



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.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.JournalofSurgicalResearch.com

Frequency and Characteristics of Social Media Use among General Surgery Trainees



Hataka R. Minami, MS,^{a,*} Xujia Li, BSE,^a Samantha K. Ong, BA,^a Steven Allen, MD,^b Parswa Ansari, MD,^c Marcus Balters, MD,^d Daniel Han, MD,^e Donald Hess, MD,^f Patrick Jackson, MD,^g Mary Kimbrough, MD,^h Michael Porter, MD,ⁱ Rebecca Schroll, MD,^j Brian Shames, MD,^k Julia Shelton, MD MPH,^l Michael Sult, MD,^m Jeffrey J. Sussman, MD,ⁿ Michael Williams, MD,^o Peter Yoo, MD,^p and Matthew R. Smeds, MD^o

^a Saint Louis University School of Medicine, Saint Louis, Missouri

^b Pennsylvania State University, University Park, Pennsylvania

^c Lennox Hill Hospital, New York, New York

^d Creighton University Medical Center, Omaha, Nebraska

^e Mount Sinai School of Medicine, New York, New York

^f Boston University, Boston, Massachusetts

^g Medstar Georgetown University Hospital, Washington, District of Columbia

^h University of Arkansas for Medical Sciences, Fayetteville, Arkansas

ⁱ University of Kansas, Wichita, Kansas

^j Tulane University School of Medicine, New Orleans, Louisiana

^k University of Connecticut, Farmington, Connecticut

^l University of Iowa, Iowa City, Iowa

^m Loyola University Health System, Maywood, Illinois

ⁿ University of Cincinnati, Cincinnati, Ohio

^o Department of Surgery, Division of Vascular and Endovascular Surgery, Saint Louis University School of Medicine, Saint Louis, Missouri

^p Yale University School of Medicine, New Haven, Connecticut

ARTICLE INFO

Article history:

Received 23 January 2022

Received in revised form

4 April 2022

Accepted 12 April 2022

Available online 10 May 2022

Keywords:

General surgery

Residency program

ABSTRACT

Introduction: With increased social isolation due to COVID-19, social media has been increasingly adopted for communication, education, and entertainment. We sought to understand the frequency and characteristics of social media usage among general surgery trainees.

Materials and methods: General surgery trainees in 15 American training programs were invited to participate in an anonymous electronic survey. The survey included questions about demographics, frequency of social media usage, and perceptions of risks and benefits of social media. Univariate analysis was performed to identify differences between high users of social media (4–7 h per week on at least one platform) and low users (0–3 h or less on all platforms).

* Corresponding author. Saint Louis University School of Medicine, 1402 S Grand Boulevard, Saint Louis, MO 63104. Tel.: +1 314 977 9870; fax: +1 314 977 8088.

E-mail address: hataka.minami@health.slu.edu (H.R. Minami).
0022-4804/\$ – see front matter © 2022 Elsevier Inc. All rights reserved.

<https://doi.org/10.1016/j.jss.2022.04.050>

Resident
Social media
SoMe
Trainee

Results: One hundred fifty-seven of 591 (26.6%) trainees completed the survey. Most respondents were PGY3 or lower (75%) and high users of social media (74.5%). Among high users, the most popular platforms were Instagram (85.7%), YouTube (85.1%), and Facebook (83.6%). YouTube and Twitter were popular for surgical education (77.3% and 68.2%, respectively). The most reported benefits of social media were improving patient education and professional networking (85.0%), where high users agreed more strongly about these benefits ($P = 0.002$). The most reported risks were seeing other residents (42%) or attendings (17%) with unprofessional behavior. High users disagreed more strongly about risks, including observing attendings with unprofessional behavior ($P = 0.028$).

Conclusions: Most respondents were high users of social media, particularly Instagram, YouTube, and Facebook. High users incorporated social media into their surgical education while perceiving more benefits and fewer risks of social media.

© 2022 Elsevier Inc. All rights reserved.

Introduction

Social media (SoMe) has been increasingly adopted by surgeons and trainees for communication, education, research, and networking.¹ The extent of SoMe use varies based on specialty and purpose, with reported literature values, including 81% in plastic surgeons,² 56% in colorectal surgeons,³ 58.4% in head and neck surgeons,⁴ and 51.8% in general surgeons for daily recreational use.⁵ The Coronavirus Disease 2019 (COVID-19) pandemic has further emphasized virtual communication and increased SoMe use in the surgical community, ranging from residency applicants to programs and departments.⁶⁻⁸

Despite increasing attention of SoMe in surgery, limited data exist on surgical trainees alone (residents and fellows), as prior studies combine one or more groups of trainees and surgeons in different practice settings.²⁻⁵ Several studies have shown that trainees or younger surgeons use SoMe more frequently,^{2,5,9} as high as 99.4% in urology trainees. Furthermore, very few studies have examined the frequency and characteristics of SoMe use among general surgery trainees. As general surgery residency programs, program directors, and departments continue creating SoMe accounts during the COVID-19 pandemic,⁶⁻⁸ trainees may also increasingly use SoMe to engage in this growing online community. The increased adoption of SoMe among trainees may be expected despite continuing to work through the COVID-19 pandemic and experiencing less social isolation, and thus trainees' current SoMe footprint should be characterized.

