection process, we sought to determine whether the number of surgeries performed correlated with the selection of the ophthalmology chief resident at Virginia Commonwealth University Health System (VCUHS).

In 1940, the Commission on graduate medical education listed duties of the chief resident within the practice of psychiatry.¹ Aside from this, there has been no formal definition of the chief resident role. Without defined roles, it is difficult to select the proper person to fill the chief resident position. Characteristics such as good teaching skills,

personality, leadership qualities, organization, strong peer advocacy, popularity, and even sense of humor have been cited as important in the selection of a chief resident.^{1,2,4-7,9-11} Given the frequent demand for high performance, under very stressful situations, often times at all hours of the day and night under constant scrutiny from attending ophthalmologists, one would suppose emotional intelligence should be considered in the selection of the ophthalmology chief resident. Emotional intelligence can be divided into four attributes: self-management, self-awareness, social awareness, and relationship management. Although these are four great attributes to have in any leader, Kilpatrick et al⁸ showed although emotional intelligence improves with age, is a teachable skill, and is higher in women, administrative chief residents did not demonstrate higher emotional intelligence than their classmates. With the exception of Panicek and Caravelli,⁷ most studies cited scholastic achievement as an important characteristic. In 1949, Ashford stated, “A man should receive responsibility as rapidly as he acquired knowledge and demonstrates the ability to take responsibility.”³ Yet in still, this ability to accept such a responsibility is subjective at best. Considering the aforementioned characteristics, bestowing the chief residency position is still rather misguided and arbitrary.



Table 1. List of procedures included for each category of procedure.

CATEGORIES	PROCEDURES INCLUDED
Cataract	Phacoemulsification, non-phacoemulsification ECCE, YAG capsulotomy, anterior vitrectomy
Corneal surgery	Penetrating keratoplasty, pterygium excision, refractive surgery, LASIK, other cornea
Strabismus	Any eye muscle surgery
Glaucoma	Filtering procedures, shunting procedures
Laser surgery	Glaucoma laser, laser trabeculoplasty, laser iridotomy, focal laser photocoagulation, cyclodestructive procedures
Retinal procedure	Retinal vitreous (rhegmatogenous retinal detachment repair, posterior vitrectomy [pars plana]), retinal laser, cryotherapy, vitreous tap/inject
Oculoplastic & orbit	Eye removal and implant, orbitotomy, eyelid laceration/canalicular repair, chalazia excision, tarsorrhaphy, ptosis repair, entropion/ectropion repair, blepharoplasty/reconstruction, temporal artery biopsy
Globe trauma	Corneal/corneoscleral laceration, globe rupture, intraocular foreign body, other globe trauma (eg, anterior chamber washout)

Bias is common, normal, and ubiquitous.¹² It is even present in the assessment of the quality of journal manuscripts. Even judges, the personnel we appoint to be impartial, have been shown to give more lenient sentences after eating—which the judges denied.¹² To help alleviate bias in residency education, Dickey et al go on to propose a simple Microsoft excel-based program that graphs competency development over time equitably and transparently when assessing residents that may be helpful as an objective measure to aide in selection of a chief resident. Our study aimed to provide a measure by which residents could be judged against their peers in an unbiased manner. Simply put, would the number of Accreditation Council for Graduate Medical Education (ACGME) logged surgical cases performed correlate with the likelihood of VCUHS ophthalmology residents being selected as chief resident?

Methods

Prior to beginning this project, the study was submitted to the VCU office of research and innovation for institutional review board (IRB) review. It was found not to be subject to the regulations of Health and Human Services Regulations for the Protection of Human Subjects and therefore the IRB/Ethics Committee ruled that approval was not required for this study. This retrospective study was performed using logged data by residents archived into the ACGME Case Log System (www.acgme.org/Data-Collection-Systems/Case-Log-System) from 2006 to 2017. The data obtained from the ACGME also included the national average for the various procedures or categories for each respective year. To identify the respective chief resident each year, the records of the residency coordinator of VCUHS department of ophthalmology were used. The names were de-identified and assigned a number only known to the residency coordinator and therefore no informed consent was obtained. At the conclusion of our data collection and analysis, the residency coordinator identified the selected chief

resident with an asterisk adjacent to the de-identified number among each resident class. Based on the vast number of surgical procedures available within ophthalmology, we created 8 broad procedure categories based on procedural similarities to the specific area involved and type of procedure (Table 1). For example, the category of “Corneal Surgery” included all penetrating keratoplasty, pterygium excision, refractive surgery, LASIK, and other unnamed surgeries involving the cornea. We excluded the 2009-2010 year given there was only 1 resident instead of 3.

