



Resident Vitreoretinal Procedure Volume: Effect of Intravitreal Injections, Region, Program Size, and Vitreoretinal Fellowship and Veterans Affairs Affiliation

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Abstract

Purpose To analyze resident vitreoretinal procedure volume across Accreditation Council of Graduate Medical Education (ACGME) accredited ophthalmology residency programs. We assessed the effect of the increase in intravitreal injections (IVI), geographic region, program size, and Veterans Affairs (VA) and vitreoretinal fellowship affiliation on vitreoretinal procedures.

Methods A request was sent to all residency programs in 2018 for their graduating residents' ACGME case logs. Vitreoretinal procedures were defined by ACGME case log categories and included vitreoretinal surgery, peripheral retinal lasers, and IVI. Procedures were categorized by Current Procedural Terminology (CPT) code. Programs were studied by geographic region, program size, and by VA and vitreoretinal fellowship affiliation.

Results A total of 38 of 115 (33.0%) programs responded, and 167 residents logged 32,860 vitreoretinal procedures. The median number of retina procedures per resident was 146 (range 36–729). Programs with a vitreoretinal fellowship had a higher average number of vitreoretinal procedures per resident (208.3 vs. 125.0; $p = 0.002$), but there was no difference between the average number of non-IVI vitreoretinal procedures (60.0 vs. 64.2; $p = 0.32$). For IVI, VA affiliation (146.6 vs. 71.1; $p = 0.02$) and vitreoretinal fellowship (149.4 vs. 60.8; $p < 0.001$) were associated with a greater number. More IVI strongly correlated with a larger total volume of retinal procedures ($r = 0.98$), and there was no difference across programs for total retinal procedures when IVI was removed.

Keywords

- ▶ resident education
- ▶ ACGME
- ▶ vitreoretinal surgery
- ▶ intravitreal injection

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Conclusions The presence of a vitreoretinal fellowship at a residency program had a positive effect on resident total vitreoretinal case volume, but their residents performed more IVI. Programs without vitreoretinal fellowships completed on average more non-IVI procedures.

The Accreditation Council of Graduate Medical Education (ACGME) Resident Review Committee (RRC) for Ophthalmology defines procedural categories for resident education in ophthalmology.¹ Although there are defined minimums for certain procedural categories, the RRC explicitly states that “achievement does not signify competence.”¹ Rather the minimum number is used to assess program compliance and breadth in surgical experience and to ensure familiarity with procedures in a broad range of ophthalmic subspecialties.^{1,2}

Prior survey studies in the mid-2000s attempted to better understand resident vitreoretinal training experience.^{3,4} Since that time, vitreoretinal practice patterns have dramatically evolved with an increase in indications for intravitreal injections (IVI) and a decline in both panretinal photocoagulation (PRP) and focal laser.^{5,6} Chadha et al reviewed the ACGME resident case logs from 2010 to 2014 and found that the number of IVI nearly tripled, fewer peripheral retinal laser (PRL) procedures were being performed, but that the vitreoretinal surgery (VRS) rates were stable.⁷ However, the ACGME case log data are limited in that it does not provide geographic region, program size, or Veterans Affairs (VA) and vitreoretinal fellowship affiliation to assess if these variable have an effect on vitreoretinal training experience. Also, individual residency program and resident data are not available for analysis.

The goal of performing this survey was to evaluate the vitreoretinal surgeries and procedures that graduating ophthalmology residents in 2018 recorded in their ACGME case logs to assess the effect of geographic region, program size, and VA and vitreoretinal fellowship affiliation on resident training experience. As the prevalence of diabetic retinopathy⁸ and age-related macular degeneration⁹ vary by state, regional differences are important to assess. We studied if programs with a greater number of residents or vitreoretinal fellow affiliation had a difference in their vitreoretinal volume.^{10,11} Further, as veterans have significant ophthalmic disease prevalence,¹² and VA hospitals

often function as medical teaching institutions,¹³ the effect of VA hospitals on the resident training experience was assessed. Finally with the increase in IVI⁵⁻⁷ we wanted to evaluate the impact of IVI on overall vitreoretinal procedure numbers.