This high prevalence of SoMe use presents a challenge for trainees managing an online presence and weighing the benefits and risks of using SoMe, including surgical education, patient privacy, and professionalism.¹⁰ Yet, perceptions of risks and benefits of using SoMe among trainees are largely unknown. This survey study aims to characterize the frequency of SoMe use, activities on SoMe, and perceived risks and benefits of using SoMe among general surgery trainees. We hope to show that most general surgery trainees will be high users of SoMe for educational and noneducational purposes and that high users of SoMe tend to perceive more of its benefits while perceiving fewer risks.

Materials and Methods

This study was approved by the Institutional Review Board at Saint Louis University. Informed consent was obtained through a recruitment statement, which was attached to the survey and provided to study participants on invitation.

Survey

General surgery trainees enrolled in 15 American training programs were invited via email from October to November 2020 to take an anonymous electronic survey. The program director of each participating program was responsible for sending out this link and reminding those surveyed at the 1-week point. Data were collected for a total of 2 wk, and no program identifiers were included in the responses. The survey was created using the Qualtrics (Qualtrics, Provo, UT) survey tool and included questions about respondent demographics, frequency of SoMe use on nine platforms (Facebook, Twitter, Instagram, Snapchat, TikTok, YouTube, LinkedIn, ResearchGate, and Reddit), prior SoMe use as residency applicants, and perceptions of risks and benefits of using SoMe on a Likert scale (1 = strongly agree, 5 = strongly disagree). Trainees using SoMe at least 4-7 h per week on at least one platform were defined as 'high users', and further queried regarding online activities and the purpose of using each platform. In contrast, trainees were defined as 'low users' if they spent 0-3 h per week or less on all platforms and were not queried for SoMe activities.

Statistical analysis

Forty-four variables were analyzed in Microsoft Excel and MATLAB Statistical Toolbox for significant differences between high and low users, including demographics, frequency of SoMe use, prior SoMe as residency applicants, and perceptions of SoMe use. Descriptive statistics were expressed as mean \pm standard deviation, mode (interquartile range), and proportions for continuous, ordinal, and categorical variables, respectively. Univariate analysis was performed with the two-tailed Student *t*-test, Mann-Whitney *U*/Wilcoxon rank-sum test, and Fisher's exact test for the appropriate variable type. Due to multiple hypothesis testing, a false discovery rate

Table 1 – Demographics.

Variable	Total	High users*	Low users*	P
Age	30.11 ± 3.13 (151)	30.01 ± 3.07 (114)	30.41 ± 3.33 (37)	0.505
Gender				0.856
Male	49.0% (76)	49.6% (57)	47.5% (19)	
Female	51.0% (79)	50.4% (58)	52.5% (21)	
Race				0.823
White	77.1% (111)	77.6% (83)	75.7% (28)	
Non-white	22.9% (33)	22.4% (24)	24.3% (9)	
Hispanic, Latino, or Spanish				1.000
Yes	7.6% (12)	7.7% (9)	7.5% (3)	
No	92.4% (145)	92.3% (108)	92.5% (37)	
Year of training				0.597
PGY1	24.8% (39)	23.1% (27)	30.0% (12)	
PGY2	29.9% (47)	33.3% (39)	20.0% (8)	
PGY3	20.4% (32)	20.5% (24)	20.0% (8)	
PGY4	8.3% (13)	7.7% (9)	10.0% (4)	
PGY5	12.1% (19)	10.3% (12)	17.5% (7)	
PGY6	3.2% (5)	3.4% (4)	2.5% (1)	
PGY7	1.3% (2)	1.7% (2)	0.0% (0)	

*High use was defined as 4-7 h per week or more on at least one social media platform. Low use was defined as 0-3 h per week or less on all platforms.

correction was applied with cutoff q of 0.05 to reduce type 1 error. Among high users of SoMe, 144 variables regarding online activities were descriptively analyzed. Secondary analyses were performed to identify predictors of using SoMe for surgical education and to identify relationships between current training level and SoMe use as residency applicants.

Results

Of the total of 591 trainees, 157 (26.6%) completed the survey. Most trainees were categorized as 'high users' of SoMe, using at least one platform 4-7 h per week or more (117/157, 74.5%),

while the remainder were 'low users' and used all platforms 0-3 h per week or less (40/157, 25.5%). There were no statistically significant differences in demographics between high and low users (Table 1).

High users, by definition, had higher frequencies of SoMe use compared to low users on almost all platforms (Table 2). Among high users, the three most popular platforms were Instagram (96/112, 85.7%), YouTube (97/114, 85.1%), and Facebook (97/116, 83.6%) (Table 3). Among high users using each platform, YouTube and Twitter were popular for surgical education (77.3% and 68.2% of users, respectively), while YouTube, Reddit, and Twitter were popular for nonsurgical education (54.6%, 43.2%, and 31.8% of users, respectively).

Table 2 – Frequency of social media use among general surgery trainees.

