Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

The American Journal of Surgery 222 (2021) 937–943

Contents lists available at ScienceDirect

The American Journal of Surgery

journal homepage: www.americanjournalofsurgery.com

Original Research Article

An evaluation of social media utilization by general surgery programs in the COVID-19 era

Hua A. Fang, BS [a, *], Hunter Boudreau BS [a], Saad Khan, BS [a], Nikhi P. Singh, BS [a], Soroush Rais-Bahrami, MD [a, b, c, d], Timothy W. King, MD, PhD, MSBE, FAAP, FACS [a, e, f], Britney Corey, MD, MACM, FACS [a, e], Herbert Chen, MD, FACS [a, d, e]

[a] School of Medicine, University of Alabama at Birmingham, Birmingham, AL, USA
[b] Department of Urology, University of Alabama at Birmingham, Birmingham, AL, USA
[c] Department of Radiology, University of Alabama at Birmingham, Birmingham, AL, USA
[d] O'Neal Comprehensive Cancer Center, University of Alabama at Birmingham, Birmingham, AL, USA
[e] Department of Surgery, University of Alabama at Birmingham, Birmingham, AL, USA
[f] Department of Biomedical Engineering, University of Alabama at Birmingham, Birmingham, AL, USA

ARTICLE INFO

Article history:
Received 14 December 2020
Received in revised form
14 April 2021
Accepted 15 April 2021

Keywords:
Social media
Virtual education
General surgery match
COVID-19
Residency training

ABSTRACT

Background: Our study investigates how general surgery residency programs utilized social media to adapt to the challenges of COVID-19.
Methods: 319 participating general surgery residency programs provided by the Electronic Residency Application Service were analyzed in this study. Associated Twitter, Instagram, and Facebook accounts were assessed to find virtual open houses and externships.
Results: Of the 319 program, 188 (59%) were found to have a social media presence. A total of 348 social media accounts were found, as some of the programs had separate residency and department accounts. Of all the social media accounts, 112 (32%) of the accounts were created after March 1, 2020. Virtual open houses opportunities were found to be advertised across all platforms.
Conclusion: Many general surgery programs responded to the physical limitations of COVID-19 pandemic by increasingly utilizing social media during the COVID-19 pandemic. Virtual opportunities should be considered as a novel approach for future outreach and recruitment.

Introduction

The physical limitations imposed on fourth year medical students and residency programs by the COVID-19 pandemic have created new challenges in an increasingly competitive general surgery residency application process.[1,2] In 2014–2015, well over half of fourth year medical students completed an away rotation.[3] The Coalition of Physician Accountability, which the American Association of Medical Colleges (AAMC) is a member of, recommended the immediate suspension of in-person visiting rotations and interviews for the 2020–2021 application cycle in response to the COVID-19 pandemic.[4] Alterations to the 2021 match process and outcomes are anticipated due to the abrupt decrease of in-person opportunities. The disruption caused by the COVID-19 pandemic has forced general surgery residency programs to shift to a novel form of interviews by way of virtual interaction.[5–9] This contrasts traditional in-person evaluations which allowed programs to directly assess an applicant's interpersonal skills and interactions with faculty and house staff.[10,11] For applicants, the traditional interview played a significant role on the order of the rank list as it allowed for applicants to evaluate important factors such as a program's fit, location, and character.[10,12]

Previous papers have examined the shift from a traditional in-person interview process to an online format.[9,11,13–16] However, to our knowledge there is no current literature that analyzes the frequency and magnitude to which general surgery residency programs are creating and implementing social media accounts to publicize virtual opportunities. We hypothesize that there has been, and will continue to be, a sharp increase in all forms of social media accounts (Facebook, Twitter, and Instagram) secondary to

* Corresponding author. Boshell Diabetes Building (BDB) 505,1720 2nd Avenue South Birmingham, AL 35294-0012, USA. Tel.: 205 934 3333; fax: 205 934 0135.
E-mail address: ahfang@uab.edu (H.A. Fang).

https://doi.org/10.1016/j.amjsurg.2021.04.014
0002-9610/

strict physical barriers imposed on prospective applicants and residency programs. Herein, we explain the extent of this virtual transition among general surgery residencies by evaluating their social media presence on Twitter, Facebook, and Instagram, advertisement of virtual open house opportunities, and offerings of virtual sub-internships to prospective applicants.

