Perspectives on Application and Interview Capping in Residency Selection of Surgical Subspecialties

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OBJECTIVE: With the advent of virtual interviews, the potential for interview hoarding by applicants became of greater concern due to lack of financial constraints associated with in-person interviewing. Simultaneously, the average number of applications submitted each year is rising. Currently there is no cap to the number of applications or interviews an applicant may complete when applying to residency, with the exception of ophthalmology with a cap of 15 interviews. No studies have assessed the applicants' perspectives on an application or interview cap. We assessed the attitudes of surgical subspecialty applicants towards capping, which may be useful when considering innovations in residency selection.

DESIGN/SETTING/PARTICIPANTS: About 1841 applicants to the Johns Hopkins' ophthalmology, urology, plastic surgery, and orthopedic surgery residency programs from the 2022-2023 cycle were invited to respond to a 22-item questionnaire. Statistical analyses of aggregate data were conducted using R.

RESULTS: Of the 776/1841 (42%) responses, 288 (40%) were in support of an application cap, while 455 (63%) were in support of an interview cap. Specialty ($p < 0.001$), gender ($p < 0.001$), taking a gap year ($p = 0.02$), medical school region ($p = 0.04$), and number of interviews accepted off of a waitlist ($p = 0.01$) were all significantly associated with a difference in opinion regarding an application cap. Specialty ($p < 0.001$), USMLE Step 1 score ($p = 0.004$), number of interviews ($p < 0.001$), and number of programs ranked ($p < 0.001$) were all significantly associated with a difference in opinion regarding an interview cap. Of those applicants who were in support of the respective caps they believed that on average a cap should consist of 48.1 (16.1) applications and 16.0 (8.0) interviews.

CONCLUSIONS: Our findings highlight the desire for interview caps among the majority of applicants to surgical subspecialties and thus this innovation may be considered by other specialties in the era of virtual interviews. (J Surg Ed 81:1013−1023. © 2024 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEYWORDS: interview cap, interview hoarding, residency selection, residency match

ACGME COMPETENCIES: Practice-Based Learning and Improvement, Systems-Based Practice

INTRODUCTION

There has been a recent shift towards primarily virtual interviews since the COVID-19 pandemic in 2020, permanently changing the landscape of in-person interviews/tours/networking once used in candidacy evaluation for graduate medical education.[1] The advent of virtual interviews has exacerbated the concerns related to interview hoarding by applicants,[2] given the lack of financial and time constraints associated with virtual interviews.[3] A study that compared the 2 different formats of interviews reported that the median cost of travel and lodging for an in-person interview was $600

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per interview (interquartile range $500-725), prior to the pandemic switch.[4] The Association of American Medical Colleges wrote in a letter that above-average applicants completed more interviews than in previous years, likely as a result of mitigating some of these barriers that previously limited applicants, like time and money. This interview "hoarding" among top applicants, does not allow for the previously declined interview invitations to be extended to the next tier of applicants.

Simultaneously, the average number of applications submitted each year is rising,[5] likely due to the increasing challenges of matching such as, the paucity of audition/away rotations since the pandemic, the uncertainty and lack of knowledge surrounding program culture and competitiveness, and general gauge on ability to match without having had in-person interactions. In the first postpandemic application cycle in 2020-2021 the average number of applications submitted by applicants from competitive surgical subspecialties like orthopedic surgery, urology, otolaryngology, neurological surgery, and plastic surgery increased by at least 15% from the previous year.[5] This inflation of applications submitted also contributes to the concerns surrounding the phenomenon of interview hoarding in the same right. Some proposed solutions to these problems include implementation of a limit or cap on the number of applications an applicant may submit, a cap on the number of interviews an applicant may complete, and the addition of a mandatory secondary application for applicants to demonstrate genuine interest in certain programs.[6,7] The consequences of application inflation and the concerns surrounding interview hoarding may ultimately lead to a further widened gap in ability to match between top-tier and below-average applicants.

Currently, there is no cap to the number of applications or interviews an applicant may complete when applying to residency, with the exception of ophthalmology. Ophthalmology started with a 20 interview cap in 2020,[8] further decreasing to 18 interviews in 2021, and currently has been capped at 15 interviews for the past 2 years.[9-12] It is unlikely that we will stay mostly virtual and equally unlikely that we will return to completely in-person interviews across all specialties; therefore, it is necessary to create measures, such as a cap, to combat the ever present problem of application inflation and potential for interview hoarding that is present in the age of hybrid and virtual interviewing.

There have been no previous studies that have assessed surgical subspecialty applicants' perspectives on an application or interview cap; therefore, we aimed to assess the attitudes of these applicants towards capping, which may be useful when developing rules around residency selection going forward.