Methods

A cross-sectional request was sent to all 115 ACGME-accredited ophthalmology residency programs in the fall of 2018 requesting the resident case logs for those that graduated in June 2018. Programs were divided into six geographic regions based on Census Bureau regional categories.¹⁴ For the South region, due to the number of responding programs, the region was divided into South Atlantic and South Central (West South Central and East South Central) divisions.¹⁴ Three different program sizes (3, 4–5, and 6+ residents per year) were used. VA hospital and vitreoretinal fellowship affiliation were recorded. Each individual resident's data were collected into a Microsoft Excel (Microsoft Corporation; Redmond, WA) document containing the institution name where the procedure was performed, CPT code and CPT description, and area of designation for the procedure per the ACGME Web site. The study was approved by Johns Hopkins University Institutional Review Board and adhered to the Tenets of Helsinki.

Using the ACGME Web site case log system, CPT codes for specific surgical and procedural categories were selected. For the ACGME category of “Retina Vitreous,” we labeled VRS (67036, 67039, 67040, 67041, 67042, 67043, 67107, 67108, 67113, 67121), which included Pars plana vitrectomy (PPV) and Scleral Buckle (SB). The ACGME category of “PRP” contains different types of PRL, including both PRP for proliferative diabetic retinopathy and retinopathy for retinal tear and detachment (67105, 67145, 67228). For IVI (67027, 67028, 67110), cryotherapy (67101, 67141, 67208, 67227), anterior vitrectomy (67005, 67010), intraocular foreign body removal (65235, 65260,

Table 1 Program characteristics by region, program size, and Veterans Affairs and vitreoretinal fellowship affiliations

Regions	<i>n</i>	Program size	<i>n</i>	Veterans affairs affiliation	<i>n</i>	Vitreoretinal fellowship	<i>n</i>
Midwest	8	Small	11	Yes	30	Yes	30
Northeast	5	Medium	17	No	8	No	8
South Atlantic	10	Large	10				
South Central	9						
West	6						

65265), focal retinal laser (67210, 67220, 67221), and other retina (0465T, 67015, 67025, 67031, 67120), we used the same name and CPT codes as the ACGME categories. For the ACGME category of "Other Cataract," we selected certain CPT codes that would be useful for a resident going into a vitreoretinal fellowship and created two sections: secondary Intraocular lens (IOL) cases that we called other cataract (66825, 66930, 66985, 66986) and pars plana lensectomy (PPL, 66852). For analysis, common procedures were VRS, PRL, and IVI, and all other procedures were deemed uncommon.

Using R statistical software (R Foundation for Statistical Computing; Vienna, Austria), all the data from the individual resident Excel spreadsheets were combined into a single spreadsheet and analyzed. Additional statistical analysis was completed using Microsoft Excel. The mean, median, and interquartile ranges were calculated, and box and whisker plots were created. Pearson correlation coefficients were used to evaluate for correlation between variables. For analysis by region, program size, and vitreoretinal fellowship and VA hospital affiliation, the mean number of vitreoretinal procedures performed per resident by program was calculated. Analysis of variance testing assessed for differences between the mean number of vitreoretinal procedures by region and program size. A *t*-test with adjustment for unequal variance calculated the difference between the means for vitreoretinal fellowship and VA hospital affiliation. Alpha was set at $p < 0.05$.

Results

Of the 115 programs, 39 (33.9%) programs responded, but 1 program was excluded as it did not have complete resident data for all 3 years. The 38 (33.0%) programs that were incorporated for analysis represented a diverse group of programs by region, program size, and VA and vitreoretinal

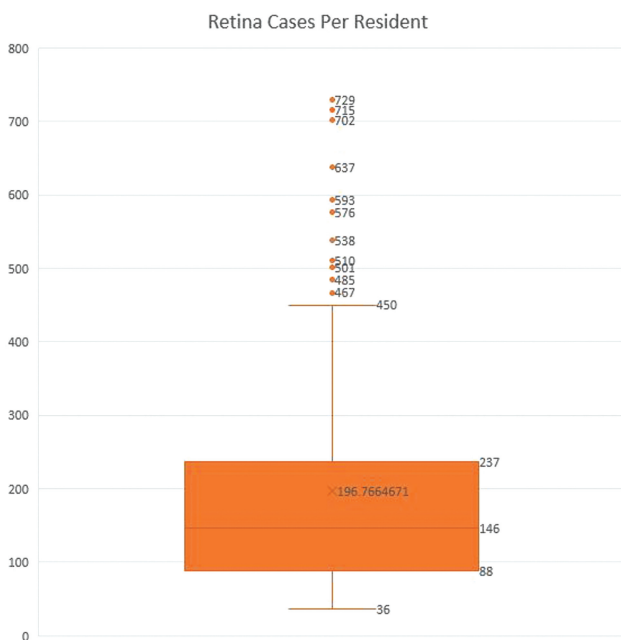


Fig. 1 Retinal procedures per resident.