Methods

A list of 319 participating general surgery residency programs provided by the Electronic Residency Application Service (ERAS) were analyzed. The Google search engine and general surgery residency website links provided by ERAS were used to identify program-specific websites as well as department and residency program social media accounts on Twitter, Instagram, and Facebook. Private or personal social media accounts were excluded. In an effort to standardize nomenclature, we defined a department account as an one dedicated to the respective institution's general surgery division and a resident account as a one that specifically denoted its affiliation with the institution's residency program. The Visiting Student Application Services (VSAS) website was used to determine sub-internship opportunities present for each general surgery residency program, both virtual and traditional in-person formats.

The date of account establishment was noted for each account. Twitter publicizes the date of creation in the biographical section of each account. Similarly, Facebook notes the establishment date of each account in the "Page Transparency" section in the sidebar. Instagram does not publicize the specific date of account establishment. Therefore, dates of establishment were deduced by obtaining the date of the first post on the account. Accounts were identified as being established either before or after March 1, 2020, to indicate whether accounts were made before or after the onset of the COVID-19 pandemic.

All programs observed under this study were for general surgery residency training programs. If surgical subspecialties (cardiothoracic surgery, plastic surgery, etc.) were included under these accounts, only information directed towards general surgery residency were accounted for. In the event that a departmental or residency social media account released information that pertained to a surgical subspecialty, the data was not included within our study.

The post history of identified accounts was investigated for posts containing announcements of live virtual open house opportunities, other similar interactive opportunities, or virtual sub-internship offerings. Opportunities such as video tours, informational videos, and other recorded, non-interactive posts were not included. The total number of opportunities available on each social media page were counted. All accounts were examined for presence of virtual sub-internship opportunities and totaled on a per account basis. The web-based service "Tweetstats.com" was utilized to determine the number of tweets from March 2019 through October 15, 2019, as well as the number of tweets from March 2020 through October 15, 2020.

Statistical analysis

T-test was used for continuous numerical values and Chi X^2 test was used to compare categorical variables. Linear trend was analyzed using ANOVA. $P < 0.05$ was considered to be significant.

Results

Comprehensive

Of the 319 programs, a total of 348 social media accounts were identified. In sum, 188 (59%) programs were associated with an account on Twitter, Instagram, or Facebook. Twenty-six (8%) programs had an account on all three platforms (Table 1). Of the 188, 99 (53%) had virtual opportunities made available. One-hundred thirty-five of the 188 programs (71.8%) were university associated general surgery programs ($p < 0.001$). Ninety programs were identified as community programs in which 38 (42.2%) of the programs had a social media account. Across all platforms, 112 (32%) accounts were created after March 1, 2020 (Fig. 1, $p < 0.001$). The development of new social media accounts was also seen among all platforms (Fig. 2a-c). Linear trend analysis projected an average of 13.6 new accounts across all three platforms in 2020. An average of 40 new accounts were observed to be created in 2020. Forty-eight of the programs created their first social media account in 2020, and 140 programs had a pre-existing account on any of the three platforms. The earliest year of creation for an account was dated 2008 on Facebook. One virtual sub-internship was posted across all social media accounts.

Website

All programs had an associated functional webpage. Fifteen (5%) listed virtual open house opportunities. No virtual sub-internships were listed on any websites.

Twitter

One hundred thirty-five (42%) programs had either a department or residency specific Twitter account. Twenty programs had both a department and residency Twitter account, resulting in 155 total twitter accounts. Twenty-six accounts (17%) were created after March 1, 2020. A majority of accounts (95, 61%) were associated with departments while the remaining accounts (60, 39%) were associated with residency programs. A total of 176 open house opportunities were listed on Twitter by 75 (53%) programs. A significant increase in the number tweets between 3/19–10/19 and 3/20–10/20 was observed among residency accounts (mean 34 vs 71.8 respectively, $p = 0.030$). For departments, an average of 22.4 tweets were seen in 2019, while an average of 28.8 tweets were seen in 2020 ($p = 0.372$). One virtual sub-internship opportunity was identified on Twitter.

Instagram

One hundred twenty-seven (40%) programs were found to be in possession of 130 departmental or residency accounts. Over half (56%) of accounts were created after March 1, 2020. Residency specific accounts accounted for 68 out of 73 (93%) accounts. In contrast to Twitter, more residency accounts (107, 82%) were reported than department accounts (23, 18%) on Instagram. Sixty-five programs (51%) posted open house opportunities to their Instagram feed. A total of 137 open houses opportunities were listed across all the accounts. No virtual sub-internships listings were reported.

Facebook

Fifty-eight (18%) programs were found to have Facebook accounts in either a department or residency form. Thirteen accounts (21%) were created after March 2020. Eighteen accounts (29%) were reported to have virtual open house opportunities posted to their

Table 1
Social media results.

