ORIGINAL ARTICLE

Going virtual: effectiveness of virtual opportunities in engaging applicants for plastic surgery residencies

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Abstract

Purpose During the COVID-19 pandemic, virtual events led by residency programs have eased deficits formed by the lack of in-person opportunities. Despite their anecdotal success, there is yet a study on their utility and value, as perceived by attendees. Therefore, we sought to investigate engagement rates of virtual opportunity posts via Instagram, equipping residency programs with recommendations for future virtual event planning.

Methods The 40 PRS residency programs with the highest number of followers on Instagram were inspected for posts regarding virtual opportunities. The virtual opportunities were classified by type, medium, and intended audience. The number of opportunities within each classification was analyzed, along with the like/comment to follower ratios, and compared via ANOVA tests.

Results A total of 141 virtual opportunities were evaluated, with the most events occurring in August (21.6%). The highest engagement rates occurred in May and June, with the most common virtual opportunity being meet and greets with residents (39.2%). The most prevalent medium for virtual events was Zoom, used in 84.7% of events. The intended audience was frequently medical students (80.6%), with a significant difference in engagement between audience groups ($p < 0.05$).

Conclusion The pandemic has disrupted the status quo of resident recruitment. In light of these findings, residency programs should consider instilling virtual opportunities for medical students as a standard practice. Peak times to broadcast events are May or June due to higher engagement. To address attendee burnout, programs should limit events to familiar ones, such as Zoom meet and greets with residents.

Keywords Virtual opportunity · Instagram · Engagement · Residency

Introduction

The COVID-19 pandemic disrupted the status quo for medical education and the residency application process, limiting medical student options to explore programs and network. This deficit led to the creation of virtual opportunities for medical students and residents. At the start of the pandemic, the "stay-at-home" mandate halted all in-person activities, including medical education. The abrupt end to face-to-face interactions left medical schools around the world searching for appropriate alternatives to continue medical student education.

Plastic and Reconstructive surgery (PRS) is a traditionally competitive specialty, with a 72% match rate for integrated plastic surgery in 2020 according to the National Residency Matching Program, that is heavily dependent on networking [1–3]. A critical component of the integrated plastic surgery

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application is sub-internships, which presents opportunities for students to learn about programs, demonstrate interest, and for programs to recruit talent [4, 5]. Prior to the onset of the pandemic, almost all (94%) of plastic surgery residency candidates completed an in-person sub-internship as a visiting fourth-year student [1]. However, these opportunities were limited and students were given travel restrictions due to the pandemic [6, 7]. The absence of visiting sub-internships creates an uneven playing field for medical students. For instance, students without home programs are hindered secondary to lack of exposure and lack of personal connections with plastic surgery residency programs [8]. The 2021 match revealed that applicants matched at significantly higher rates into their home programs than previous years (36.0 vs. 24.1%, $p = 0.019$), illuminating the intrinsic disadvantage for students without home programs [9]. Moreover, for applicants in the 2021 match that did not match at their home institution, the lack of visiting sub-internships likely led to the significant decrease in the number of applicants that reported prior contact with their matched institution in comparison to the 2020 match (19.8 vs. 50.5%, $p < 0.001$) [10]. To mitigate this intrinsic disadvantage for students without home programs, many residency programs that dissolved in-person sub-internships sought to create appropriate alternatives for students via virtual opportunities.

Social media is a powerful tool for communication in the modern era, and its use has been rapidly increasing within surgical education, by both prospective residents and residency programs, throughout the COVID-19 pandemic [11]. In a survey of plastic surgery residency applicants, 97% of respondents admitted to searching online platforms or social media for information about PRS programs, and 20% of respondents claimed social media campaigns influenced their opinion and rank order for particular programs [12]. Residency programs in all surgical specialties, including plastic surgery, have utilized social media to announce their opportunities via various platforms, with Instagram and Twitter as the dominant domains [13]. Instagram account creation has exceeded that of Twitter, and serves as the most widely adopted social media platform by both plastic surgery residency programs and other surgical specialties [14, 15]. Thus, Instagram was chosen for the focus of our study. Despite its rapid involvement in surgical education, a lack of literature on virtual events announced via social media leaves their efficacy in the residency application process unknown. Therefore, we sought to investigate engagement rates of virtual opportunity posts via Instagram, providing residency programs with knowledgeable insight as the pandemic continues.