MATERIALS AND METHODS

A 22-item questionnaire was developed for email distribution to individuals who applied during the 2022-2023 match cycle. Previous research studying stakeholder perspectives on the use of caps in OBGYN informed the creation of our questionnaire.[13] Potential participants included ophthalmology applicants to the Wilmer Eye Institute (615 total), urology applicants to the Brady Urological Institute (369 total), plastic surgery applicants to the Department of Plastic and Reconstructive Surgery (341 total), and orthopedic surgery applicants to the Department of Orthopedic Surgery (516 total) all at the Johns Hopkins University School of Medicine. The questionnaire was sent to all 1841 of these applicants after they received their match results (with ophthalmology match happening over a month in advance of the others), with responses collected from February 15 to April 5, 2023. The study was deemed exempt by the Institutional Review Board (IRB00346325) of Johns Hopkins University School of Medicine as survey responses included no identifiable data and were otherwise anonymous. Participation was voluntary, with an optional raffle for 1 of 3 $100 Amazon gift cards; email addresses for the raffle were collected in a separate form such that the contact information was not connected to survey answers.

The questionnaire was administered using the Qualtrics online survey platform and took approximately 3 minutes to complete. Applicants received an initial invitation via email and those who hadn't responded received a single reminder email before the survey close date. The survey questions are included in the Supplemental information, and are described in brief as follows.

Applicants were asked what specialty they applied to; United States medical graduate or International medical graduate status; reapplicant status; if gap years were taken prior to residency; USMLE Step 1 score; if USMLE Step 2 was taken prior to submitting their residency applications; USMLE Step 2 score if taken prior to residency applications; and number of applications submitted, interview invitations received, interviews completed, programs ranked, interviews accepted and subsequently cancelled, and interviews offered off of a waitlist. Several questions asked for demographic data (gender, race, ethnicity, degree(s) obtained, and medical school region), with an option for participants to select "prefer not to say," and a free-text box for those who selected "other." Four questions evaluated participants' opinion regarding support or lack thereof of an application cap and interview cap, and if they expressed support for either cap they then indicated what number should constitute each cap, respectively.

Six questions evaluated participants' agreement with statements regarding the equity of interview caps on a 5-point Likert scale from "Strongly Agree" to "Strongly Disagree."

Statistical analyses of aggregate data were conducted using R (v3.2.3, R Project for Statistical Computing) with $p < 0.05$ considered statistically significant. Chi-squared and Fisher's exact tests were used to test the association between categorical variables. Among these 2 tests, Fisher exact test was used when more than 20% of cells have expected frequencies < 5. For the continuous variables, nonparametric Kruskal-Wallis test were utilized. For Likert scale questions, chi-squared was used to compare the results stratified by specialty.

RESULTS

Survey Respondents

There were 776 total responses (288 ophthalmology, 169 urology, 143 plastic surgery, 176 orthopedic surgery), equivalent to a 42% response rate. Detailed demographic information is displayed in Table 1 organized by the specialty applied to. Out of all respondents, 307 (40%) were female, most (49%) were White/Caucasian with the next most common races being Asian (27%) and Black/African American (7%); 9% identified as Hispanic/Latino; most (76%) graduated with an MD degree only; and respondents came from medical schools across the United States with 7% international graduates. There was no statistically significant difference in the distribution of reapplicants, having taken a gap year, and medical school region between respondents of the 4 specialties. Gender, race/ethnicity, degree(s) obtained, USMLE Step 1 score ($p < 0.001$), Step 2 taken before residency application ($p < 0.001$), number of applications ($p < 0.001$), number of interviews ($p < 0.001$), number of programs ranked ($p < 0.001$), number of interviews accepted and subsequently cancelled ($p = 0.004$), and number of interviews accepted off of a waitlist ($p < 0.001$) were all significantly different across the 4 different specialties. Orthopedic surgery had the lowest proportion of applicants who identified as women (23.3%), the greatest proportion of White/Caucasian applicants (60.2%), the highest scores on USMLE Step 1, and the greatest proportion of applicants taking USMLE Step 2 before they submitted their residency applications in 2022 (94.0%). Plastic Surgery had the greatest proportion of applicants with multiple degrees (23.1%). Urology applicants had the highest average number of applications submitted at 92.4 (28.1), highest average number of interviews completed at 18.1 (10.3), highest average number of programs ranked at 15.0 (6.59), and highest average number of interviews accepted from a waitlist at 2.35 (2.46). Ophthalmology applicants had the highest average number of interviews accepted and subsequently cancelled at 1.97 (4.16); however, this is with the understanding that it is the only specialty with an existing interview cap.