WEBSITE	
Total Number of Programs with Websites	319
Total Number of Virtual Open House Opportunities	15
Total Number of Virtual Sub-Internships Available	0
TWITTER	
Total Number of Programs with Twitter Accounts	135
Total Number of General Surgery Twitter Accounts (Dept + Res)	155
Total Number of Accounts Made **After March 1, 2020**	26
Total Number of General Surgery Department Accounts	95
Total Number of Department Accounts Made **After March 1, 2020**	5
Total Number of General Surgery Residency Accounts	60
Total Number of Residency Accounts Made **After March 1, 2020**	21
Total Number of Programs with Department + Residency Accounts	20
INSTAGRAM	
Total Number of Programs with Instagram Accounts	127
Total Number of General Surgery Instagram Accounts (Dept + Res)	130
Total Number of Accounts Made **After March 1, 2020**	73
Total Number of General Surgery Department Accounts	23
Total Number of Department Accounts Made **After March 1, 2020**	5
Total Number of General Surgery Residency Accounts	107
Total Number of Residency Accounts Made **After March 1, 2020**	68
Total Number of Programs with Department + Residency Accounts	3
FACEBOOK	
Total Number of Programs with Facebook Pages	58
Total Number of General Surgery Facebook Accounts (Dept + Res)	63
Total Number of Accounts Made **After March 1, 2020**	13
Total Number of General Surgery Department Accounts	32
Total Number of Department Accounts **Made After March 1, 2020**	4
Total Number of General Surgery Department Accounts	31
Total Number of Residency Accounts **Made After March 1, 2020**	9
Total Number of Programs with Department + Residency Accounts	5
COMBINED (out of 319 programs)	
Total Number of Programs with Social Media	188 (59%)
Total Number of Programs without Social Media	131 (41%)
Total Number of Social Media Accounts (Dept + Res)	348
Total Number of Programs with Twitter, Instagram, and Facebook	26 (8%)
Total Number of Programs with Only One Account	75 (24%)
Total Number of Programs with More Than One Account	113 (25%)
University Associated Programs with Social Media	135 (42%)
Community Associated Programs with Social Media	38 (12%)
Community with University Associated Programs with Social Media	15 (5%)
SUB-INTERNSHIP/AWAYS OPPORTUNITIES	
Total Number of Sub-Internships Available on VSAS	1
Total Number of Sub-Internships Available on Twitter	1
Total Number of Sub-Internships Available on Instagram	0
Total Number of Sub-Internships Available on Facebook	0
OPEN HOUSE OPPORTUNITIES	
Total Number of Programs with Open House Opportunities	99
Twitter (out of 135 programs)	
Total Number of Programs with Open House Opportunities	75 (53%)
Total Number of Open House Opportunities	176
Total Number of Programs with More Than One Open House Opp.	56 (41%)
Instagram (out of 127 programs)	
Total Number of Programs with Open House Opportunities	65 (51%)
Total Number of Open House Opportunities	137
Total Number of Programs with More Than One Open House Opp.	39 (31%)
Facebook (out of 58 programs)	
Total Number of Programs with Open House Opportunities	18 (31%)
Total Number of Open House Opportunities	35
Total Number of Programs with More Than One Open House Opp.	8 (14%)

Facebook page. A total of 35 open house opportunities were found. No virtual sub-internships listings were reported.

VSAS

One virtual opportunity was found on the VSAS through the Association of American Medical Colleges. Traditionally, there are approximately 380 in-person sub-internships available through

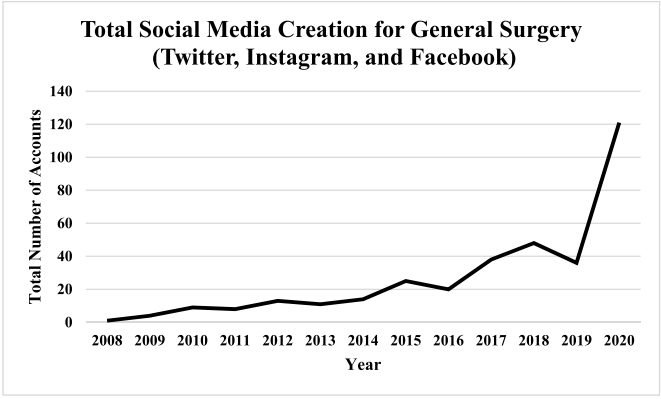

Fig. 1. Social media account growth.

this platform.

Discussion

The COVID-19 pandemic has dramatically shifted the format for the 2020–2021 residency application cycle, and programs appeared to have responded by increasing their presence on social media.[17,18] Traditionally, general surgery residency programs have relied on in-person interviews, sub-internships, and social events to facilitate applicant-program interactions.[10] The uncertainty of these in-person opportunities moving forward into future application cycles compounds the importance of the findings in this study.