Methods

The top 40 PRS residency programs with the highest number of followers on Instagram as of June 1st, 2021 were selected for this study [16]. The total number of PRS residency programs with Instagram accounts is reported to be 69 as of 2020 [17]. However, the remaining 29 programs with Instagram accounts were excluded due to inactivity to avoid skewing the data. The Doximity scores for each program were used, if available, to determine the top ten programs within the sample pool [18].

The Instagram accounts for each program were evaluated, and the number of followers, number following, and total number of posts were recorded as of June 1st, 2021. The geographic region in which each program is located was also noted for comparison. Virtual opportunities were defined as any event occurring via an online platform that was advertised via Instagram post by the residency program. Posts published by each PRS residency program account between March 1st, 2020 and June 1st, 2021, were evaluated, and the following data points were collected: date of post, date of virtual event, number of likes, number of comments, and classification of the virtual event. For the overlapping months of March, April, and May, the number of events as well as associated data were recorded as the average between that respective month in 2020 and in 2021. The like/follower ratio and comment/follower ratio were calculated per post as a standardized metric. We chose to separate likes and comments in our analysis to avoid overcounting an individual's engagement.

Virtual opportunities were categorized as meet and greets with residents, meet and greets with faculty, meet and greets with both residents and faculty, virtual sub-internships, grand rounds, virtual tours, virtual conferences, presentations by faculty or residents, or other educational opportunities. The target audience and medium were also recorded. The intended audiences were medical students, residents, medical students and residents, any healthcare professional, patients, or open to all. The mediums used for virtual opportunities were characterized as Zoom, Skype, Instagram Live/Stories, or WebEx.

Inclusion criteria were defined as posts published within the mentioned time frame and marketed as an online event. Exclusion criteria were defined as posts with missing information, such as the date of the event. Additionally, posts unrelated to any of the aforementioned categories outlined for virtual opportunities were excluded. For duplicate posts or posts referring to the same event, only the most-liked photo was included in the study to ensure that each opportunity was only counted once, as it was assumed there would be significant overlap between users that liked each duplicate post.

The number of virtual opportunities by month was determined for each category of event, as well as each medium used and intended audience. The average like/follower ratio and comment/follower ratio for each month were also found. This process was repeated using only the ten residency programs with the highest Doximity scores, to determine whether higher ranked programs exhibit different trends in engagement.

ANOVA tests between the like/follower ratios within each category, medium, and intended audience were carried out via OpenEpi [19]. Statistical significance was set at < 0.05. Student's t tests between different intended audiences, as well as all other calculations, were carried out on Excel [20]. Linear regression models to determine the correlation between engagement (measured via like/follower ratio) and number of posts, events, and followers were also carried out on Excel [20].

Results

The 40 PRS residency programs used in this study are displayed in Table 1, and listed in order from greatest to least number of followers. The Northeast accounted for 38% of all programs included in this study, while the Southeast accounted for 17%, Midwest accounted for 28%, Southwest contained 12%, and the West comprised only 5% (Fig. 1). In comparison, 29% of integrated PRS programs are located in the Northeast, 27% in the South (Southeast and Southwest combined), 18% in the West, and 26% in the Midwest [21].

There were a total of 141 virtual opportunities analyzed out of 143 virtual opportunities identified. Both of the posts excluded were due to insufficient information. August was the most popular month for virtual events, containing 21.6% of all events (Fig. 2). Meanwhile, March was the least popular month for virtual opportunities, accounting for only 1.5% of events (Fig. 2). The corresponding average like/follower ratio and comment/follower ratio for each month were evaluated and are shown in Fig. 3. The highest like/follower ratio was 0.033 (3.3%) in June, indicating that this month has the highest amount of engagement. However, the highest comment/follower ratio was 0.001 (0.1%) in May, suggesting that the most engagement with comments occurs in May. In most cases, an Instagram engagement rate of 1–3% is considered good, and very good engagement is deemed 5% or greater [22].