Survey Findings

About 288 total applicants (37%) were in support of an application cap, while 455 total applicants (59%) were in support of an interview cap. Specialty ($p < 0.001$), gender ($p < 0.001$), taking a gap year ($p = 0.02$), medical school region ($p = 0.04$), and number of interviews accepted off of a waitlist ($p = 0.01$) were all significantly associated with a difference in opinion regarding an application cap, as demonstrated in Table 2. Urology applicants demonstrated the strongest support of an application cap at 56%, with plastic surgery demonstrating the least amount of support with only 22% of its applicants. Both men (54%) and women (68%) were more likely to not support implementation of an application cap. Those that took a gap year prior to applying to residency were more likely to not support the application cap at 67%. Also, those that had a greater average number of interviews accepted off of a waitlist, with an average of 1.3 (1.7), were in support of an application cap.

With regards to an interview cap, specialty ($p < 0.001$), USMLE Step 1 score ($p = 0.004$), number of interviews ($p < 0.001$), and number of programs ranked ($p < 0.001$) were all significantly associated with a difference in opinion, as demonstrated in Table 3. Ophthalmology applicants demonstrated the strongest support of an interview cap at 84%, with orthopedic surgery applicants demonstrating the least amount of support with only 42% of its applicants. Applicants with a lower average number of interviews at 12.5 (8.4) interviews were in support of an interview cap, whereas applicants who did not support an interview cap had a greater average number of interviews at 16.5 (9.0). Similarly, applicants with a lower average number of programs ranked at 10.8 (6.2) programs were in support of an interview cap, whereas applicants who did not support an interview cap had a greater average number of programs ranked at 14.2 (6.3).

Of those applicants who were in support of the respective caps they believed that on average a cap should consist of 48.1 (16.1) applications and 16.0 (8.0) interviews. As seen in Table 4, there was a significant difference in the number of applications each specialty believed should constitute the cap ($p = 0.02$). Urology demonstrated a belief that 52.8 (13.4) applications should constitute the cap, the highest of all the

TABLE 1. Descriptive Statistics of the Survey Population by Specialty

Variables	Overall	Ophthalmology	Urology	Plastic Surgery	Orthopedic Surgery	p-Value
	(N = 776)	(N = 288)	(N = 169)	(N = 143)	(N = 176)	
Gender						< **0.001**
Man	432 (55.7%)	146 (50.7%)	98 (58.0%)	56 (39.2%)	132 (75.0%)	
Woman	307 (39.6%)	122 (42.4%)	60 (35.5%)	84 (58.7%)	41 (23.3%)	
Non-binary/third gender	2 (0.3%)	1 (0.3%)	1 (0.6%)	0 (0%)	0 (0%)	
Prefer not to say	9 (1.2%)	7 (2.4%)	2 (1.2%)	0 (0%)	0 (0%)	
Missing	26 (3.4%)	12 (4.2%)	8 (4.7%)	3 (2.1%)	3 (1.7%)	
Race/Ethnicity						< 0.001
White	381 (49.1%)	109 (37.8%)	99 (58.6%)	67 (46.9%)	106 (60.2%)	
Black	51 (6.6%)	18 (6.3%)	9 (5.3%)	8 (5.6%)	16 (9.1%)	
Asian	212 (27.3%)	106 (36.8%)	30 (17.8%)	38 (26.6%)	38 (21.6%)	
Native	4 (0.5%)	1 (0.3%)	0 (0%)	1 (0.7%)	2 (1.1%)	
Hispanic	69 (8.9%)	21 (7.3%)	16 (9.5%)	23 (16.1%)	9 (5.1%)	
Other	33 (4.3%)	21 (7.3%)	7 (4.1%)	3 (2.1%)	2 (1.1%)	
Missing	26 (3.4%)	12 (4.2%)	8 (4.7%)	3 (2.1%)	3 (1.7%)	
Degree						**0.03**
MD	586 (75.5%)	219 (76.0%)	118 (69.8%)	102 (71.3%)	147 (83.5%)	
DO	20 (2.6%)	6 (2.1%)	8 (4.7%)	2 (1.4%)	4 (2.3%)	
Multiple	127 (16.4%)	42 (14.6%)	33 (19.5%)	33 (23.1%)	19 (10.8%)	
Other	43 (5.5%)	21 (7.3%)	10 (5.9%)	6 (4.2%)	6 (3.4%)	
Reapplicant						0.213
No	666 (85.8%)	243 (84.4%)	139 (82.2%)	131 (91.6%)	153 (86.9%)	
Yes	81 (10.4%)	30 (10.4%)	22 (13.0%)	9 (6.3%)	20 (11.4%)	
Missing	29 (3.7%)	15 (5.2%)	8 (4.7%)	3 (2.1%)	3 (1.7%)	
Gap y						0.146
Yes	231 (29.8%)	81 (28.1%)	45 (26.6%)	55 (38.5%)	50 (28.4%)	
No	519 (66.9%)	194 (67.4%)	116 (68.6%)	86 (60.1%)	123 (69.9%)	
Missing	26 (3.4%)	13 (4.5%)	8 (4.7%)	2 (1.4%)	3 (1.7%)	
Medical school region						0.08
Northeast	189 (24.4%)	67 (23.3%)	43 (25.4%)	33 (23.1%)	46 (26.1%)	
South	236 (30.4%)	94 (32.6%)	41 (24.3%)	43 (30.1%)	58 (33.0%)	
Midwest	167 (21.5%)	53 (18.4%)	46 (27.2%)	28 (19.6%)	40 (22.7%)	
West	104 (13.4%)	39 (13.5%)	19 (11.2%)	21 (14.7%)	25 (14.2%)	
Outside of US	52 (6.7%)	22 (7.6%)	12 (7.1%)	15 (10.5%)	3 (1.7%)	
Prefer not to say	2 (0.3%)	1 (0.3%)	0 (0%)	0 (0%)	1 (0.6%)	
Missing	26 (3.4%)	12 (4.2%)	8 (4.7%)	3 (2.1%)	3 (1.7%)	
USMLE Step 1 score						< **0.001**
< 200	1 (0.1%)	1 (0.3%)	0 (0%)	0 (0%)	0 (0%)	
200-220	24 (3.1%)	11 (3.8%)	7 (4.1%)	6 (4.2%)	0 (0%)	
221-240	150 (19.3%)	67 (23.3%)	48 (28.4%)	26 (18.2%)	9 (5.1%)	
241-260	415 (53.5%)	145 (50.3%)	83 (49.1%)	79 (55.2%)	108 (61.4%)	
> 260	93 (12.0%)	27 (9.4%)	11 (6.5%)	19 (13.3%)	36 (20.5%)	
Pass	66 (8.5%)	25 (8.7%)	12 (7.1%)	9 (6.3%)	20 (11.4%)	
Fail	1 (0.1%)	0 (0%)	0 (0%)	1 (0.7%)	0 (0%)	
Missing	26 (3.4%)	12 (4.2%)	8 (4.7%)	3 (2.1%)	3 (1.7%)	
Step 2 taken before residency application						< **0.001**
Yes	657 (84.7%)	224 (77.8%)	137 (81.1%)	130 (90.9%)	166 (94.3%)	
No	89 (11.5%)	51 (17.7%)	23 (13.6%)	9 (6.3%)	6 (3.4%)	
Missing	30 (3.9%)	13 (4.5%)	9 (5.3%)	4 (2.8%)	4 (2.3%)	
Number of applications						< **0.001**
Mean (SD)	86.4 (27.3)	84.6 (25.0)	92.4 (28.1)	82.7 (24.1)	86.4 (31.6)	
Median (min, max)	83.0 (1.00, 200)	85.0 (1.00, 200)	90.0 (1.00, 143)	82.0 (20.0, 200)	81.5 (30.0, 199)	
Missing	53 (6.8%)	21 (7.3%)	14 (8.3%)	10 (7.0%)	8 (4.5%)	