Platform	Total	High users	Low users	P
Facebook	3 (2 - 3) (156)	3 (2 - 4) (116)	3 (1.5 - 3) (40)	0.004 [†]
Twitter	2 (1 - 3) (157)	2 (1 - 3) (117)	1 (1 - 2) (40)	0.004 [†]
Instagram	3 (2 - 4) (157)	4 (2 - 4) (117)	2 (1 - 3) (40)	<0.001 [†]
Snapchat	2 (1 - 3) (156)	2 (1 - 3) (116)	1 (1 - 2.5) (40)	0.002
TikTok	1 (1 - 1) (156)	1 (1 - 1) (116)	1 (1 - 1) (40)	0.017
YouTube	3 (2 - 4) (156)	3 (2 - 4) (116)	3 (2 - 3) (40)	0.003 [†]
LinkedIn	1 (1 - 2) (157)	2 (1 - 2) (117)	1 (1 - 2) (40)	0.018
ResearchGate	1 (1 - 2) (156)	1 (1 - 2) (116)	1 (1 - 1) (40)	<0.001 [†]
Reddit	1 (1 - 2) (154)	1 (1 - 2) (114)	1 (1 - 1) (40)	0.053

(Median and IQRs; 1 = No Use, 2 = Less than weekly, 3 = 0-3 h per week, 4 = 4-7 h per week, 5 = 8-14 h per week, 6 = 15-21 h per week, 7 = more than 21 h per week).

[†]Statistically significant after false discovery rate correction.

Table 3 – Social media activities among high users.

Activity	Facebook	Twitter	Instagram	Snapchat	TikTok	YouTube	LinkedIn	ResearchGate	Reddit
Using platform									
Yes	83.6% (97)	58.9% (66)	85.7% (96)	63.7% (72)	18.2% (20)	85.1% (97)	37.9% (44)	31.5% (35)	40.4% (44)
No	16.4% (19)	41.1% (46)	14.3% (16)	36.3% (41)	81.8% (90)	14.9% (17)	62.1% (72)	68.5% (76)	59.6% (65)
Surgical education									
Yes	19.6% (19)	68.2% (45)	15.6% (15)	0.0% (0)	0.0% (0)	77.3% (75)	9.1% (4)	37.1% (13)	45.5% (20)
No	80.4% (78)	31.8% (21)	84.4% (81)	100.0% (72)	100.0% (20)	22.7% (22)	90.9% (40)	62.9% (22)	54.5% (24)
Non-surgical education									
Yes	13.4% (13)	31.8% (21)	11.5% (11)	0.0% (0)	0.0% (0)	54.6% (53)	2.3% (1)	8.6% (3)	43.2% (19)
No	86.6% (84)	68.2% (45)	88.5% (85)	100.0% (72)	100.0% (20)	45.4% (44)	97.7% (43)	91.4% (32)	56.8% (25)
Professional networking									
Yes	7.2% (7)	47.0% (31)	12.5% (12)	0.0% (0)	5.0% (1)	1.0% (1)	95.5% (42)	48.6% (17)	2.3% (1)
No	92.8% (90)	53.0% (35)	87.5% (84)	100.0% (72)	95.0% (19)	99.0% (96)	4.5% (2)	51.4% (18)	97.7% (43)
Research									
Yes	2.1% (2)	28.8% (19)	3.1% (3)	0.0% (0)	0.0% (0)	14.4% (14)	0.0% (0)	57.1% (20)	6.8% (3)
No	97.9% (95)	71.2% (47)	96.9% (93)	100.0% (72)	100.0% (20)	85.6% (83)	100.0% (44)	42.9% (15)	93.2% (41)
Entertainment									
Yes	61.9% (60)	53.0% (35)	80.2% (77)	29.2% (21)	95.0% (19)	84.5% (82)	0.0% (0)	0.0% (0)	93.2% (41)
No	38.1% (37)	47.0% (31)	19.8% (19)	70.8% (51)	5.0% (1)	15.5% (15)	100.0% (44)	100.0% (35)	6.8% (3)
Socialize with friends									
Yes	88.7% (86)	19.7% (13)	84.4% (81)	88.9% (64)	10.0% (2)	4.1% (4)	0.0% (0)	0.0% (0)	6.8% (3)
No	11.3% (11)	80.3% (53)	15.6% (15)	11.1% (8)	90.0% (18)	95.9% (93)	100.0% (44)	100.0% (35)	93.2% (41)
News									
Yes	32.0% (31)	65.2% (43)	20.8% (20)	5.6% (4)	0.0% (0)	25.8% (25)	0.0% (0)	0.0% (0)	40.9% (18)
No	68.0% (66)	34.8% (23)	79.2% (76)	94.4% (68)	100.0% (20)	74.2% (72)	100.0% (44)	100.0% (35)	59.1% (26)
Meet new people									
Yes	3.1% (3)	4.5% (3)	8.3% (8)	1.4% (1)	0.0% (0)	0.0% (0)	2.3% (1)	0.0% (0)	2.3% (1)
No	96.9% (94)	95.5% (63)	91.7% (88)	98.6% (71)	100.0% (20)	100.0% (97)	97.7% (43)	100.0% (35)	97.7% (43)
View posts									
Yes	94.7% (89)	89.2% (58)	90.9% (90)	72.5% (50)	94.7% (18)	87.2% (82)	51.5% (17)	65.5% (19)	95.2% (40)
No	5.3% (5)	10.8% (7)	9.1% (9)	27.5% (19)	5.3% (1)	12.8% (12)	48.5% (16)	34.5% (10)	4.8% (2)
'Like' posts									
Yes	53.2% (50)	49.2% (32)	79.8% (79)	2.9% (2)	36.8% (7)	10.6% (10)	6.1% (2)	0.0% (0)	21.4% (9)
No	46.8% (44)	50.8% (33)	20.2% (20)	97.1% (67)	63.2% (12)	89.4% (84)	93.9% (31)	100.0% (29)	78.6% (33)
Repost posts									
Yes	5.3% (5)	50.8% (33)	12.1% (12)	0.0% (0)	5.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)	4.8% (2)