The total number of virtual opportunities for each category of event is illustrated in Fig. 4a. The most common virtual opportunity was meet and greets with residents, accounting for 39.2% of events. According to the evaluation of like/follower ratios within each category, there was not a significant difference in engagement between different categories ($p > 0.05$). When only the top ten schools were considered, there was still not a significant difference in engagement between different categories ($p > 0.05$).

The total number of virtual opportunities by medium used revealed Zoom is the most common platform for these events, comprising 84.7% of all events (Fig. 4b). Upon evaluation of the like/follower ratios within each medium used, there was not a significant difference in engagement between different mediums ($p > 0.05$).

The most prevalent classification for intended audience was medical students, accounting for 80.6% for events (Fig. 4c). Assessment of the like/follower ratios between each intended audience revealed that there was a significant difference in engagement between different groups of audiences, specifically events for medical students versus medical students and residents ($p < 0.05$) and residents versus medical students and residents ($p < 0.05$).

On linear regression, greater Instagram engagement, measured via like/follower ratio, was not correlated with the number of events held during the study period ($p > 0.05$, $R^2 = 0.024$), the account's total number of posts ($p > 0.05$, $R^2 = 0.00003$), or the account's total number of followers ($p > 0.05$, $R^2 = 0.034$).

Discussion

The use of social media was on the rise among residency programs even prior to the start of the COVID-19 pandemic. The younger generation of future physicians spends a significant amount of time on social media platforms, such as Instagram, and serves as a primary method of communication between individuals. Hence, residency programs have taken advantage of this platform to highlight opportunities, promote accomplishments, as well as advertise the social environment of their respective programs to prospective applicants [15]. Studies have noted that many programs have recently strengthened their social media presence to showcase their program and interact more with potential residents [17, 23]. However, the onset of the pandemic has caused residency programs to shift the focus of their social media presence to include a greater emphasis on virtual events and other virtual interactions with residents. Virtual events serve as a tool to engage students in their program and allow students to gain information in preparation for their virtual interviews. Therefore, these events have partially eased the deficit formed by the lack of in-person opportunities during the residency application cycle, allowing students a better understanding of program culture during the restriction of travel. We sought to investigate engagement rates of virtual opportunity posts via Instagram, to equip residency programs with insight as the pandemic continues.

Due to the nature of virtual interviews, it is difficult to pick up on social aspects of residency programs [24].