To determine whether there is a correlation between being selected as the VCUHS ophthalmology chief resident and the volume versus type of procedures performed, the data were analyzed with principal components analysis (PCA). PCA is a method that reduces data dimensionality by performing a covariance analysis between variables as well as correcting for overlapping information between 2 or more correlated indicators. PCA is recommended as an exploratory tool to uncover unknown trends in data. It explores correlations between samples to help remove the signal out of a noise variable. PCA was used to assign weight to each of the 8 procedural categories based on the linear combination of all the variables. The weight was generated based on the variables from the 10 years of data and its correlation to the national average of ophthalmology residents. This is a better approach because it allowed us to circumvent the biasness of arbitrarily assigning weights to each surgical category. Although arbitrarily assigning weights to each category could have been an option, PCA helped generate a “fair” weight through a mathematical procedure which reduced the collinearity between the measures, thus giving us a pure weight which could be applied to each category (Table 2). Based on the weights, we calculated each resident’s overall procedures performed in each respective category and obtained the sum of each category to give us a total number (Tables 3 and 4). In addition, PCA also revealed the

Table 2. Baseline weight per category as generated by principal component analysis using 10 years of data from the ACGME data website national averages for each category ($P < 0.0001$).

	WEIGHTS	
National average cataracts	0.677	Use as the baseline weights
National average corneal surgery	0.976	
National average strabismus	0.027	
National average glaucoma	0.560	
National average laser surgery	0.783	
National average retinal procedures	0.205	
National average oculoplastic & orbit	0.581	
National average globe trauma	0.584	

Table 3. Total number of procedures performed by each VCU resident: Also included is the national resident average (NRA) for each year.

TOTAL CASES PERFORMED IN EACH CATEGORY FOR EACH RESIDENT									
		TOTAL CATARACTS	TOTAL CORNEAL SURGERY	TOTAL STRABISMUS	TOTAL GLAUCOMA	TOTAL LASER SURGERY	TOTAL RETINAL PROCEDURES	TOTAL OCULOPLASTIC & ORBIT	TOTAL GLOBE TRAUMA
2006-2007	R1	177	6	21	31	20	167	99	8
	R2	191	11	31	32	18	174	127	22
	R3	227	22	32	29	29	135	94	14
	NRA1	225	26	38	24	25	107	104	13
2007-2008	R4	192	12	30	33	17	136	57	20
	R5	185	6	67	18	20	115	55	18
	R6	318	46	56	20	27	248	102	24
	NRA2	235	26	40	24	27	113	103	14
2008-2009	R7	165	7	38	17	22	161	42	20
	R8	230	9	34	9	30	178	80	18
	R9	229	20	73	30	22	248	89	42
	NRA3	245	29	39	24	28	120	107	14
2009-2010	R10	191	9	86	37	15	184	96	44
	NRA4	247	30	41	24	28	127	113	14
2010-2011	R11	248	21	77	26	13	134	39	18
	R12	299	20	43	16	19	187	60	15
	R13	304	15	41	17	25	95	55	11
	NRA5	254	36	43	25	29	148	113	14
2011-2012	R14	154	16	51	26	72	81	42	6
	R15	185	35	47	24	107	173	60	17
	R16	213	16	29	25	134	164	71	22
	NRA6	243	39	42	25	117	99	119	14
2012-2013	R17	266	12	33	37	209	127	67	17
	R18	233	11	52	31	157	175	71	22
	R19	278	25	59	24	185	250	62	13
	NRA7	246	39	43	25	117	110	118	12

(Continued)

Table 3. (Continued)