(continued)

TABLE 1 (*continued*)

Variables	Overall	Ophthalmology	Urology	Plastic Surgery	Orthopedic Surgery	p-Value
Number of interviews						< **0.001**
Mean (SD)	14.0 (8.85)	11.8 (8.04)	18.1 (10.3)	13.6 (9.24)	14.1 (6.83)	
Median (min, max)	12.0 (0, 51.0)	10.0 (0, 45.0)	16.0 (1.00, 51.0)	10.0 (0, 40.0)	13.0 (2.00, 38.0)	
Missing	53 (6.8%)	21 (7.3%)	14 (8.3%)	10 (7.0%)	8 (4.5%)	
Number of programs ranked						< **0.001**
Mean (SD)	12.0 (6.47)	9.46 (4.66)	15.0 (6.59)	11.9 (6.54)	13.6 (7.18)	
Median (min, max)	12.0 (0, 70.0)	10.0 (0, 19.0)	15.0 (1.00, 31.0)	10.0 (0, 28.0)	13.0 (2.00, 70.0)	
Missing	55 (7.1%)	21 (7.3%)	15 (8.9%)	10 (7.0%)	9 (5.1%)	
Number of interviews accepted, and subsequently cancelled						**0.004**
Mean (SD)	1.47 (4.01)	1.97 (4.16)	1.36 (4.55)	1.46 (4.56)	0.796 (2.40)	
Median (min, max)	0 (0, 31.0)	0 (0, 25.0)	0 (0, 27.0)	0 (0, 31.0)	0 (0, 22.0)	
Missing	60 (7.7%)	24 (8.3%)	17 (10.1%)	10 (7.0%)	9 (5.1%)	
Number of interviews accepted off of a waitlist						< **0.001**
Mean (SD)	1.10 (1.66)	0.856 (1.31)	2.35 (2.46)	0.752 (1.05)	0.619 (0.934)	
Median (min, max)	1.00 (0, 15.0)	0 (0, 8.00)	2.00 (0, 15.0)	0 (0, 5.00)	0 (0, 4.00)	
Missing	58 (7.5%)	24 (8.3%)	16 (9.5%)	10 (7.0%)	8 (4.5%)	

Bold values indicate statistical signficance with a $p < 0.05$.

specialties, while plastic surgery had the lowest average, wanting 38.6 (18.8) applications in the cap. There was also a significant difference in the number of interviews each specialty believed should constitute the cap ($p < 0.001$). Plastic surgery demonstrated a belief that 18.8 (15.4) interviews should constitute the cap, the highest of all the specialties, while ophthalmology had the lowest average, wanting 13.7 (2.68) interviews in the cap.