Table 1 Collection of the 40 PRS residency programs analyzed in this study

Program	Region	Username	Followers	Following	Posts	Virtual opportunities
Harvard Medical School/Brigham And Women's Hospital Program	Northeast	@harvard_plastic_surgery	5716	492	273	3
Johns Hopkins University/ University of Maryland Program	Northeast	@hopkinsplasticsurgery	4214	411	365	19
Mayo Clinic College of Medicine and Science (Rochester) Program	Midwest	@mayomnplasticsurgeryresidency	3432	1166	222	1
Stanford Health Care- Sponsored Stanford University Program	West	@stanfordplastic	3386	226	326	6
University of Pennsylvania Health System Program	Northeast	@pennplasticsurgery	2766	217	127	3
Duke University Hospital Program	Southeast	@dukeplasticsurgery	2624	281	266	9
Emory University School of Medicine Program	Southeast	@emoryplasticsurgery	2415	229	155	8
Washington University/ B-JH/SLCH Consortium Program	Midwest	@washuprs	2339	300	641	15
Cleveland Clinic Foundation Program	Midwest	@ccfplasticsurgery	2318	413	80	1
Yale-New Haven Medical Center Program	Northeast	@yaleplasticsurgery	2194	75	33	6
McGaw Medical Center of Northwestern University Program	Midwest	@northwesternplasticsurgery	2124	473	105	3
Ohio State University Hospital Program	Midwest	@osuplasticsurgery	2003	162	103	6
University of Rochester Program	Northeast	@roc_prs_residency	1943	144	248	3
Rutgers New Jersey Medical School Program	Northeast	@rutgersplasticsurgery	1916	321	204	4
Mayo Clinic College of Medicine and Science (Arizona) Program	Southwest	@mayoazplasticsurgeryresidency	1906	389	283	2
University of Chicago Program	Midwest	@uchicagoprs	1882	120	115	2
Vanderbilt University Medical Center Program	Southeast	@vumcplasticsresidency	1878	228	89	5
University of Kansas School of Medicine Program	Midwest	@ku_plasticsurgery_residency	1865	32	217	3
Baylor College of Medicine Program	Southwest	@bcmprs	1786	94	174	7
Beth Israel Deaconess Medical Center Program	Northeast	@bidmcharvardprs	1699	302	84	1
University of Texas Southwestern Medical Center Program	Southwest	@utswplasticsurgery	1699	218	65	2
Saint Louis University School of Medicine Program	Midwest	@sluplasticsurgery	1683	207	206	1
University of Texas Medical Branch Hospitals Program	Southwest	@utmbplasticsurgery	1659	540	214	7
MedStar/Georgetown University Hospital Program	Northeast	@medstarplasticsurgery	1559	905	151	1
Southern Illinois University Program	Midwest	@siuplasticsurgeryresidents	1543	392	218	2
Louisiana State University School of Medicine Program	Southeast	@lsu_plastics	1535	356	79	4
Zucker School of Medicine at Hofstra/Northwell Program	Northeast	@nh_plasticsurgery	1506	497	68	0
Brown University Program	Northeast	@brownprs	1504	161	227	3
Montefiore Medical Center/ Albert Einstein College Program	Northeast	@montefioreplastics	1425	264	23	0
Oregon Health & Science University Program	West	@ohsuplastics	1404	342	273	1
West Virginia University School of Medicine Program	Southeast	@wvuplastics	1404	0	85	1
New York Presbyterian Hospital (Columbia and Cornell Campus) Program	Northeast	@columbiacornellplasticsurgery	1384	161	36	0
Texas A&M College of Medicine- Scott & White Medical Center Program	Southwest	@bswplasticsurgery	1383	173	70	1
Virginia Commonwealth University Health System Program	Southeast	@vcuplasticsurgeryresidency	1359	301	84	3
Rush University Medical Center Program	Midwest	@rushplasticsresidency	1282	119	45	1

Table 1 (continued)

Program	Region	Username	Followers	Following	Posts	Virtual opportunities
Wake Forest University School of Medicine Program	Southeast	@wake_forest_plastics	1278	1832	93	5
University of Cincinnati Medical Center/ College of Medicine Program	Midwest	@ucincyplasticsurgery	1250	460	28	1
Lahey Clinic Program	Northeast	@laheyplasticsurgery	1233	593	37	0
Icahn School of Medicine at Mount Sinai Program	Northeast	@mountsinaiprsresidency	1215	316	56	2
Albany Medical Center Program	Northeast	@amc_prs	1176	236	57	1