Our results suggest that social media and virtual sessions appear to have been developed to make up for the lack of in-person opportunities, with a surge of accounts developed after March 1, 2020 (Fig. 1). For applicants, a virtual and social media-driven application process provides a low barrier of entry regarding financial burden, schedule flexibility, and enhanced geographic distribution.[19] Traditionally, travel, food, and hotel expenses, as well as the mental toll of in-person interviewing has hindered applicants from applying to a large number of residency programs.[16,19] In 2016, Over 50% of medical students applying to a general surgery residency program reported spending between $2500-$7500 dollars in accrued educational debt and cost of attending interviews, not including application costs.[19] Additionally, 41% of students admitted to declining at least one interview opportunity due to financial burden.[19] The transition to an virtual interview format will likely reduce this financial stress on students which may results in programs receiving an increased number of applications this year.

Among the three social media platforms, Twitter appeared to be the most utilized. This may be attributed to recent increases in use of this platform for professional networking purposes seen in other medical and surgical fields.[20–24] This increased number of tweets observed in more than half the programs on Twitter is likely a response to the virtual shift due to the COVID-19 pandemic. While our study did not analyze the content of each tweet, we postulate that each account promoted their department and residency program, shared events, and publicized new virtually available opportunities. Hill et al. surveyed 32 departments of surgery with Twitter accounts and found that Twitter to be beneficial in promoting new research, increasing academic community visibility, resident engagement, and faculty engagement.[25] Surprisingly, only 34% of the department accounts on Twitter were run by physicians.[25] Applicant perception of physician and non-physician run counts may be of interest in future studies. Of note, Twitter also saw a rise in new account creation in 2017 (Fig. 2a), which may be due to the increased character limit per tweet and creation of "threads." This potentially allowed for more engaging and detailed information to be shared through this platform.[26] However, this increase in the new account creation observed in 2017 may also be due to random variation.

Instagram also experienced a spike in general surgery accounts, with a majority of accounts created after March 1, 2020, most (93%) being residency program specific (Fig. 2b). Approximately half of programs with an Instagram account posted open house opportunities on their feed. A total of 137 virtual open houses were found to be permanently publicized on Instagram. As seen with Twitter,

a

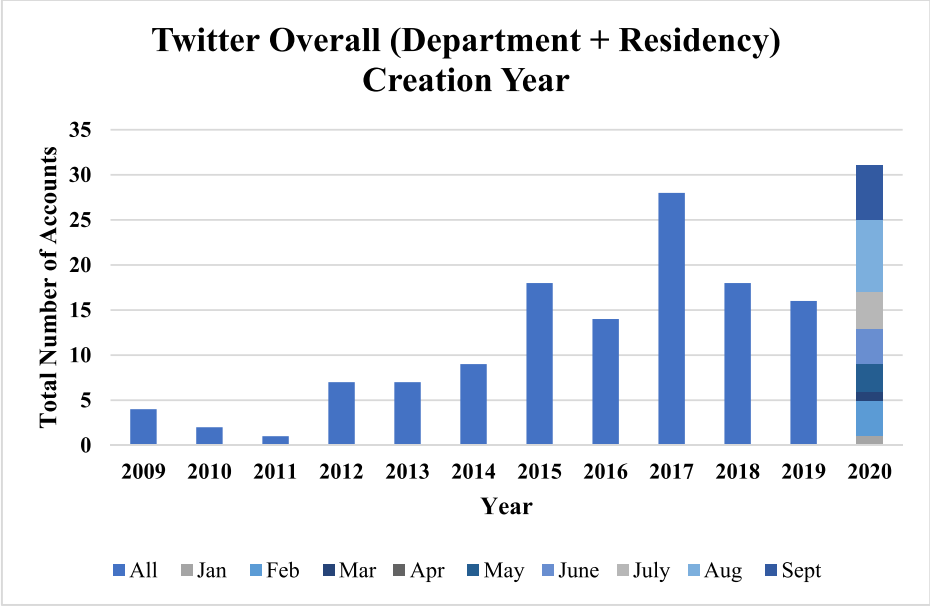

Fig. 2a. Creation of overall Twitter accounts.