Table 2 Mean number of procedures performed as a surgeon and assistant for our study versus the nationwide reported rates to ACGME

	Anterior vitrectomy	Cryotherapy	Focal retinal laser	Intraocular foreign body	Intravitreal injection	Other cataract	Other retina	Pars plana lensectomy	Peripheral retinal laser	Retina surgery
Our study	2.1	0.5	2.1	0.5	138.0	2.2	0.9	0.6	30.8	22.4
Nationwide	1.5	0.5	2.3	0.6	124.7	N/A	0.3	N/A	37.8	26.2

Abbreviations: ACGME, Accreditation Council of Graduate Medical Education; N/A, not available.

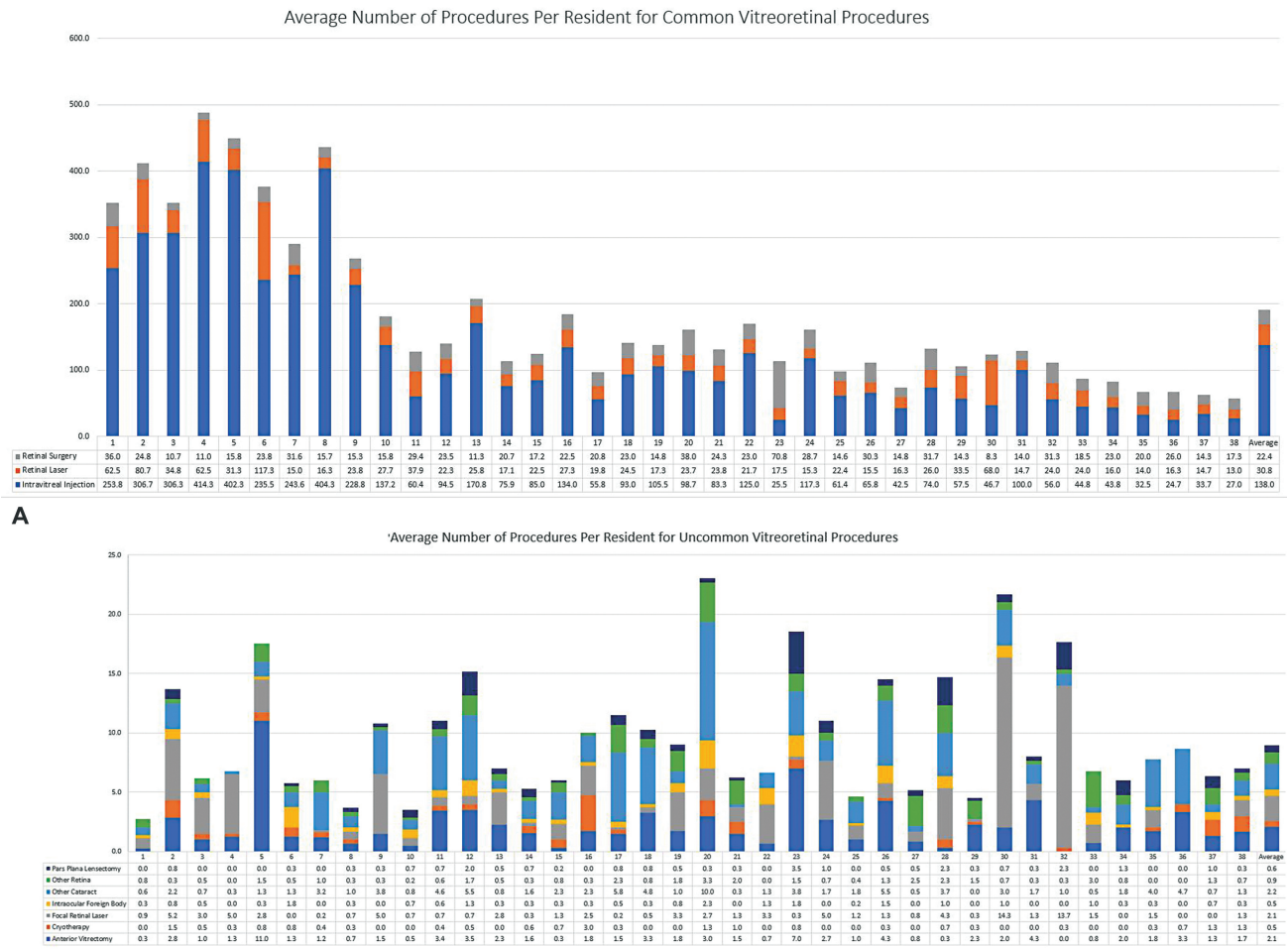


Fig. 2 Average number of vitreoretinal cases performed per resident by program. (A) Common vitreoretinal procedures. (B) Uncommon vitreoretinal procedures.