Figure 1 displays responses to Likert scale questions regarding the efficacy/equity of an interview cap, stratified by applicant specialty. 61% of those who applied into ophthalmology. agreed or strongly agreed that "an interview cap reduces anxiety/stress about the match process" compared to the less than 50% from each of the other 3 specialties ($p < 0.001$). Regarding the statement that "an interview cap may disadvantage applicants who have reasons to interview more broadly (couples match, less traditionally competitive applicants, geographic constraints)" a majority of applicants from urology, plastic surgery, and orthopedic surgery agreed or strongly agreed with the statement, whereas applicants from ophthalmology were more likely to disagree ($p < 0.001$). Across all 4 specialties there was a universal agreement towards the statement claiming that "an interview cap decreases 'interview hoarding' among competitive applicants." Urology and orthopedic surgery applicants both believed that an interview cap reduces financial burden for applicants, whereas the majority of ophthalmology and plastic surgery applicants did not believe that to be the case ($p = 0.002$); however, this is with the understanding that ophthalmology is the only specialty of these 4 to remain fully virtual. Across all specialties there was agreement that "each specialty would need a unique interview cap, based on competitiveness of specialty," and plastic surgery applicants demonstrated the strongest support of that statement (81%, $p = 0.024$). A majority of respondents across all 4 specialties strongly agreed that programs should have a set interview release date, with a statistically significant positive skew for respondents who applied to urology (85%, $p < 0.001$).

CONCLUSIONS

The average number of applications submitted, and the significant concerns related to interview hoarding is a continually increasing phenomenon, especially with the recent implementation of virtual interviews.[2,5] This raises the question of whether implementation of either an application or interview cap would be useful going forward, and if so, how do applicants feel about its utilization, as it would directly impact their future. Our findings highlight the desire for interview caps among the majority of respondents to the survey, while the use of an application cap is not as widely supported among these same applicants. Thus, the role of an interview cap may be considered during residency selection in the era of virtual interviews.

TABLE 2. Proportion of Medical Students Who Want Application Caps by Applicant Characteristics

Variables	Do Not Support Application Cap	Support Application Cap	p-Value
Specialty, n (%)			< **0.001**
Ophthalmology	164 (61%)	104 (39%)	
Urology	68 (44%)	87 (56%)	
Plastic surgery	103 (78%)	29 (22%)	
Orthopedic surgery	100 (60%)	68 (40%)	
Gender, n (%)			< **0.001**
Man	226 (54%)	192 (46%)	
Woman	201 (68%)	93 (32%)	
Non-binary/third gender	1 (50%)	1 (50%)	
Prefer not to say	7 (78%)	2 (22%)	
Race/Ethnicity, n (%)			0.38
White	211 (57%)	159 (43%)	
Black	32 (64%)	18 (36%)	
Asian	123 (61%)	79 (39%)	
Native	2 (50%)	2 (50%)	
Hispanic	44 (69%)	20 (31%)	
Other	23 (70%)	10 (30%)	
Degree, n (%)			0.40
MD	332 (59%)	235 (41%)	
DO	13 (68%)	6 (32%)	
Multiple	80 (66%)	41 (34%)	
Other	10 (62%)	6 (38%)	
Reapplicant, n (%)			0.84
Yes	45 (59%)	31 (41%)	
No	389 (60%)	255 (40%)	
Gap y, n (%)			**0.02**
Yes	146 (67%)	73 (33%)	
No	289 (57%)	214 (43%)	
Medical school region, n (%)			**0.04**
Northeast	106 (58%)	76 (42%)	
South	133 (57%)	99 (43%)	
Midwest	96 (61%)	62 (39%)	
West	58 (59%)	41 (41%)	
Outside of US	40 (80%)	10 (20%)	
Prefer not to say	2 (100%)	0 (0%)	
USMLE Step 1 score, n (%)			0.30
< 200	1 (100%)	0 (0%)	
200-220	11 (48%)	12 (52%)	
221-240	88 (60%)	58 (40%)	
241-260	232 (58%)	168 (42%)	
> 260	62 (69%)	28 (31%)	
Pass	40 (65%)	22 (35%)	
Fail	1 (100%)	0 (0%)	
Step 2 taken before residency application, n (%)			0.80
Yes	380 (60%)	254 (40%)	
No	54 (61%)	34 (39%)	
Number of applications, mean (SD)	87.1 (26.5)	85.4 (28.5)	0.27
Number of interviews, mean (SD)	14.2 (9.0)	13.8 (8.7)	0.57
Number of programs ranked, mean (SD)	11.9 (6.1)	12.2 (7.1)	0.10
Number of interviews accepted, and subsequently cancelled, mean (SD)	1.6 (4.4)	1.2 (3.3)	0.09
Number of interviews accepted off of a waitlist, mean (SD)	1.0 (1.6)	1.3 (1.7)	**0.01**