b

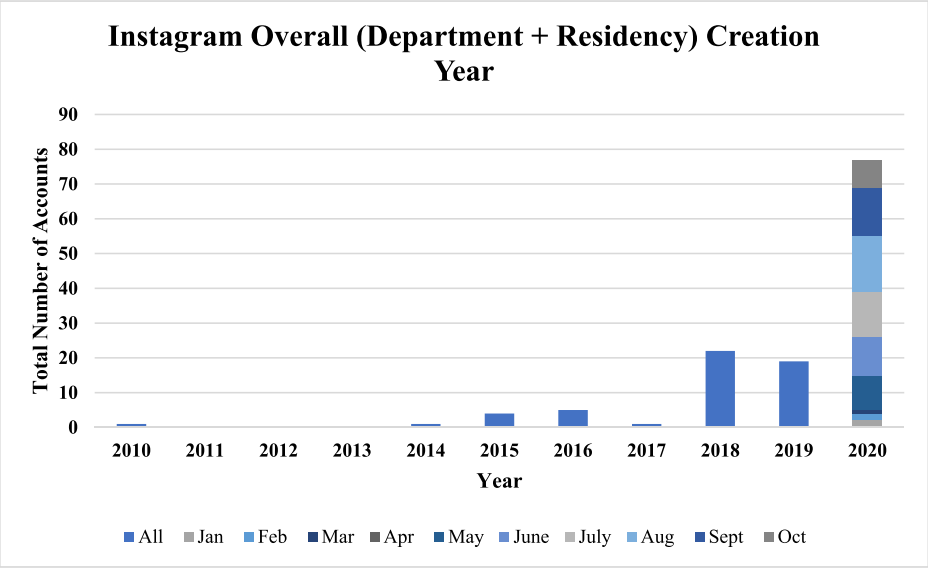

Fig. 2b. Creation of overall Instagram accounts.

c

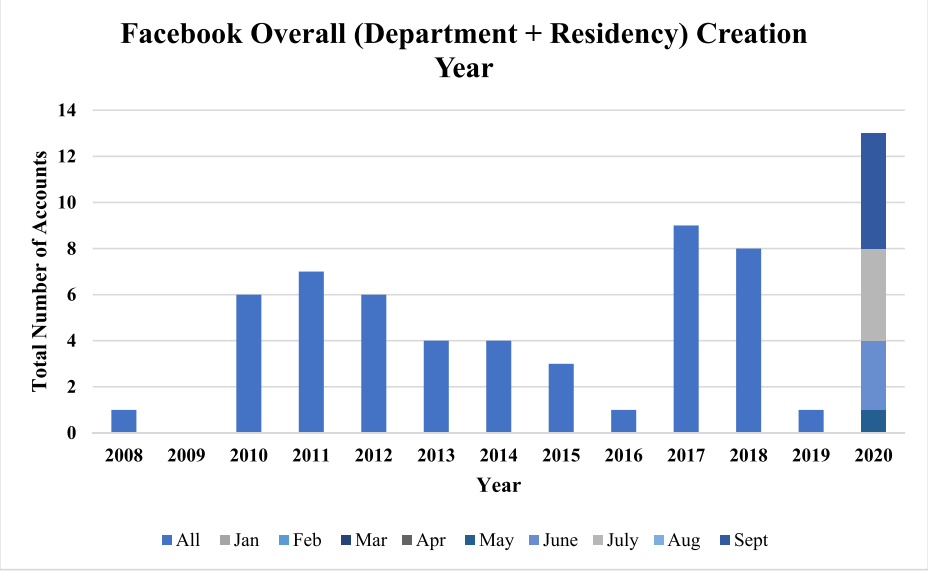

Fig. 2c. Creation of overall Facebook accounts.

Instagram provides a free avenue for programs to reach a large number of potential residents. A third of users on Instagram are from ages 25–34, the traditional age range for those entering residency.[27] This further supports that the effort put forth by general surgery residency programs is to reach their target audience. Notably, the number of new of Instagram accounts created in response to COVID-19 was nearly 3 fold that of new Twitter accounts created (73 vs. 26, respectively). However, the prominence of General Surgery accounts on Twitter was far greater than it was on Instagram prior to March 1, 2020 (129 vs 57). It may be suggested that the imbalance of new accounts is likely due to relative underuse of Instagram in before 2020.

Facebook was the least utilized social media platform in offering and publicizing residency open house opportunities when compared to Twitter and Instagram. While Facebook lagged behind the other social media platforms in account totals, 2020 growth trends (Fig. 2c) suggest that Facebook is still considered a valuable resource by select general surgery programs and should be considered a valid avenue for information by medical students. Roughly 30% of programs with an account listed opportunities on their Facebook pages. Over 20% of general surgery Facebook accounts were created after March 1, 2020, paralleling the recent growth of Instagram and Facebook.