TOTAL CASES PERFORMED IN EACH CATEGORY FOR EACH RESIDENT									
		TOTAL CATARACTS	TOTAL CORNEAL SURGERY	TOTAL STRABISMUS	TOTAL GLAUCOMA	TOTAL LASER SURGERY	TOTAL RETINAL PROCEDURES	TOTAL OCULOPLASTIC & ORBIT	TOTAL GLOBE TRAUMA
2013-2014	R20	164	23	37	10	153	160	54	18
	R21	182	24	29	21	100	55	60	21
	R22	231	20	47	26	197	212	71	12
	NRA8	248	40	40	25	115	120	115	11
2014-2015	R23	195	20	31	22	176	344	71	9
	R24	163	8	11	25	49	74	29	13
	R25	143	16	32	8	70	163	48	9
	NRA9	258	39	38	25	106	127	114	11
2015-2016	R26	214	21	14	6	59	153	41	11
	R27	318	17	32	23	189	216	47	7
	R28	251	24	26	17	137	158	57	19
	NRA10	268	42	37	25	112	150	113	11
2016-2017	R29	280	33	42	25	106	218	97	6
	R30	341	22	41	17	134	242	62	18
	R31	319	16	21	11	109	240	40	14
	NRA11	262	40	34	24	105	153	111	11

correlation between the data points and gave a P value of $<.0001$ leading us to reject the null hypothesis. Thus, we deduced that the resident in each class of residents with the highest weighted total would be the chief resident.

Results

In all of the years reviewed, there were 3 ophthalmology residents in each class except 2009–2010 when there was only 1 VCUHS ophthalmology resident and therefore no chief resident was selected. Interestingly, the resident with the highest weighted total each year was not selected as chief resident. In other words, there seems to be no correlation between being selected as the VCUHS ophthalmology chief resident and the total volume of procedures performed (Table 5). When reviewing the total procedures performed in each respective category, this finding held true (Table 4). The only 2 years in which we correctly predicted the chief resident, 2011–2012 and 2013–2014, those residents logged the most total procedures compared with their 2 colleagues in different categories. The 2011–2012 chief had more cataracts, lasers, oculoplastics, and globe traumas compared with their colleagues versus the 2013–2014 chief who logged the most total procedures compared with their 2 colleagues in all categories except cornea and globes. These academic years, 2011–2012 and 2013–2014, are also the 2 years when the chief had the most categories among total cases performed, with the highest weighted values. When taking into

account total cases logged as surgeon versus assistant, the 2011–2012 chief resident logged the most procedures as surgeon.

There seemed to be a stronger correlation when considering those cases logged as surgeon only. This was particularly true within the cataract category. The most commonly ascribed surgery to the field of ophthalmology is cataract surgery. Currently, cataract surgery is the category of surgery set by the ACGME with the highest minimum number as surgeon to achieve for graduation from residency. The authors therefore believe it is paramount to review this category for secondary analysis. For 6 of the 10 years analyzed, the same chief resident was correctly predicted when comparing with the weighted value of cataracts performed as surgeon only (Table 6). This finding suggests there may be a correlation between the number of cataract cases performed as surgeon and selection as the chief resident.

In 5 of the 10 years analyzed, the VCUHS ophthalmology program average of total cases performed was below the national average for those respective years but this was not statistically significant ($P=0.35$) (Figure 1).

Discussion

Ophthalmology is a surgical sub-specialty requiring many attributes and abilities not unlike other surgical subspecialties. The critical desiderata required to become a competent, compassionate, successful ophthalmic surgeon are developed over

Table 4. Weighted procedures performed by each VCU Ophthalmology resident and National Resident average for each year of data collected in each respective category.