Fig. 1 Distribution of PRS residency programs used in this study
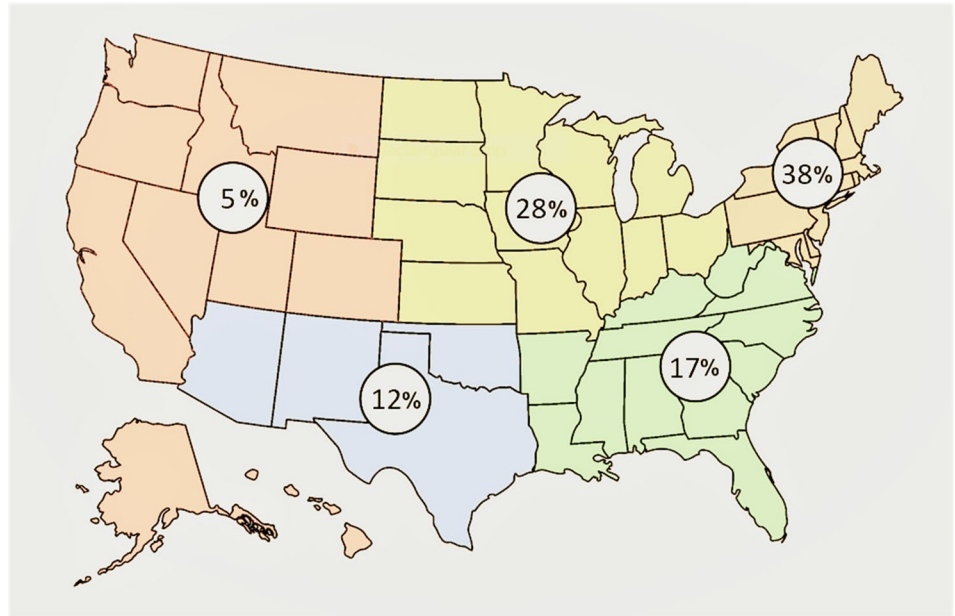
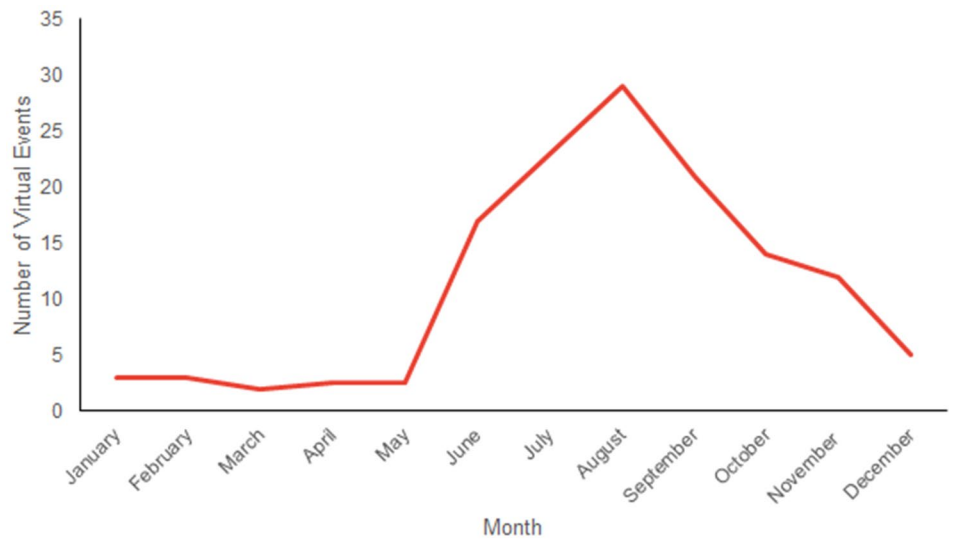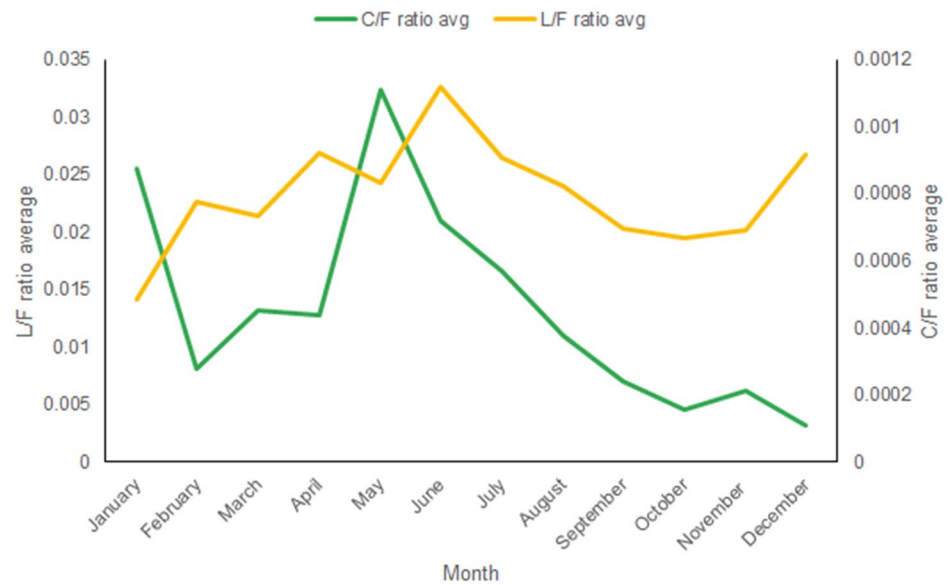**Fig. 2** Number of virtual events by month