Only two virtual sub-internship opportunities were found throughout social media and VSAS. Traditionally, VSAS was the official platform through which programs connected with students

for sub-internship opportunities across the country. Virtual sub-internship have limitations as there may be limited assessment of applicants' clinical competency and overall fit for the program. We also acknowledge the great deal of effort and work institutions would need to put forth to create an optimal virtual surgical sub-internship in a short amount of time. No study has analyzed the perception of medical students on virtual sub-internships. Future studies have an opportunity to expand on and compare virtual sub-internships to traditional in-person experiences by way of student accounts.

To our knowledge, no previous studies have fully analyzed the recruitment efforts made by residency programs prior to this year. We assume that most of the recruitment efforts made before the interview were passive: information provided by the NMRP, website listings, pre-recorded videos, and periodic social media posts.[28] In 2018, Shappell et al. proposed that residency programs should begin branding themselves as it seemed to be a foreign concept to most residency programs.[29] The main recruitment event occurred on the interview day(s) where programs were able to thoroughly plan for interactive sessions and highlight their strengths.[30] The rapid increase of general surgery residency social media accounts across all platforms in 2020, along with the creation and broadcast of virtual open house opportunities, suggests that many programs have increasingly utilized social media in their recruitment efforts in an attempt to attract and interact with applicants due to the social distancing guidelines. Traditionally, the reputation of a program, geographical location, volume of patients, and faculty experience were among important factors for medical students to consider when applying to residency programs.[31,32] Virtual sessions will arguably become an important factor for future applicants to consider when applying to and choosing a residency program. While some social media platforms have shown more activity than others, our data supports the idea that there is universal growth of account numbers, advertisement, and outreach across all modalities. Which social media platform the audience chooses to engage with is dependent on user preference. We believe all the social media platforms serve a similar purpose: promoting their department and residency program. However, we also would like to note the use of Twitter where the hashtag "#medtwitter" is used to by many medical professionals to network and create a community on the platform.[33] Interestingly, only 15 (5%) programs listed open house opportunities on their residency website compared the 99 (31%) that listed opportunities on at least one form of social media. This strongly suggests that general surgery residency programs acknowledge the power and widespread presence of social media in today's society. Though virtual experiences have limitations, online interviews and discouragement of away rotations have allowed applicants financial flexibility and the opportunity to interview at more programs than ever before. In a study of Urology applicants, 4/5 applicants found virtual open houses to be beneficial and informative.[34] The minimal constraints of entry to virtual opportunities allows applicants to experience more programs when compared to in-person evaluations. While our data shows that a majority of general surgery residency programs utilize at least one form of social media platform as an avenue for outreach during the COVID-19 pandemic, approximately two fifths of programs did not. Programs that fail to adapt to the unavoidable shift from traditional to virtual residency application cycle may be at a disadvantage.

As for applicants, having a social media account allows them to discover opportunities, establish social networks, and be informed of the latest events regarding their programs of interests.[35] A "follow" and "like" on these social media pages could even signal interests in the program. However, we acknowledge there are risks that comes with creating a social media account as certain content may be viewed as potentially unprofessional.[36] Though the National Resident Matching Program has created the "Match Communication Code of Conduct," no clear instructions regarding social media have been recommended. As for our recommendations, we believe that social media is a tremendous tool to acquire more information about residency programs, and the degree of interaction(s) and posted content is up to the applicant's professional judgement.

Limitations and future directions

Limitations of this study include the rapidly changing nature of social media which we attempted to address by limiting our data capture to a single week to minimize chronologically-dependent variability across different programs' representation on social media platforms. Additionally, transient events advertised through platforms, such as Instagram stories, were not captured. Future directions of investigation should examine if social media is responsible for students' awareness of virtual opportunities, or if other routes of advertisement were more impactful. In order to engage effectiveness of the use of social media, feedback from applicants in 2020–21 match cycle would be extremely beneficial. Along the same survey, analysis of how many applicants created a social media account during this time or who relied on social media to obtain information about programs should be examined Personal student accounts and surveys in the future will provide insight for general surgery residency programs in the years to come. Our study also only focused on the interactive opportunities that social media was able to publicize and provide during the pandemic. Future analysis should be focused on how social media was used for each individual program's recruitment and public image in terms of content and posts during this time. Those categories could include, but not limited to, promotion of research and education, resident well-being and success, and faculty recognition.

Conclusion

Many general surgery programs increasingly utilized social media during the COVID-19 pandemic. Virtual open houses were predominately created to adapt to the social distancing guidelines and institutional safety protocols, while virtual sub-internships were not found to be heavily created for students. However, there were also a significant number of programs that did not employ social media as a resource. As there is continued uncertainty regarding the end of the pandemic and an increasing competitiveness of the general surgery field, virtual opportunities and social media should be considered as a legitimate approach in future outreach and professional recruitment efforts.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

None pertaining to this project and publication of this work.