WEIGHTED VALUES OF THE TOTAL CASES PERFORMED FOR EACH CATEGORY BY EACH RESIDENT												
	TOTAL CATARACTS	TOTAL CORNEAL SURGERY	TOTAL STRABISMUS	TOTAL GLAUCOMA	TOTAL LASER SURGERY	ALL RETINA PROCEDURES	TOTAL OCULOPLASTIC & ORBIT	TOTAL GLOBE TRAUMA	TOTAL WEIGHT			
2006-2007	R1	119.8717956	5.85837488	0.577042771	17.36304109	15.66691572	34.15728765	57.54864472	4.671208954	255.7143114		
	R2	129.3531806	10.74035395	0.851825043	17.92313919	14.10022415	35.58903024	73.82502909	12.84582462	295.2286069		
	R3	153.7338848	21.48070789	0.879303271	16.24284489	22.7170278	27.61217864	54.64214752	8.17461567	305.4827105		
	NRA1	152.3794012	25.38629115	1.044172634	13.44235439	19.58364465	21.88520825	60.45514193	7.590714551	301.7669288		
2007-2008	R4	130.0304224	11.71674976	0.824346816	18.48323729	13.31687836	27.81671329	33.13406817	11.67802239	247.0004385		
	R5	125.2897299	5.85837488	1.841041223	10.08176579	15.66691572	23.52148551	31.97146929	10.51022015	224.7410025		
	R6	215.3628871	44.91420741	1.538780723	11.20196199	21.15033623	50.72459483	59.29254305	14.01362686	418.1989382		
	NRA2	159.1518191	25.38629115	1.099129088	13.44235439	21.15033623	23.11241619	59.87384249	8.17461567	311.3908043		
2008-2009	R7	111.7448942	6.834770693	1.044172634	9.521667693	17.2336073	32.93007971	24.41457655	11.67802239	215.4017912		
	R8	155.7656101	8.78756232	0.934259725	5.040882896	23.50037358	36.40716887	46.50395533	10.51022015	287.450033		
	R9	155.0883684	19.52791627	2.005910586	16.80294299	17.2336073	50.72459483	51.73565031	24.52384701	337.6428376		
	NRA3	165.9242369	28.31547859	1.071650861	13.44235439	21.93368201	24.54415879	62.19904026	8.17461567	325.6052175		
2010-2011	R11	167.9559622	20.50431208	2.115823495	14.56255059	10.18349522	27.40764398	22.67067822	10.51022015	275.9106686		
	R12	202.4952932	19.52791627	1.18156377	8.961569593	14.88356994	38.24798078	34.8779665	8.75851679	328.9343768		
	R13	205.8815021	14.6459372	1.126607315	9.521667693	19.58364465	19.43079237	31.97146929	6.422912312	308.5845329		
	NRA5	172.0194129	35.15024928	1.18156377	14.00245249	22.7170278	30.27112917	65.68683691	8.17461567	349.203288		
2011-2012	R14	104.2952346	15.62233301	1.401389587	14.56255059	56.4008966	16.56730718	24.41457655	3.503406716	236.7676949		
	R15	125.2897299	34.17385347	1.291476679	13.44235439	83.81799912	35.38449559	34.8779665	9.926319028	338.2041947		
	R16	144.2524998	15.62233301	0.796868589	14.00245249	104.9683353	33.54368368	41.27226036	12.84582462	367.3042579		
	NRA6	164.5697533	38.07943672	1.154085543	14.00245249	91.65145698	20.248931	69.17463356	8.17461567	407.0553653		

(Continued)

Table 4. (Continued)