Bold values indicate statistical signficance with a $p < 0.05$.

TABLE 3. Proportion of Medical Students Who Want Interview Caps by Applicant Characteristics

Characteristic	Do not Support Interview Cap	Support Interview Cap	p-Value
Specialty, n (%)			< **0.001**
Ophthalmology	43 (16%)	225 (84%)	
Urology	76 (49%)	78 (51%)	
Plastic surgery	51 (39%)	81 (61%)	
Orthopedic surgery	97 (58%)	71 (42%)	
Gender, n (%)			0.96
Man	154 (37%)	264 (63%)	
Woman	108 (37%)	185 (63%)	
Non-binary/third gender	1 (50%)	1 (50%)	
Prefer not to say	4 (44%)	5 (56%)	
Race/Ethnicity, n (%)			0.77
White	140 (38%)	229 (62%)	
Black	22 (44%)	28 (56%)	
Asian	70 (35%)	132 (65%)	
Native	2 (50%)	2 (50%)	
Hispanic	21 (33%)	43 (67%)	
Other	12 (36%)	21 (64%)	
Degree, n (%)			0.56
MD	207 (37%)	359 (63%)	
DO	10 (53%)	9 (47%)	
Multiple	44 (36%)	77 (64%)	
Other	6 (38%)	10 (62%)	
Reapplicant, n (%)			0.20
Yes	23 (30%)	53 (70%)	
No	243 (38%)	400 (62%)	
Gap y, n (%)			0.49
Yes	77 (35%)	142 (65%)	
No	190 (38%)	312 (62%)	
Medical school region, n (%)			0.25
Northeast	64 (35%)	118 (65%)	
South	85 (37%)	147 (63%)	
Midwest	67 (43%)	90 (57%)	
West	33 (33%)	66 (67%)	
Outside of US	16 (32%)	34 (68%)	
Prefer not to say	2 (100%)	0 (0%)	
USMLE Step 1 score, n (%)			**0.004**
< 200	0 (0%)	1 (100%)	
200-220	4 (17%)	19 (83%)	
221-240	39 (27%)	106 (73%)	
241-260	155 (39%)	245 (61%)	
> 260	44 (49%)	46 (51%)	
Pass	25 (40%)	37 (60%)	
Fail	0 (0%)	1 (100%)	
Step 2 taken before residency application, n (%)			0.32
Yes	239 (38%)	395 (62%)	
No	28 (32%)	59 (68%)	
Number of applications, mean (SD)	87.2 (28.9)	86.1 (26.1)	0.74
Number of interviews, mean (SD)	16.5 (9.0)	12.5 (8.4)	< **0.001**
Number of programs ranked, mean (SD)	14.2 (6.3)	10.8 (6.2)	< **0.001**
Number of interviews accepted, and subsequently cancelled, mean (SD)	1.4 (3.7)	1.5 (4.2)	0.52
Number of interviews accepted off of a waitlist, mean (SD)	1.2 (1.7)	1.1 (1.7)	0.19

Bold values indicate statistical signficance with a $p < 0.05$.

TABLE 4. Opinion on What Number Should Constitute an Application Cap and Interview Cap Among Those Respondents in Support of These Caps Respectively

Specialty	Number of Applications in a Cap, Mean (SD)	p-Value	Number of Interviews in a Cap, Mean (SD)	p-Value
Ophthalmology	49.6 (18)	0.02	13.7 (2.68)	< 0.001
Urology	52.8 (13.4)		17.8 (3.53)	
Plastic surgery	38.6 (18.8)		18.8 (15.4)	
Orthopedic surgery	43.8 (12.3)		17.9 (8.64)	