(continued)

Table 3 – (continued)

Activity	Facebook	Twitter	Instagram	Snapchat	TikTok	YouTube	LinkedIn	ResearchGate	Reddit
No	94.7% (89)	49.2% (32)	87.9% (87)	100.0% (69)	94.7% (18)	100.0% (94)	100.0% (33)	100.0% (29)	95.2% (40)
Write or create my own posts									
Yes	14.9% (14)	30.8% (20)	51.5% (51)	39.1% (27)	0.0% (0)	0.0% (0)	0.0% (0)	6.9% (2)	9.5% (4)
No	85.1% (80)	69.2% (45)	48.5% (48)	60.9% (42)	100.0% (19)	100.0% (94)	100.0% (33)	93.1% (27)	90.5% (38)
Use for another reason									
Yes	2.1% (2)	1.5% (1)	3.0% (3)	20.3% (14)	5.3% (1)	13.8% (13)	48.5% (16)	34.5% (10)	4.8% (2)
No	97.9% (92)	98.5% (64)	97.0% (96)	79.7% (55)	94.7% (18)	86.2% (81)	51.5% (17)	65.5% (19)	95.2% (40)
Follow or friend co-residents									
Yes	94.6% (88)	69.5% (41)	91.6% (87)	64.2% (43)	25.0% (4)	0.0% (0)	55.6% (15)	34.6% (9)	0.0% (0)
No	5.4% (5)	30.5% (18)	8.4% (8)	35.8% (24)	75.0% (12)	100.0% (83)	44.4% (12)	65.4% (17)	100.0% (37)
Follow or friend attendings									
Yes	55.3% (52)	68.3% (41)	49.5% (46)	1.6% (1)	0.0% (0)	3.5% (3)	42.9% (12)	48.1% (13)	2.6% (1)
No	44.7% (42)	31.7% (19)	50.5% (47)	98.4% (63)	100.0% (17)	96.5% (82)	57.1% (16)	51.9% (14)	97.4% (38)

LinkedIn was mostly used for professional networking (95.5%), and ResearchGate was mostly used for research (57.1%) and professional networking (48.6%). Entertainment was popular across many platforms, particularly TikTok (95.0%), Reddit (93.2%), YouTube (84.5%), and Instagram (80.2%). Most trainees followed or befriended each other on Facebook (94.6%), Instagram (91.6%), Twitter (69.5%), and Snapchat (64.2%). Trainees also followed or befriended attending physicians to a similar degree on Twitter (68.3%); however, much fewer on Facebook (55.3%), Instagram (49.5%), or Snapchat (1.6%).

Among the trainees 21% (33/157) reported using SoMe to evaluate residency programs in the Match as previous residency applicants. High users tended to use SoMe as residency applicants more often than low users, but this was not statistically significant ($P = 0.07$, Table 4). The most common platforms were Twitter (57.6%), Instagram (51.5%), and Facebook (45.5%), which were used to understand the residency program's social environment (84.8%), residents (84.8%), educational environment (60.6%), and to a lesser degree faculty (42.4%).

The most reported benefits of using SoMe were improving patient education and professional networking (134/157, 85.0%). High users agreed more strongly about benefits, including promoting their healthcare organization ($P = 0.001$), improving patient care ($P = 0.03$) or education ($P = 0.002$), professional networking ($P = 0.002$), and surgical education ($P < 0.001$) (Table 5). The most reported risks of SoMe were seeing other residents (66/157, 42.0%) or attendings (27/157, 17.2%) with unprofessional behavior. High users similarly disagreed more strongly about risks, including observing attendings with unprofessional behavior ($P = 0.028$), residents and attendings posting wrong surgical information ($P = 0.001$ and 0.004 , respectively), and residents sharing patient information ($P = 0.007$).

Secondary analysis among high users revealed that trainees using SoMe for surgical education used SoMe more frequently on most platforms (e.g., $P = 0.002$ for Facebook), used SoMe more as residency applicants ($P = 0.027$), and perceived more benefits and fewer risks of using SoMe (Table A1 in Appendix). There were no significant associations between current training level (intern, resident, or senior/chief) and SoMe use as residency applicants (Table A2 in Appendix).