WEIGHTED VALUES OF THE TOTAL CASES PERFORMED FOR EACH CATEGORY BY EACH RESIDENT												
	TOTAL CATARACTS	TOTAL CORNEAL SURGERY	TOTAL STRABISMUS	TOTAL GLAUCOMA	TOTAL LASER SURGERY	ALL RETINA PROCEDURES	TOTAL OCULOPLASTIC & ORBIT	TOTAL GLOBE TRAUMA	TOTAL WEIGHT			
2012-2013	R17	180.1463143	11.71674976	0.906781498	20.72362968	163.7192693	25.97590138	38.94706259	9.926319028	452.0620276		
	R18	157.7973355	10.74035395	1.428867815	17.36304109	122.9852884	35.7935649	41.27226036	12.84582462	400.2265367		
	R19	188.2732157	24.40989533	1.621215405	13.44235439	144.9189704	51.13366414	36.04056538	7.590714551	467.4305954		
	NRA7	166.6014787	38.07943672	1.18156377	14.00245249	91.65145698	22.49881222	68.59333412	7.006813432	409.6153484		
2013-2014	R20	111.0676525	22.45710371	1.016694407	5.600980996	119.8519053	32.72554505	31.39016985	10.51022015	334.6202719		
	R21	123.2580046	23.43349952	0.796868589	11.76206009	78.33457862	11.24940611	34.8779665	12.26192351	295.9743075		
	R22	156.4428519	19.52791627	1.291476679	14.56255059	154.3191199	43.36134719	41.27226036	7.006813432	437.7843363		
	NRA8	167.9559622	39.05583253	1.099129088	14.00245249	90.08476541	24.54415879	66.84943579	6.422912312	410.0146487		
2014-2015	R23	132.0621477	19.52791627	0.851825043	12.32215819	137.8688584	70.35992186	41.27226036	5.255110074	419.5201979		
	R24	110.3904107	7.811166506	0.302260499	14.00245249	38.38394352	15.13556459	16.85768381	7.590714551	210.4741966		
	R25	96.845575	15.62233301	0.879303271	4.480784797	54.83420503	33.33914902	27.9023732	5.255110074	239.1588334		
	NRA9	174.7283801	38.07943672	1.044172634	14.00245249	83.03465333	25.97590138	66.26813635	6.422912312	409.5560453		
2015-2016	R26	144.9297416	20.50431208	0.384695181	3.360588598	46.21740138	31.29380246	23.83327711	6.422912312	276.9467907		
	R27	215.3628871	16.59872883	0.879303271	12.88225629	148.0523536	44.17948582	27.32107376	4.087307835	469.3633965		
	R28	169.9876876	23.43349952	0.714433907	9.521667693	107.3183727	32.31647574	33.13406817	11.09412127	387.5203266		
	NRA10	181.5007979	41.00862416	1.016694407	14.00245249	87.73472805	30.68019849	65.68683691	6.422912312	428.0532447		
2016-2017	R29	189.6276993	32.22106184	1.154085543	14.00245249	83.03465333	44.58855513	56.38604584	3.503406716	424.5179602		
	R30	230.9394481	21.48070789	1.126607315	9.521667693	104.9683353	49.49738689	36.04056538	10.51022015	464.0849388		
	R31	216.0401289	15.62233301	0.577042771	6.161079095	85.38469069	49.08831758	23.25197767	8.17461567	404.3001853		
	NRA11	177.4373472	39.05583253	0.934259725	13.44235439	82.25130755	31.29380246	64.52423802	6.422912312	415.3620542		

Table 5. Chief resident as predicted by weighted sum vs actual chief resident selected.

CHIEF RESIDENT AS PREDICTED BY WEIGHTED SUM VS ACTUAL CHIEF RESIDENT SELECTED				
YEAR	RESIDENTS	WEIGHTED SUM	PREDICTED CHIEF	ACTUAL CHIEF
2006-2007	R1	255.7143114		ACTUAL
	R2	295.2286069		
	R3	305.4827105	Predicted	
2007-2008	R4	247.0004385		
	R5	224.7410025		ACTUAL
	R6	418.1989382	Predicted	
2008-2009	R7	215.4017912		ACTUAL
	R8	287.450033		
	R9	337.6428376	Predicted	
2010-2011	R11	275.910686		
	R12	328.9343768	Predicted	
	R13	308.5845329		ACTUAL
2011-2012	R14	236.7676949		
	R15	338.2041947		
	R16	367.3042579	Predicted	ACTUAL
2012-2013	R17	452.0620276		ACTUAL
	R18	400.2265367		
	R19	467.4305954	Predicted	
2013-2014	R20	334.6202719		
	R21	295.9743075		
	R22	437.7843363	Predicted	ACTUAL
2014-2015	R23	419.5201979	Predicted	
	R24	210.4741966		ACTUAL
	R25	239.1588334		
2015-2016	R26	276.9467307		
	R27	469.3633965	Predicted	
	R28	387.5203266		ACTUAL
2016-2017	R29	424.5179602		
	R30	464.0849388	Predicted	
	R31	404.3001853		ACTUAL

the surgeon's career and begins in residency. Each year within ophthalmology residency programs across the nation, there seems to be one resident setting themselves apart from their peers. Qualifying attributes used to determine chief resident and recognized by a candidate's peers, program directors, chairs, other attending physicians, and others remarking on their

performance remain imprecise. Such an important honor and responsibility should not only be awarded based on biased attributes but also on unbiased data. Although our research did not uncover these data, it did highlight that surgical volume may not be a paramount factor in the selection process of an ophthalmology chief resident.