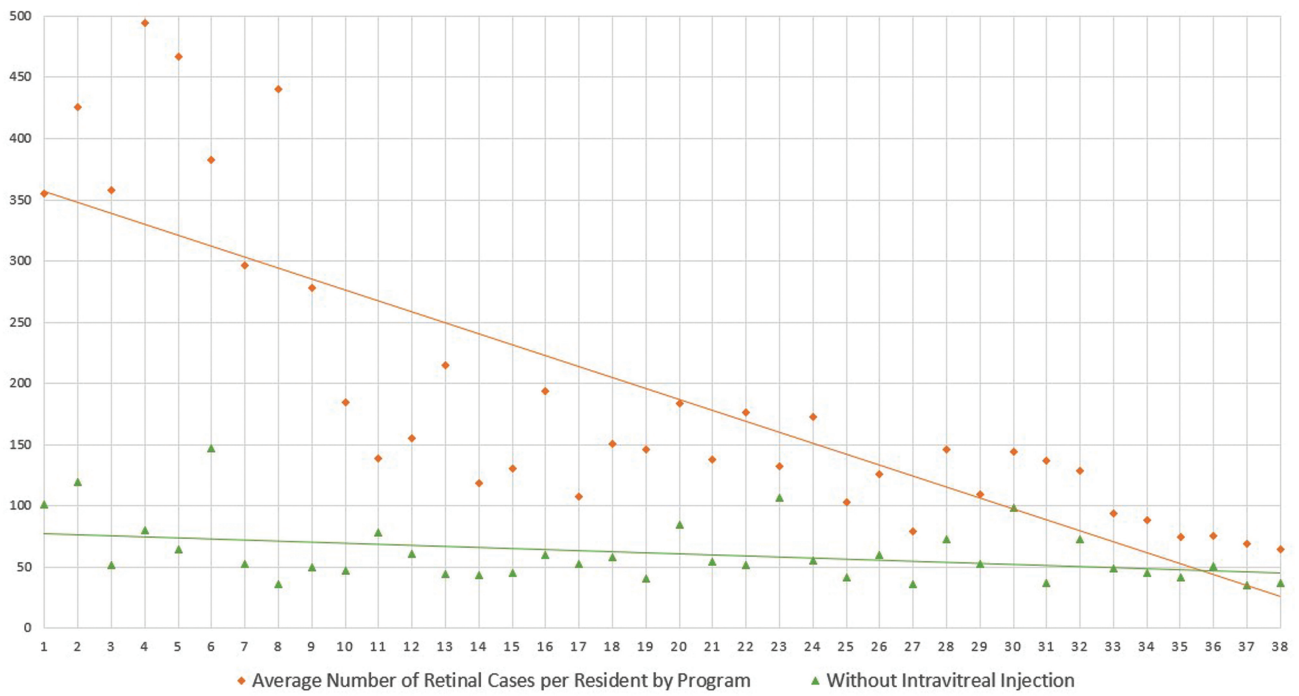


Fig. 3 Effect of intravitreal injection on the average number of retinal procedures per resident.