Discussion

Most general surgery trainees responding to our survey were characterized as 'high users' of SoMe. This was unsurprising and paralleled the overall rise of SoMe in surgery, particularly among trainees and younger surgeons.^{2,5,9} The tech-savviness of younger generations and the need for marketing to establish a self-referred practice have been suggested to drive this age difference in SoMe.^{5,10} Although we did not find a significant age difference between high and low users in our study, respondents were younger at around 30 y old.

Among high users of SoMe, the three most popular platforms for any use were Instagram (85.7%), YouTube (85.1%), and Facebook (83.6%). Facebook and Instagram have been popular in other surgical specialties, including plastic surgery

Table 4 – Prior social media use as residency applicants.

Platform	Total	High use trainees	Low use trainees	P
Used any platform				
Yes	21.0% (33)	24.8% (29)	10.0% (4)	0.070
No	79.0% (124)	75.2% (88)	90.0% (36)	
Facebook				
Yes	45.5% (15)	48.3% (14)	25.0% (1)	0.607
No	54.5% (18)	51.7% (15)	75.0% (3)	
Twitter				
Yes	57.6% (19)	55.2% (16)	75.0% (3)	0.620
No	42.4% (14)	44.8% (13)	25.0% (1)	
Instagram				
Yes	51.5% (17)	55.2% (16)	25.0% (1)	0.335
No	48.5% (16)	44.8% (13)	75.0% (3)	
Snapchat				
Yes	0.0% (0)	0.0% (0)	0.0% (0)	NA
No	100.0% (33)	100.0% (29)	100.0% (4)	
TikTok				
Yes	0.0% (0)	0.0% (0)	0.0% (0)	NA
No	100.0% (33)	100.0% (29)	100.0% (4)	
YouTube				
Yes	12.1% (4)	13.8% (4)	0.0% (0)	1.000
No	87.9% (29)	86.2% (25)	100.0% (4)	
LinkedIn				
Yes	3.0% (1)	3.4% (1)	0.0% (0)	1.000
No	97.0% (32)	96.6% (28)	100.0% (4)	
ResearchGate				
Yes	0.0% (0)	0.0% (0)	0.0% (0)	NA
No	100.0% (33)	100.0% (29)	100.0% (4)	
Reddit				
Yes	9.1% (3)	10.3% (3)	0.0% (0)	1.000
No	90.9% (30)	89.7% (26)	100.0% (4)	
Used social media to understand				
Educational environment				
Yes	60.6% (20)	58.6% (17)	75.0% (3)	1.000
No	39.4% (13)	41.4% (12)	25.0% (1)	
Social environment				
Yes	84.8% (28)	86.2% (25)	75.0% (3)	0.500
No	15.2% (5)	13.8% (4)	25.0% (1)	
Faculty				
Yes	42.4% (14)	37.9% (11)	75.0% (3)	0.288
No	57.6% (19)	62.1% (18)	25.0% (1)	
Residents				
Yes	84.8% (28)	86.2% (25)	75.0% (3)	0.500
No	15.2% (5)	13.8% (4)	25.0% (1)	

trainees for personal use (Facebook 86.9%, Instagram 77.7%),² and bariatric or general surgeons for personal use (Facebook 80.3%, Instagram 27.1%).⁵ Facebook is considered the dominant SoMe platform with versatile methods of forming communities and disseminating medical information,^{11,12} while Instagram became popular among plastic surgeons due to its

engagement with visual images and videos.^{13,14} YouTube was also popular in our study and the most used platform for surgical education (77.3%). This finding was echoed by several survey studies, where 86% of video users turned to YouTube to prepare for surgical procedures,¹⁵ and residents used YouTube significantly more than specialists.¹⁶ The benefit of

Table 5 – Perception of Risks and Benefits of Surgeons using Social Media among General Surgery Trainees.

Perception	Total	High users	Low users	P
Risk				
Seen residents with unprofessional behavior	3 (2 - 4) (157)	3 (2 - 4) (117)	3 (2 - 4) (40)	0.363
Seen attendings with unprofessional behavior	4 (3 - 4) (157)	4 (3 - 4) (117)	3 (2 - 4) (40)	0.028
Seen residents posting wrong surgical information	4 (4 - 5) (157)	4 (4 - 5) (117)	4 (3 - 4) (40)	0.001[†]
Seen attendings posting wrong surgical information	4 (4 - 5) (157)	4 (4 - 5) (117)	4 (3 - 4) (40)	0.004[†]
Seen residents sharing patient information	4 (4 - 5) (157)	5 (4 - 5) (117)	4 (3.5 - 5) (40)	0.007[†]
Seen attendings sharing patient information	4 (4 - 5) (157)	5 (4 - 5) (117)	4 (3 - 5) (40)	0.086
Seen residents criticizing other physicians	4 (3 - 5) (157)	4 (3 - 5) (117)	4 (3 - 4) (40)	0.173
Seen attendings criticizing other physicians	4 (3 - 5) (156)	4 (3 - 5) (116)	4 (3 - 4) (40)	0.141
Benefit				
Promoting healthcare organization	2 (1 - 2) (157)	2 (1 - 2) (117)	2 (2 - 3) (40)	0.001[†]
Improving patient care	2 (2 - 3) (157)	2 (1 - 3) (117)	2 (2 - 3) (40)	0.030
Improving patient education	2 (1 - 2) (157)	2 (1 - 2) (117)	2 (2 - 2) (40)	0.002[†]
Professional networking	2 (1 - 2) (157)	2 (1 - 2) (117)	2 (2 - 2) (40)	0.002[†]
Planned use for job seeking	3 (2 - 3) (157)	2 (2 - 3) (117)	3 (2 - 3.5) (40)	0.019
Surgical education	2 (1 - 2) (157)	2 (1 - 2) (117)	2 (2 - 3) (40)	<0.001[†]
Nonsurgical education	2 (1 - 2) (156)	2 (1 - 2) (117)	2 (2 - 3) (39)	<0.001[†]