Fig. 3 Average like/follower (L/F) ratio and average comment/follower (C/F) ratio by month


However, virtual platforms, such as social media, provide students an insight into the underlying culture of residency programs. One study found that 63% of survey respondents claimed that they interact with the social media accounts of plastic surgery residency programs on at least a weekly basis, and another study found that 89% of respondents that followed prospective residency programs claimed that they were influenced based on the program's account, further strengthening the idea that social media is becoming a more prominent factor in learning about and networking with residency programs [25, 26]. Recently published interview tips from Phillips, et al. even encouraged students to engage with prospective residency programs on social media prior to residency interviews, further bolstering the idea that social media has become a new currency for the residency application cycle [27].

The main finding of this study includes optimal months of the year for posting virtual opportunities. The most common month for virtual opportunities posted was August; however, the highest engagement was appreciated in May and June. Therefore, programs should aim to advertise their largest virtual events from May to June. It is interesting that August is a popular month for posting virtual opportunities as many medical students are doing sub-internships at this time, and residency applications are due at the end of September. The benefit of posting at this stage in the residency application cycle is that it gives students an opportunity to get to know programs that they did not have the opportunity to have a sub-internship at. Additionally, interns will be able to share their first impressions of their chosen residency program early in their training. However, it may be more helpful to medical students to attend meet and greets in early spring to help them decide which programs to apply to for sub-internships. Furthermore, it is speculated that many students

decrease their social media presence in the months leading up to the residency application process, as their profiles are increasingly likely to undergo scrutiny and serve as a tool to evaluate their fit for the residency program by program directors during this process [28, 29]. This decreased social media usage may contribute to the decline in events surrounding the months in which applicants are generating their rank lists, November to February. Therefore, residency programs should perhaps focus on the months with higher engagement rates, May and June, rather than the most common advertising month, August. All things considered, programs should remain cognizant of conflicting virtual events with other residency programs, and not cluster all of their virtual opportunities in this time frame. If there is heavy virtual traffic in these months, students may have to choose between events, or they could lose interest in attending copious amounts of meet and greets.

The other main findings of this study include the most prevalent modalities, mediums, and audiences used for virtual events. Virtual events or webinars come in many forms, with the most prevalent being meet and greets with residents and/or faculty, program Q&A's, grand rounds, virtual presentations, and virtual sub-internships. Meet and greets and program Q&A's provide students the opportunity to meet their potential co-residents and faculty, allowing them to gauge the social dynamic of the program. In contrast, grand rounds, virtual sub-internships, and virtual presentations give students a taste of what it is like to attend the residency program. Other events such as virtual tours give students the opportunity to envision themselves at the program and see the flow of the hospital. Meet and greets with residents were the most common category of virtual event held, an unsurprising discovery given the relaxed nature of this type of event. Additionally, residents may be more inclined to