Table 6. Chief resident as predicted by the weighted total cataracts performed as surgeon only vs actual chief selected.

CHIEF AS PREDICTED BY TOTAL CATARACTS VS ACTUAL CHIEF SELECTED			
YEAR	RESIDENTS	TOTAL CATARACT (SURGEON)	ACTUAL CHIEF
2006-2007	R1	88.7186736	ACTUAL
	R2	83.97798112	
	R3	104.2952346	
2007-2008	R4	84.65522291	
	R5	92.10488252	ACTUAL
	R6	89.39591539	
2008-2009	R7	77.88280507	ACTUAL
	R8	112.422136	
	R9	84.65522291	
2010-2011	R11	122.5807628	
	R12	152.3794012	
	R13	167.2787205	ACTUAL
2011-2012	R14	83.97798112	
	R15	109.7131689	
	R16	132.7393895	ACTUAL
2012-2013	R17	141.5435327	ACTUAL
	R18	119.8717956	
	R19	148.9931923	
2013-2014	R20	98.87730035	
	R21	109.7131689	
	R22	114.4538614	ACTUAL
2014-2015	R23	97.52281679	
	R24	104.9724764	ACTUAL
	R25	93.45936609	
2015-2016	R26	134.7711149	
	R27	190.3049411	
	R28	163.8925115	ACTUAL
2016-2017	R29	136.1255984	
	R30	161.8607862	
	R31	167.9559622	ACTUAL

Chiefs as predicted by the total cataract surgery performed and the actual chief resident selected by VCU department of Ophthalmology.

There are limitations of this study and other circumstances to consider when determining why surgical volume proved to not correlate with selection as chief resident. One major consideration is the ACGME data are based on resident-logged cases and therefore it is the sole responsibility of the resident

for logging cases. It should also be taken into consideration that the attending physician will vary the level of autonomy and participation depending on what point in time during their residency tenure a resident completes a specific rotation. This may help to promote anchoring bias when the time

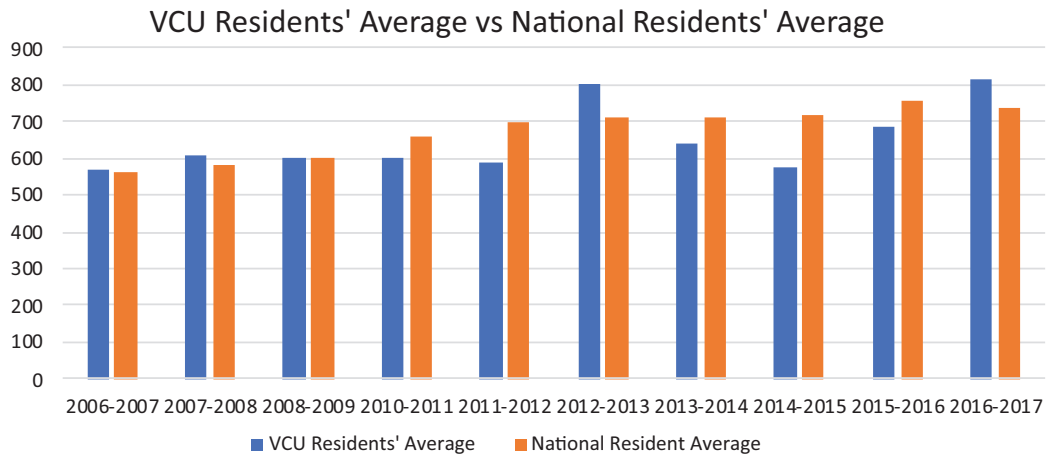


Figure 1. Average procedures performed by VCU ophthalmology residents as compared with the national resident average ($P=0.35$).

comes to select a chief resident.¹² It would be interesting to perform the same analysis on other programs of varying class sizes and surgical volume to investigate if our conclusions would remain. It would likewise be interesting to survey current ophthalmology professors of all levels affiliated with an academic health system to not only better understand their perception of the importance of surgical volume in the selection of a chief resident but other components that are or should be considered.


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Author Contributions

NQR wrote a portion of the abstract, purpose, methods, results, and discussion sections. RKO wrote a portion of the methods, results, and discussion sections as well as performed the majority of the data calculations.

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