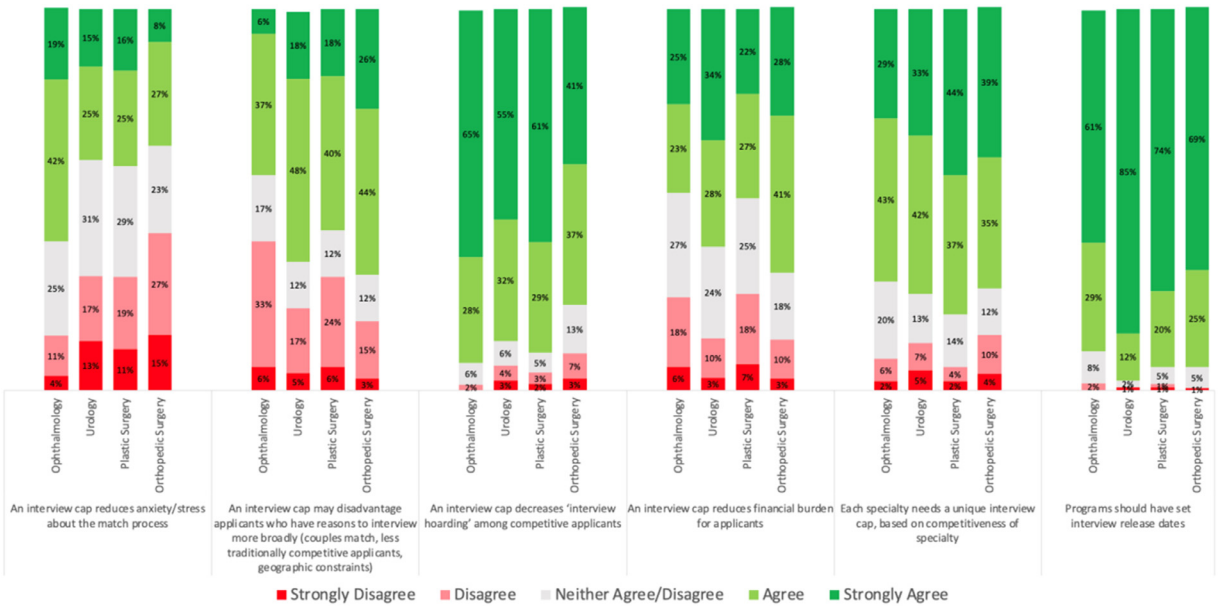

FIGURE 1. Likert scale responses to statements regarding efficacy of interview caps by specialty.

The case for an application cap begins with the idea that in recent years, even prior to the pandemic, there has been an overall trend towards increasing numbers of applications submitted.[5] Several specialty programs including ophthalmology, plastic surgery, orthopedics, and otolaryngology have recently called for limiting the number of residency applications an applicant can submit.[14-17] Application inflation also limits the ability of programs to perform a holistic review of its applicants.[18] For example, if 10 minutes are spent reading each application, screening 500 applications would take 5000 minutes (over 80 hours) and therefore, simply due to the sheer magnitude of applications to sift through, the detail and attention paid to each one suffers. This inundation of applications encourages use of traditional metrics to screen applications such as USMLE Step scores, Alpha Omega Alpha membership, clerkship grades, and other objective measures.[18] While secondary applications could reduce the presence of application inflation,[6] it can also become onerous for both applicants and programs. Also, as selection committees often rank applicants higher based on perceived interest, a cap would allow selection committees to know that all applicants are interested in their program, as they decided to apply to that program given a cap. A cap can be compounded with recent era of program-specific personal statements and preference signaling or tokens. Recent data from the AAMC suggests a notable drop in the average number of applications for many specialties that participated in signaling, specifically among US MD and DO applicants.[19] The largest drops in average applications per applicant was among the "large signal" and "two-tier signal" specialties.[19] Urology experienced a 24% drop in applications from the 2024 application cycle as compared to the 2023 cycle, whereas orthopedic surgery experienced an equally impressive 20% drop.[19]

Furthermore, there is a significant cost to applicants associated with application inflation. Residency applicants often apply through the Electronic Residency Application Service (ERAS), which has a tiered fee system that requires $99 for the first 10 programs applied to, $19 each for programs 11 to 20, $23 each for programs 21 to 30, and $27 each for programs 31 or more.[20] In our study, applicants to surgical

subspecialties at Johns Hopkins University School of Medicine applied to 86 programs on average, and if applying through ERAS this would cost applicants $2031. Whereas, if according to our study an applicant applies to 48 programs, as this was the average number of applications desired in a cap reported by those that were in support of an application cap, then it would only be a cost of $1005 to the applicant applying through ERAS, an over 50% reduction in application costs. There have also been movements and trends to combat this through other avenues, like in plastic surgery, through the use of a centralized common application for the specialty, with a $100 flat fee to apply to as many programs as an applicant would like.[21] Additionally, the AAMC recently published that they are expanding their "AAMC Fee Assistance Program" to include ERAS in 2025, as well as establishing a new fee structure for the 2025 ERAS cycle that will result in discounts of up to 36% for most applicants.[22] Although this does not address the problem of application inflation, it could help mitigate some of the financial burden for economically disadvantaged applicants.