Fig. 4 **a** Number of virtual events by category, **b** number of virtual events by medium used, and **c** number of virtual events by intended audience
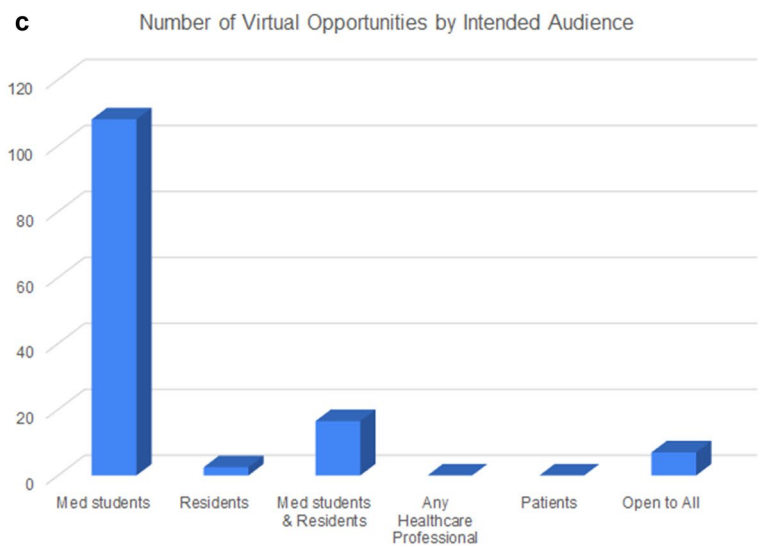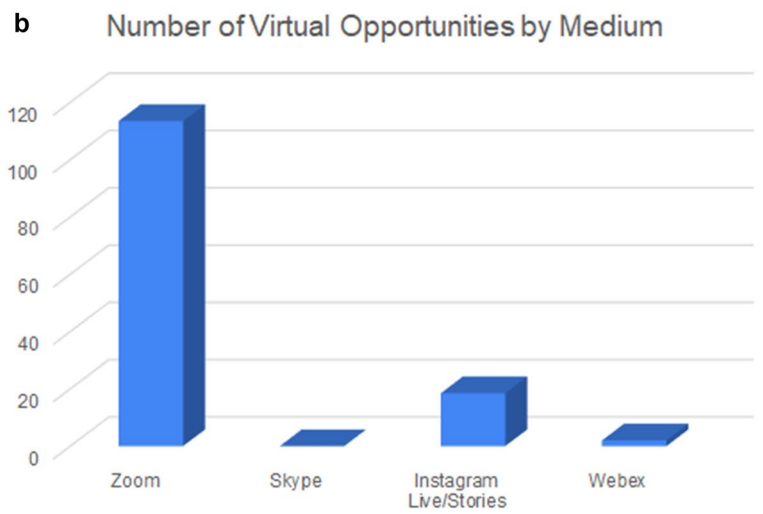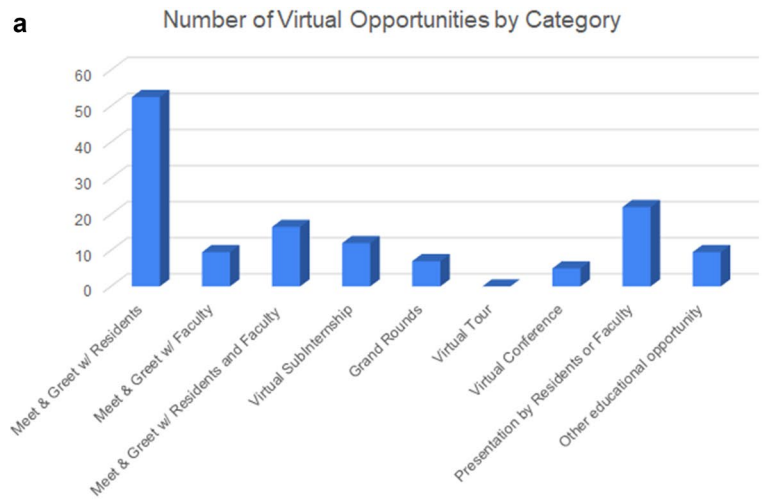
speak realistically about their program, since there is no added pressure to positively market their program. Therefore, medical students are able to ask questions that may come across as taboo in an interview, such as work-life balance or family planning. Overall, meet and greets provide a safe space for medical students to subjectively learn about residency programs, and we recommend prioritizing this category of virtual event.