References

1. Stain SC, Hiatt JR, Ata A, et al. Characteristics of highly ranked applicants to general surgery residency programs. *JAMA Surg*. 2013 May;148(5):413–417. https://doi.org/10.1001/jamasurg.2013.180.
2. Dream S, Olivet MM, Tanner L, Chen H. Do male chairs of surgery have implicit gender bias in the residency application process? *Am J Surg*. 2020 Aug 15;(20): S0002–S9610. https://doi.org/10.1016/j.amjsurg.2020.08.010, 30497-9.

3. Akers A, Blough C, Iyer MS. COVID-19 implications on clinical clerkships and the residency application process for medical students. *Cureus*. 2020 Apr 23;12(4), e7800. https://doi.org/10.7759/cureus.7800.
4. Coalition of physician accountability "final report and recommendations for medical education institutions of LCME-accredited, U.S. Osteopathic, and non-U.S. Medical school applicants". PDF file https://www.aamc.org/media/44736/download.
5. Chesney TR, Bogach J, Devaud N, et al. How we did it: creating virtual interviews for postgraduate medical trainee recruitment and keeping it personal. *Ann Surg*. 2020 Nov 4. https://doi.org/10.1097/SLA.0000000000004183.
6. Hill MV, Ross EA, Crawford D, et al. Program and candidate experience with virtual interviews for the 2020 Complex General Surgical Oncology interview season during the COVID pandemic. *Am J Surg*. 2020 Nov 9;20:S0002–S9610. https://doi.org/10.1016/j.amjsurg.2020.11.007, 30730-3.
7. Xu L, Ambinder D, Kang J, et al. Virtual grand rounds as a novel means for applicants and programs to connect in the era of COVID-19. *Am J Surg*. 2020 Sep 2. https://doi.org/10.1016/j.amjsurg.2020.08.044. S0002-9610(20)30536-5.
8. Sutzko DC, Martin CA, Chu DI. Development and implementation of virtual grand rounds in surgery. *Am J Surg*. 2020 Jul 8. https://doi.org/10.1016/j.amjsurg.2020.06.075. S0002-9610(20)30429-3.
9. Butler PD, Nagler A, Atala A, et al. Virtual surgery residency selection: strategies for programs and candidates. *Am J Surg*. 2020 Aug 1;20:S0002–S9610. https://doi.org/10.1016/j.amjsurg.2020.07.026, 30480-3.
10. Klammer RM, Haydel MJ, Gallahue F, et al. Program visits and residency interviews. *J Emerg Med*. 2019 Oct;57(4):e133–e139. https://doi.org/10.1016/j.jemermed.2019.04.028.
11. Boyd CJ, Inglesby DC, Corey B, et al. Impact of COVID-19 on away rotations in surgical fields. *J Surg Res*. 2020 Nov;255:96–98. https://doi.org/10.1016/j.jss.2020.05.049.
12. McCord JH, McDonald R, Leverson G, et al. Motivation to pursue surgical subspecialty training: is there a gender difference? *J Am Coll Surg*. 2007 Nov;205(5):698–703. https://doi.org/10.1016/j.jamcollsurg.2007.06.014.
13. Sell NM, Qadan M, Delman KA, et al. Implications of COVID-19 on the general surgery match. *Ann Surg*. 2020;272(2):e155–e156. https://doi.org/10.1097/SLA.0000000000004032.
14. Zaki MM, Nahed BV. Utilizing virtual interviews in residency selection beyond COVID-19. *Acad Med*. 2020 Nov;95(11):e7–e8. https://doi.org/10.1097/ACM.0000000000003589.
15. Davis MG, Haas MRC, Gottlieb M, et al. Zooming in versus flying out: virtual residency interviews in the era of COVID-19. *AEM Educ Train*. 2020 Jun 27;4(4):443–446. https://doi.org/10.1002/aet2.10486.
16. Seifi A, Mirahmadizadeh A, Eslami V. Perception of medical students and residents about virtual interviews for residency applications in the United States. *PloS One*. 2020 Aug 31;15(8), e0238239. https://doi.org/10.1371/journal.pone.0238239.
17. Morris M, Pierce A, Carlisle B, et al. Pre-operative COVID-19 testing and decolonization. *Am J Surg*. 2020 Sep;220(3):558–560. https://doi.org/10.1016/j.amjsurg.2020.05.027.
18. Chen HA, Trinh J, Yang GP. Anti-Asian sentiment in the United States - COVID-19 and history. *Am J Surg*. 2020 Sep;220(3):556–557. https://doi.org/10.1016/j.amjsurg.2020.05.020.