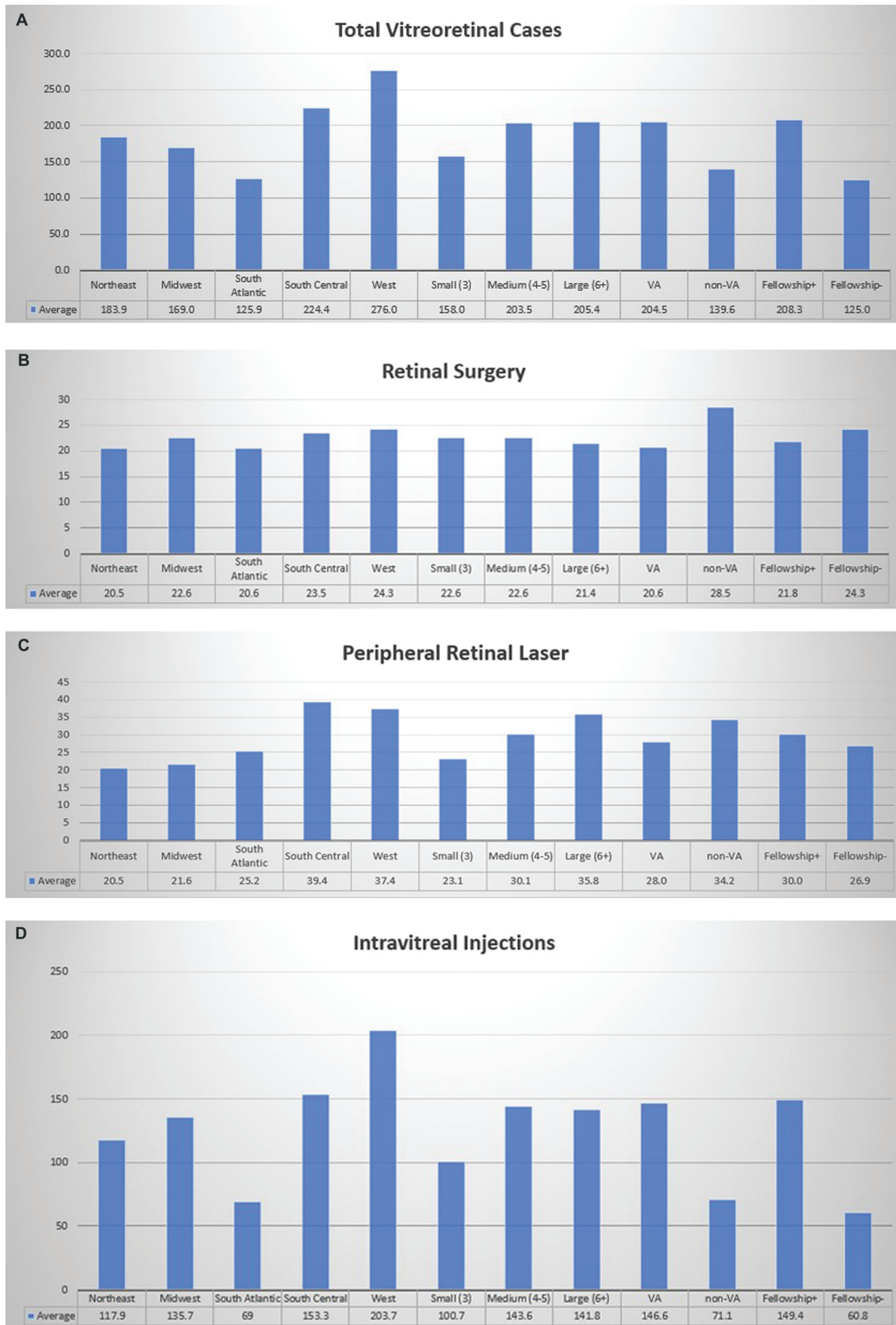


Fig. 4 Effect of region, program size, and VA hospital and fellowship affiliation on the mean number of vitreoretinal procedures performed per resident. (A) All vitreoretinal procedures. (B) Intravitreal injections. (C) Vitreoretinal surgery. (D) Peripheral retinal laser.

fellowship affiliations (►Table 1). The average vitreoretinal procedural volume per resident for these programs was a representative sample with similarity to the nationwide reported ACGME numbers in 2018 (►Table 2).¹⁵ Overall, our cohort performed a fewer number of PRL and VRS, but a greater number of IVI and other retinal procedures.

Of the 38 programs, there were 167 (34.2%; $n=488$ nationwide) recently graduated residents who completed a total of 32,860 retinal procedures. The total number of retinal procedures per resident (►Fig. 1) demonstrates a wide diversity in vitreoretinal experience. The total number of retinal procedures correlated with a greater number of total ophthalmic procedures ($r=0.74$).