Various methods of delivery are available for virtual events. For didactic learning opportunities and meetings, platforms such as Zoom, Skype, or WebEx have proven useful in the past, and therefore are popular mediums in which virtual events are held [30]. The most utilized medium for virtual events was Zoom, an expected outcome considering its exponential increase in use since the start of the pandemic. Most, if not all, medical students should be familiar with Zoom for this reason, and we recommend continuing with this medium for virtual events. Finally, the intended audience of virtual events was most commonly medical students, emphasizing our suggestion that residency programs have shifted their social media platform presence to be geared toward potential applicants. There was a statistically significant difference in engagement based on whether the events were for residents or medical students alone, versus residents and medical students together, which can likely be attributed to the nature of the respective events. For instance, an educational opportunity open to residents and medical students will likely garnish less engagement than prospective resident events aimed at graduating medical students. It is interesting to note that there were numerous events targeted at non-medical students, such as residents or open to everyone including patients. By including non-medical students in these virtual events, excluding meet and greets with residents, the prospective residents may not get a proper feel for the program. Therefore, it is recommended that programs create different accounts for targeting medical students versus non-medical individuals. Many private practice surgeons already carry out this practice, by maintaining social media accounts that aim to attract patients and educate the public [31]. Similarly, plastic surgery residency programs should adopt accounts geared toward the public, separate from their accounts intended for medical students.

These recommendations can be employed by advertising virtual events via Instagram from May to June. Residency programs should also consider conducting meet and greets with residents via Zoom for medical students. By adhering to these recommendations, residency programs may expect an increase in Instagram engagement regarding their virtual events.

Regardless of the efficacy of virtual events, in-person opportunities surrounding interviews will still be preferred as part of the interview process, as attendance and presence are not synonymous; many medical students can attend virtual events due to pressures to "show interest", but presence and engagement in conversation can be lacking. Additionally, since interviews are trials for residency, the interview process should reflect the residency experience. Consequently, virtual activities may be an appropriate alternative while in-person events are prohibited, but can never replace in-person interaction. Thus, virtual events should serve as supplements to in-person interviews. By implementing virtual events prior to or during interview season, medical students can gauge their interest in various residency programs prior to committing to interviews. Virtual interviews have minimized both the financial and time costs associated with in-person interviews; therefore, this benefit can be applied to the use of virtual events rather than in-person events [23, 32]. Furthermore, the accessibility of virtual events prior to interviews may prevent interview hoarding. Interview hoarding refers to medical students stockpiling interview invitations to increase the probability of matching, which is normally deterred by the high cost involved with attending in-person interviews [33]. Interview hoarding by highly competitive students leaves fewer interview invites for less-competitive applicants, creating a disparity between above- and below-average students [33]. Because of this, many strong applicants went unmatched in the most recent application cycle, as residency programs are limited in the number of interview invites they can extend, but students were not limited in their acceptance of these interviews [34]. Therefore, by holding virtual events prior to interviews, medical students can gauge which programs they are most interested in, or not interested in at all, to mitigate them accepting interviews to undesired programs.

Since residency programs have only been pushed to offer virtual events in the past 1–2 years of the COVID-19 pandemic, the current data presented are merely a cross section. Therefore, the narrow date range of this study serves as a potential study limitation. Despite this, virtual events have been most prominent in this date range, so it is the most applicable date range to our study purpose. Moreover, since our study is limited to the most recent residency application cycle, this will be most indicative of the culture surrounding virtual opportunities in the upcoming application cycle. Additionally, the retrospective nature of this study serves as a study limitation, as the world of social media is ever changing. Hence, there is no way to know the follower ratios at the time of publication nor the population of individuals that interact with each post. Furthermore, we only evaluated virtual events that were advertised as posts, and Instagram engagement is not a perfect representation of attendance at virtual events. Some medical students may not have Instagram accounts to interact with virtual opportunities they attend. In contrast, some medical students may engage with virtual opportunity posts and not attend the associated event. Despite these limitations, Instagram engagement serves as our best measure of interest for various types of virtual events, considering Instagram is a

vastly growing platform for medical students to interact with residency programs and is commonly the platform in which individuals learn about potential webinars [25].

Conclusion

As the pandemic lingers, residency programs should consider instilling virtual opportunities for medical students as a standard practice, especially in the month of August. Advertising these events in May or June may increase the odds of engagement. Streamlining virtual events to only include the most familiar ones, meet and greets with residents via Zoom, may also improve engagement, although there was no statistically significant difference in their engagement rates.

Declarations

Conflict of interest The authors have nothing to disclose.

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