(Median and IQRs; 1 = Strongly Agree, 2 = Somewhat Agree, 3 = Neither, 4 = Somewhat Disagree, 5 = Strongly Disagree).

[†]Statistically significant after false discovery rate correction.

YouTube for surgical education may be explained by its easy access on wireless devices and lack of requirement for expert instruction.

Although not included in the three most popular platforms, Twitter was also widely used for surgical education among general surgery trainees (68.2%). The growing Twitter community in healthcare has been fueled by public dissemination of knowledge with short posts or ‘tweets’ with 280 characters or less, active engagement with the audience through ‘favorites’ or ‘retweets’, and forming communities and groups through ‘hashtags’.¹⁷ Twitter’s functionality encourages reciprocal engagement in a professional setting and may explain why trainees followed or befriended attending physicians more frequently on Twitter (68.3%) compared to Facebook (55.3%), Instagram (49.5%), or Snapchat (1.6%). Furthermore, the Thoracic Surgery Social Media Network was created by cardiothoracic journals to highlight key publications and improve visibility, and a corresponding Trainee Group was established to discuss papers akin to a virtual journal club.^{18,19} Considering that trainees using SoMe for surgical education were more frequently using Twitter (along with other platforms) in our secondary analysis, the use of SoMe for surgical education may continue to increase with SoMe prevalence.

The preferred SoMe platform was dependent on the purpose of use, such as surgical education, professional networking, or entertainment. Although Facebook was one of the most popular platforms in our study overall, a minority of general surgery residents used Facebook for professional networking (2.1%). Similar trends were found across the literature, and Facebook was used more for personal than professional purposes: 86.9% versus 20.8% in plastic surgery trainees² and 93% versus 33% in young international urologists.²⁰ The frequency of using a SoMe

platform was largely consistent with the platform’s intended purpose (e.g., 95.5% professional networking with LinkedIn users). Recently, however, closed Facebook groups among surgeons emerged to share clinical ideas, offer feedback, or provide surgical education while maintaining social distancing during the COVID-19 pandemic (e.g., Robotic Surgical Collaboration, International Hernia Collaboration, and Online Society of Gastrointestinal and Endoscopic Surgeons).²¹⁻²³ These closed groups highlight the rapidly growing importance of an online surgical community, but challenges remain for surgeons to critically view information on SoMe for helpful information and maintain patient privacy and informed consent.^{24,25}

High-frequency users additionally tended to use SoMe to evaluate residency programs during the Match. Although interpersonal sources of information from mentors, residents, and students remain invaluable, residency applicants have increasingly relied on online sources, including program websites and SoMe, to evaluate residency programs’ culture, training, research, and benefits,^{26,27} especially in the age of COVID-19 due to lack of away rotations and in-person interviews.²⁸ Although only 21% of trainees used SoMe during the Match, our study included trainees who applied for residency programs prior to Fall 2020, before the widespread influence of the COVID-19 pandemic on residency applicants. A significantly larger proportion of current applicants likely used SoMe during the Match. General surgery residency programs also seemed to respond to this demand, with significantly more Instagram and Twitter accounts created in 2020 compared to departmental accounts.⁷ More than half (55%) of all general surgery residency programs had at least one SoMe account in 2021, and more than half (51.2%) of these accounts were created in 2020.²⁹

Importantly, SoMe may enhance networking and mentorship in the surgical community, especially for women in surgical subspecialties who lack same-sex mentorship at their institutions and desire such mentorship.³⁰⁻³² For instance, women were more likely to be mentored by the opposite sex and used SoMe to engage in same-sex mentorship.³² Although mentorship was not directly investigated in our study, high users have engaged in SoMe for professional networking and followed or befriended attendings on various platforms. These users of SoMe may be trainees who lack same-sex mentorship at their institutions or those looking for mentorship to plan further surgical training or subspecialization. The relationship between frequency of SoMe use, mentorship, and plans for further training, warrants further investigation.