Although our study did not display an overwhelming support of an application cap among respondents, there were significant differences in support based on specialty. This idea could be explored further with a targeted survey or even a focus group of students in each specialty leading to a more nuanced understanding of attitudes towards an application cap and could eventually lead to use of a specialty-specific cap based on difficulty/competitiveness of each specialty. This also leads to the discussion and case against application capping, in that applicants may have reasons to apply more broadly, namely those that are less traditionally competitive applicants, have geographic constraints, are couples matching, etc. There are also currently no caps on college or medical school applications, and implementing a cap on residency applications could pose a legal challenge. Our study demonstrated that this difference in opinion regarding an application cap extends from specialty, to gender, gap year(s) taken prior to residency, and medical school region, similar in nature to the reasons in the case against application caps. Thus, this decision to institute a cap must be equitable to all and take into special consideration these demographics so as not to disadvantage certain groups of applicants.

Some alternative methods to the application cap that could decrease the trend of application inflation include increased transparency from programs regarding standardized testing score cutoffs, consideration of international medical graduates (IMG) or osteopathic medical students, visa support for IMGs, and research publication/presentation expectations. In the era of virtual interviews, it can also be hard to gauge a program's culture and community or personal "fit" without meeting in person with residents and faculty. In this case websites or promotional material that clearly describe research or clinical focus, specific training opportunities like global health, policy, or the business of medicine, program size, patient populations served, call-schedules, paid time-off and maternity/paternity leave, resident graduate outcomes in the fellowship match or future career endeavors, and clinical volume could all help in applicants deciding whether or not to submit an application to a certain program.

The number of interviews an applicant receives correlates with competitiveness and probability of matching, and potential interview hoarding among top applicants has become increasingly prevalent since virtual interviews without the financial burden of travel associated with an in-person interview.[2] The reason for an interview cap comes from trying to mitigate potential interview hoarding but also can increase equity in the interview process and reduce the financial burden of interviewing, as there has been a slow return to in-person interviewing since the years following the COVID-19 pandemic.

Our study demonstrated that the majority of applicants to surgical subspecialties at Johns Hopkins in 2022-2023 were in support of an interview cap, with those in support of the interview cap believing that the cap should be set at 16 interviews. There were statistically significant differences in opinion regarding the interview cap based on specialty and competitiveness of applicants indicated by USMLE Step 1 score, number of interviews completed, and number of programs ranked. Therefore, implementation of an interview cap may be individualized based on specialty. Although the reason for the overwhelming support for an interview cap from ophthalmology applicants could be an agreement with the status quo as these respondents applied with an interview cap. A previous study that assessed the attitudes towards an interview cap among obstetrics and gynecology (OBGYN) residency applicants demonstrated that 65% of medical students supported an interview cap for all applicants to OBGYN, with only 10% supporting a cap for competitive applicants only, with the cap consisting of about 15 interviews.[13] Our study demonstrated that of applicants that supported the interview cap, plastic surgery applicants wished for the highest cap of about 19 interviews, while ophthalmology desired cap of about 14 interviews. As these ophthalmology applicants had already applied in the 2022-2023 match cycle with a cap of 15 interviews,[12] this could explain why ophthalmology applicants demonstrated the lowest proposed interview cap among the 4 specialties.

Most respondents demonstrated an understanding that an interview cap could disadvantage those students who had reasons to apply more broadly like couples match, less traditionally competitive, or geographic constraints. Respondents also agreed with the sentiment that an interview cap decreases "interview hoarding" among top applicants, as well as could reduce financial burden for applicants, which both support the case for implementation of some sort of interview cap across all specialties. However, it is important to consider specialty specific interview caps based on competitiveness of the specialty and specialty specific data on the number of interviews needed to match, as respondents demonstrated differing support of an interview cap based on specialty, but also showed overwhelming support for the statement that "each specialty needs a unique interview cap." One way to increase transparency in the process, as well as ensure applicants choose appropriate programs to interview, is to require programs to have set interview release dates, as respondents to this study overwhelmingly described. There is however a difference in opinion regarding whether or not an interview cap reduces anxiety/stress of the match process, and this should be explored further with more qualitative research exploring the nuances of these viewpoints.

Future research needs to be done with regards to how best we can implement certain caps while avoiding disadvantaging certain applicants in the process. There can be further studies on the attitudes and matching outcomes of recent measures already set in place, whether that be the interview capping that exists in ophthalmology,[8-12] or tokens and signaling that exist among several ERAS surgical subspecialties like urology, ENT, and orthopedic surgery.[19] Ultimately, any implementation of a cap needs to be heavily scrutinized before being enacted, so as to not disadvantage applicants in the process.

Implementation of interview caps may be widely considered among surgical subspecialties in the residency selection process, as our study demonstrates positive applicant attitudes towards its use. However, the role of an application cap remains in question, as it is difficult to enact such a cap without disadvantaging some applicants.

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SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jsurg.2024.04.007.