19. Fogel HA, Liskutin TE, Wu K, et al. The economic burden of residency interviews on applicants. *Iowa Orthop J*. 2018;38:9–15.
20. Asyyed Z, McGuire C, Samargandi O, et al. The use of twitter by plastic surgery journals. *Plast Reconstr Surg*. 2019 May;143(5):1092e–1098e. https://doi.org/10.1097/PRS.0000000000005535.
21. Attai DJ, Anderson PF, Fisch MJ, et al. Collaboration for Outcomes on Social Media in Oncology (COSMO). Risks and benefits of Twitter use by hematologists/oncologists in the era of digital medicine. *Semin Hematol*. 2017 Oct;54(4):198–204. https://doi.org/10.1053/j.seminhematol.2017.08.001.
22. Hill SS, Dore FJ, Em ST, et al. Twitter use among departments of surgery with general surgery residency programs. *J Surg Educ*. 2020 Jul 3;20:S1931–S7204. https://doi.org/10.1016/j.jsurg.2020.06.008, 30201-4.
23. Markham MJ, Gentile D, Graham DL. Social media for networking, professional development, and patient engagement. *Am Soc Clin Oncol Educ Book*. 2017;37:782–787. https://doi.org/10.1200/EDBK_180077.
24. Choinski K, Carnevale M, Koleilat I, Phair J. The prevalence and utility of vascular surgery training programs' and vascular societies' social media presence. *Ann Vasc Surg*. 2020 Nov;69:115–124. https://doi.org/10.1016/j.avsg.2020.05.061.
25. Hill SS, Dore FJ, Em ST, et al. Twitter use among departments of surgery with general surgery residency programs. *J Surg Educ*. 2021 Jan-Feb;78(1):35–42. https://doi.org/10.1016/j.jsurg.2020.06.008.
26. Murphy C. Tweet twist: the evolution of twitter. *Boston digital*; 2019, November. https://www.bostondigital.com/insights/tweet-twist-evolution-twitter. Accessed February 24, 2021.
27. Distribution of Instagram users worldwide as of October 2020, by age group. https://www.statista.com/statistics/325587/instagram-global-age-group/. Accessed October 15, 2020.
28. Joshi ART, Choi J, Terhune K. ERAS and the NRMP and their roles in residency recruitment-A primer for surgical program directors. *J Surg Educ*. 2019 Sep-Oct;76(5):1163–1166. https://doi.org/10.1016/j.jsurg.2019.03.010.
29. Shappell E, Shakeri N, Fant A, et al. Branding and recruitment: a primer for residency program leadership. *J Grad Med Educ*. 2018 Jun;10(3):249–252. https://doi.org/10.4300/JGME-D-17-00602.1.
30. Nilsen K, Callaway P, Phillips JP, Walling A. How much do family medicine residency programs spend on resident recruitment? A cera study. *Fam Med*. 2019 May;51(5):405–412. https://doi.org/10.22454/FamMed.2019.663971.
31. Wojnarwsky PKL, Wang Y, Shah K, Koka S. Factors influencing resident choice of prosthodontic residency program. *J Prosthodont*. 2017 Jun;26(4):339–343. https://doi.org/10.1111/jopr.12599.
32. Kelley SR, Colibaseanu DT, Mathis KL, et al. Factors influencing colon and rectal surgery residency program selection. *J Surg Res*. 2019 Jun;238:137–143. https://doi.org/10.1016/j.jss.2019.01.042.
33. O'Glasser AY, Jaffe RC, Brooks M. To tweet or not to tweet, that is the question. *Semin Nephrol*. 2020 May;40(3):249–263. https://doi.org/10.1016/j.semnephrol.2020.04.003.
34. Jiang J, Key P, Deibert CM. Improving the residency program virtual open house experience: a survey of Urology applicants. *Urology*. 2020 Oct 10;S0090–4295(20). https://doi.org/10.1016/j.urology.2020.08.077, 31256-5.
35. Herweck AM, Ness AR, Delamater JM, Diez EDT, Khosravani N. A medical student's perspective on social media in the surgical field. *Ann Surg*. 2020 Aug;272(2):234–235. https://doi.org/10.1097/SLA.0000000000003904.
36. Rohde SC, White EM, Yoo PS. Residency program use of social media in the COVID-19 era: an applicant's perspective. *J Surg Educ*. 2020 Dec 17. https://doi.org/10.1016/j.jsurg.2020.12.011. S1931-7204(20)30481-5.