The benefits of SoMe may persuade high users to continue using SoMe and may thus explain why high users agreed more strongly about benefits, including surgical education ($P < 0.001$) and professional networking ($P = 0.002$). However, the risks of SoMe must also be considered. Low users agreed more strongly about the risks of SoMe, including seeing residents posting wrong surgical information ($P = 0.001$) or residents sharing patient information ($P = 0.007$). These risks may lead to avoidance and thus low usage of SoMe in trainees. Prior studies have similarly commented on risks of SoMe if not used correctly, such as unprofessionalism, blurring of patient and physician boundaries, and HIPAA violations.^{1,33-35} Unprofessionalism was especially prevalent among surgical trainees using Facebook (14.1% with potentially unprofessional content, 12.2% with clearly unprofessional content),³⁶ and our study revealed relatively low concern for risks of using SoMe among trainees (median risk perception was mostly 'Somewhat Disagree'). Thus, surgical trainees may benefit from further education and a better understanding of SoMe risks to avoid its pitfalls.

Limitations of this survey study include potential selection bias and reporting bias. Trainees who frequently use SoMe and perceive more of its benefits may experience a stronger personal connection to this study and be motivated to fill out the survey. Survey invitations were also sent by email, and trainees who respond to electronic forms of communication may be more likely to be engaged with SoMe. Our response rate was only 26.6%, which may further have skewed the distribution toward mostly 'high users' (74.5%) and younger trainees (75.0% PGY3 or lower). Nevertheless, we found that most general surgery trainees frequently use SoMe, comparable to trainees in other surgical specialties. Other limitations include recalling bias for more familiar SoMe platforms or activities, dishonest answers, and non-answers, although nonanswers were minimal even at the end of the survey. Last, resident participation in the survey was not spread evenly across the country (none from the West coast and minimal from the South), and thus, study findings may not apply to residents from these geographic regions.

Conclusions

Most general surgery trainees use social media, particularly Instagram, YouTube, and Facebook. High users also incorporated social media into their surgical education while

perceiving more benefits and fewer risks of using social media usage as compared to low users.

Supplementary Materials

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jss.2022.04.050>.

Author Contributions

Mr. Hataka Minami has contributed to the study design, statistical analysis, initial drafting and revision of the article, and approval of the final manuscript. Ms. Xujia Li has contributed to the study design, development of survey questions, revision of the article, and approval of the final manuscript for submission. Ms. Samantha Ong has contributed to the study design, development of survey questions, revision of the article, and approval of the final manuscript for submission. Dr Steven Allen has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Parswa Ansari has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Marcus Balters has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Daniel Han has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Donald Hess has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Patrick Jackson has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Mary Kimbrough has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Michael Porter has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Rebecca Schroll has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Brian Shames has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Julia Shelton has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Michael Sault has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Jeffrey Sussman has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Michael Williams has contributed to the

study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Peter Yoo has contributed to the study design, development of survey questions, soliciting participation, revision of the article, and approval of the final manuscript. Dr Matthew Smeds has contributed to the study design, development of survey questions, soliciting participation, revision of the article, approval of the final manuscript, and oversight of the entire study.

Acknowledgments

None.

Disclosure

This study was selected for presentation at the 17th Annual Academic Surgical Congress in Orlando, Florida, on February 2, 2022. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

Funding

None.