The average number of vitreoretinal procedures performed per resident by program for common and uncommon procedures can be seen in ►Fig. 2A and B. A greater number of IVI strongly correlated with a larger total number of retinal procedures ($r=0.98$) and overall number of all ophthalmic procedures ($r=0.68$), whereas PRL ($r=0.77$ and 0.60) and VRS ($r=0.34$ and 0.56) had weaker relationships. All other uncommon vitreoretinal procedures had r values less than 0.3 . The effect of IVI on the average number of retinal procedures per resident by program is demonstrated in ►Fig. 3, and there was essentially no difference across programs for vitreoretinal procedures performed when IVI procedures were removed.

Effect of Region, Program Size, and Veterans Affairs and Fellowship Affiliation

When evaluating program surgical experience for total retinal procedures only, vitreoretinal fellowship affiliation was found to be associated with increased surgical experience ($p=0.002$), whereas region ($p=0.15$), program size ($p=0.55$), and VA affiliation ($p=0.08$) were not (►Fig. 4A). Although vitreoretinal fellowship affiliation had a significant effect on the overall number of vitreoretinal procedures, this was likely due to the number of IVI performed. There was no difference noted between the average number of non-IVI vitreoretinal procedures between programs with a vitreoretinal fellowship and those without (60.0 vs. 64.2 ; $p=0.32$).

No statistically significant effect across variables was noted for either VRS (►Fig. 4B) or PRL (►Fig. 4C). For IVI (►Fig. 4D), being affiliated with a VA ($p=0.02$) or a vitreoretinal fellowship ($p<0.001$) had a positive effect on IVI procedure volume, whereas region ($p=0.20$) and program size ($p=0.59$) did not affect the volume of IVI performed.

Discussion

To better understand variables that effected the total number of vitreoretinal procedures experienced by residents we evaluated region, program size, vitreoretinal fellowship, and VA hospital affiliation. Although we did not find a difference by region or program size, we did find that vitreoretinal fellows had a positive impact on the total procedures (208.3 vs. 125.0 ; $p=0.002$) and IVI (149.4 vs. 60.8 ; $p<0.001$) performed, but notably there was no statistically significant difference in non-IVI procedures com-

pleted (60.0 vs. 64.2 ; $p=0.32$). VA hospitals are important teaching institutions,¹³ and residents at the VA performed not only a larger number of procedures per resident (204.5 vs. 139.6 , $p=0.08$), but also a greater number of IVI (146.6 vs. 71.1 ; $p=0.02$).

The substantial increase in IVI⁵⁻⁷ has led to the inflation of procedures performed at certain programs. As demonstrated in ►Fig. 3, if one removes IVI, there is essentially no difference across programs for total retinal procedures. As the number of IVI correlates both with total retinal ($r=0.98$) and total ophthalmic procedures ($r=0.68$), this provides an opportunity for programs whose residents perform a greater number of IVI to report that they have a larger volume of retinal procedures.

There are certain important limitations for this study. First, only about a third of programs responded to this survey; however, this is similar to prior survey studies evaluating resident vitreoretinal education.^{3,4} Also, the large majority of programs had VA and fellowship affiliation making it difficult for analysis for these groups to be robust. There could also be nonresponse bias as those programs that have residents that did not meet minimum requirements declined to answer. Further, these data are reported by residents and depend on the accuracy of their entry.^{11,16} Frequently, residents may make errors in the CPT codes logged.¹⁶ They are also less likely to log assistant procedures that would affect the accuracy of the VRS numbers more than IVI and PRL.¹¹ Finally, the data in this study were prior to the coronavirus disease 2019 pandemic, and it is still unclear how the pandemic will effect vitreoretinal practice patterns and training in the future.¹⁷

In conclusion, program region and size did not influence the volume of procedures performed. VA hospital affiliation had a positive effect on IVI, but not on overall vitreoretinal procedures. Residents at programs with a vitreoretinal fellowship appear to complete more vitreoretinal procedures; however, this is because they perform more IVI. Programs without vitreoretinal fellows completed on average more non-IVI procedures. Reporting of only total vitreoretinal procedures by residency programs may misrepresent the actual diversity of procedures performed due to a higher volume of IVI.

Informed Consent

No informed consent was required for the publication of this manuscript.

Note

Abstract was presented at the Retina Society Annual Meeting, September 2021, Chicago, Illinois.

Disclaimer

The view(s) expressed herein are those of the author(s) and do not reflect the official policy or position of U.S. Army Medical Department, the U.S. Army Office of the Surgeon General, the Department of the Air Force, the Department of the Army, Department of Defense, the Uniformed Services University of the Health Sciences, or any other agency of the U.S. Government.

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Conflict of Interest

None declared.

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