REFERENCES

- Ovaere S, Zimmerman DDE, Brady RR. Social media in surgical training: opportunities and risks. *J Surg Educ.* 2018;75:1423–1429.
- Cho MJ, Li AY, Furnas HJ, Rohrich RJ. Current trends in the use of social media by plastic surgeons. *Plast Reconstr Surg.* 2020;146:83e–91e.
- Long LE, Leung C, Hong JS, Wright C, Young CJ. Patterns of internet and social media use in colorectal surgery. *BMC Surg.* 2019;19:52.
- Oyewumi M, Lee J, Vescan A. Social media in otolaryngology-head and neck surgery. *Ear Nose Throat J.* 2017;96:E29–E33.
- Zerrweck C, Arana S, Calleja C, et al. Social media, advertising, and internet use among general and bariatric surgeons. *Surg Endosc.* 2020;34:1634–1640.
- Ahmadmehrabi S, Xie DX, Ward BK, Bryson PC, Byrne P. OHNS residency program and applicant social media presence during the COVID-19 pandemic. *Ann Otol Rhinol Laryngol.* 2021;130:961–965.
- Bludevich BM, Fryer M, Scott EM, Buettner H, Davids JS, LaFemina J. Patterns of general surgery residency social media use in the age of COVID-19. *J Surg Educ.* 2021;78:e218–e225.
- Fang HA, Boudreau HB, Khan S, et al. An evaluation of social media utilization by general surgery programs in the COVID-19 era. *Am J Surg.* 2021;222:937–943.
- Dubin JM, Greer AB, Patel P, et al. Global survey of the roles and attitudes toward social media platforms amongst urology trainees. *Urology.* 2021;147:64–67.
- Economides JM, Choi YK, Fan KL, Kanuri AP, Song DH. Are we witnessing a paradigm shift?: a systematic review of social media in residency. *Plast Reconstr Surg Glob Open.* 2019;7:e2288.
- Mogul DB, Nagy PG, Bridges JFP. Building stronger online communities through the creation of Facebook-integrated health applications. *JAMA Pediatr.* 2017;171:933–934.
- Lugo-Fagundo C, Johnson MB, Thomas RB, Johnson PT, Fishman EK. New frontiers in education: Facebook as a vehicle for medical information delivery. *J Am Coll Radiol.* 2016;13:316–319.
- Chandawarkar AA, Gould DJ, Stevens WG. Insta-grated plastic surgery residencies: the rise of social media use by trainees and responsible guidelines for use. *Aesthet Surg J.* 2018;38:1145–1152.
- Chartier C, Chandawarkar AA, Gould DJ, Stevens WG. Insta-Grated plastic surgery residencies: 2020 update. *Aesthet Surg J.* 2021;41:372–379.
- Rapp AK, Healy MG, Charlton ME, Keith JN, Rosenbaum ME, Kapadia MR. YouTube is the most frequently used educational video source for surgical preparation. *J Surg Educ.* 2016;73:1072–1076.
- Mota P, Carvalho N, Carvalho-Dias E, Joao Costa M, Correia-Pinto J, Lima E. Video-based surgical learning: improving trainee education and preparation for surgery. *J Surg Educ.* 2018;75:828–835.
- Pershad Y, Hange PT, Albadawi H, Oklu R. Social medicine: twitter in healthcare. *J Clin Med.* 2018;7:121.
- Ni hIci T, Archer M, Harrington C, Luc JGY, Antonoff MB. Trainee thoracic surgery social media network: early experience with TweetChat-based journal clubs. *Ann Thorac Surg.* 2020;109:285–290.
- Luc JGY, Archer MA, Arora RC, et al. Social media improves cardiothoracic surgery literature dissemination: results of a randomized trial. *Ann Thorac Surg.* 2020;109:589–595.
- Rivas JG, Socarras MR, Patruno G, et al. Perceived role of social media in urologic knowledge acquisition among young urologists: a European survey. *Eur Urol Focus.* 2018;4:768–773.
- Myers CG, Kudsi OY, Ghaferi AA. Social media as a platform for surgical learning: use and engagement patterns among robotic surgeons. *Ann Surg.* 2018;267:233–235.
- Docimo Jr S, Jacob B, Seras K, Ghanem O. Closed Facebook groups and COVID-19: an evaluation of utilization prior to and during the pandemic. *Surg Endosc.* 2021;35:4986–4990.
- Ghanem O, Logghe HJ, Tran BV, Huynh D, Jacob B. Closed Facebook groups and CME credit: a new format for continuing medical education. *Surg Endosc.* 2019;33:587–591.
- Bernardi K, Milton AN, Hope W, et al. Are online surgical discussion boards a safe and useful venue for surgeons to ask for advice? A review of the International Hernia Collaboration Facebook Group. *Surg Endosc.* 2020;34:1285–1289.
- Bittner JG, Logghe HJ, Kane ED, et al. A Society of Gastrointestinal and Endoscopic Surgeons (SAGES) statement on closed social media (Facebook(R)) groups for clinical education and consultation: issues of informed consent, patient privacy, and surgeon protection. *Surg Endosc.* 2019;33:1–7.
- Zhao H, Souders CP, Freedman A, Breyer BN, Anger JT. The applicant's perspective on urology residency interviews: a qualitative analysis. *Urology.* 2020;142:43–48.
- Steele TN, Galarza-Paez L, Aguilo-Seara G, David LR. Social media impact in the match: a survey of current trends in the United States. *Arch Plast Surg.* 2021;48:107–113.
- Rohde SC, White EM, Yoo PS. Residency program use of social media in the COVID-19 era: an applicant's perspective. *J Surg Educ.* 2021;78:1066–1068.

29. Gleason A, Singh G, Keffer L, Nepomnayshy D. General surgery going viral: current trends in social media utilization by general surgery residency programs. *J Surg Educ*. 2021;78:e62–e67.
30. Corsini EM, Luc JGY, Antonoff MB. Women in thoracic surgery: social media and the value of mentorship. *J Thorac Dis*. 2021;13:464–472.
31. Luc JGY, Stamp NL, Antonoff MB. Social media as a means of networking and mentorship: role for women in cardiothoracic surgery. *Semin Thorac Cardiovasc Surg*. 2018;30:487–495.
32. Luc JGY, Stamp NL, Antonoff MB. Social media in the mentorship and networking of physicians: important role for women in surgical specialties. *Am J Surg*. 2018;215:752–760.
33. Azoury SC, Bliss LA, Ward WH, Liepert AE, Leichtle SW. Surgeons and social media: threat to professionalism or an essential part of contemporary surgical practice? *Bull Am Coll Surg*. 2015;100:45–51.
34. Bennett KG, Berlin NL, MacEachern MP, Buchman SR, Preminger BA, Vercler CJ. The ethical and professional use of social media in surgery: a systematic review of the literature. *Plast Reconstr Surg*. 2018;142:388e–398e.
35. Langenfeld SJ, Batra R. How can social media get us in trouble? *Clin Colon Rectal Surg*. 2017;30:264–269.
36. Langenfeld SJ, Cook G, Sudbeck C, Luers T, Schenarts PJ. An assessment of unprofessional behavior among surgical residents on Facebook: a warning of the dangers of social media. *J Surg Educ*. 2014;71:28–32.