

Evaluation of Social Media and Online Utilization Among Members of the American Orthopaedic Society for Sports Medicine

Implications in Practice

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Background: Social media has the potential to act as an avenue for patient recruitment, patient and surgeon education, and expansion of the physician-patient relationship.

Purpose: To evaluate the existing social media presence among members of the American Orthopaedic Society for Sports Medicine (AOSSM) to describe trends in different subgroups within the membership.

Study Design: Cross-sectional study.

Methods: The AOSSM database was queried for a complete membership list. Members were excluded from analysis if they were not orthopaedic sports medicine surgeons practicing in the United States. Demographic characteristics, online media profiles, and levels of online presence were evaluated, and an online media presence score was calculated. Bivariate analysis was performed to compare demographic variables and levels of online presence.

Results: A total of 2870 surgeons were included in the analysis. LinkedIn was the most used platform (56%), while YouTube was the least used (10%). Surgeons in academic practice had a significantly greater overall social media presence than their private practice counterparts. Female surgeons had a more significant active online presence on Twitter, Instagram, and Facebook than male surgeons. Surgeons practicing in the Northeast had a greater social media presence than those in any other United States region, and surgeons in the earlier stages of practice (0-14 years) were more likely to utilize social media than their more senior colleagues (≥ 15 years of practice). On multivariate analysis, surgeons in the earlier stages of practice were more likely to have active Twitter, Instagram, and Facebook accounts, and female surgeons were more likely to have an active Facebook account. Additionally, multivariate analysis revealed that a greater number of ResearchGate publications were associated with male sex and having an academic practice. Comparatively, active Twitter and Instagram use was associated with having an academic practice.

Conclusion: The most used platform in this surgeon population was LinkedIn. Orthopaedic surgeons in academic practice, female surgeons, those early in their career, and those practicing in the Northeast highlighted a subset of the sports medicine community who were more likely to have an active online presence compared to the rest of the AOSSM.

Keywords: social media; orthopaedic surgery; sports medicine; online presence

Growing technological advances and accessibility have led to drastic increases in connectivity and overall internet usage among American adults. The Pew Research Center reported that between 2005 and 2021, usage of at least one

social networking site increased from 5% to 72% across all adults in the United States.¹⁶ Earp et al⁶ looked at the online presence of 246 orthopaedic surgeons from the American Academy of Orthopaedic Surgeons registry, composed of a random selection of 1% of surgeons from each state, and found that 94.3% of surgeons had at least one online profile. These societal changes have led to a wide breadth of research to understand the relationship and

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implications of practice management for orthopaedic surgeons as well as patient perception of the management and treatment of common orthopaedic abnormalities.^{8,9,17} Social media has the potential to act as an avenue for patient referral, patient and surgeon education, and expansion of the physician-patient relationship. Yet, the overall utility of social media and the associated time, monetary investment, and benefit for a surgeon's practice are difficult to measure, and evidence is lacking.

Several studies have evaluated social media activity at the organizational level to define the existing landscape for orthopaedic subspecialty societies, including the American Shoulder and Elbow Surgeons (ASES), Cervical Spine Research Society (CSRS), and Pediatric Orthopaedic Society of North America (POSNA).^{3,12,14} One study investigated wait times and online reviews for a small number of sports medicine-trained surgeons and found that social media presence was correlated with higher overall physician ratings.¹⁸ Yet, no studies have investigated the online presence of the orthopaedic sports medicine community as a whole to discern whether differences exist based on surgeon demographics, location, level of training, and experience.

The purpose of this study was to provide a detailed evaluation of the existing social media presence among orthopaedic surgeons who are members of the American Orthopaedic Society for Sports Medicine (AOSSM) to describe trends among different subgroups within the society. We hypothesized that surgeons who had been in practice for a shorter duration and those in academic practice would have a greater online footprint than surgeons who had been in practice for a longer duration and those in private practice settings.

METHODS

This cross-sectional study was exempt from institutional review board approval at our institution. The AOSSM membership database was queried on June 24, 2021, producing a list of 3334 members. Current sports medicine fellows were excluded from analysis, as they represent a collection of surgeons currently in training and not currently in practice. Additionally, non-orthopaedic surgeons (ie, athletic trainers, physician assistants, researchers, radiologists, physical medicine and rehabilitation, primary care sports medicine, etc) or those surgeons practicing outside of the United States were also excluded. Demographic variables including practice type, sex, region of country,

and number of years since fellowship were collected. If they did not complete a fellowship, the number of years since finishing residency was recorded. Level of experience was categorized into 4 groups as follows: group 1 (≤ 4 years in practice), group 2 (5-14 years in practice), group 3 (15-24 years in practice), and group 4 (≥ 25 years in practice). The highest level of sports event coverage at any time point in the surgeon's training/career was also recorded and determined based on information reported on a given surgeon's AOSSM profile (ie, professional > college > high school > recreational = youth). Practice location was stratified based on 4 regions: Northeast (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, Pennsylvania), Midwest (Illinois, Indiana, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota), South (Delaware, Florida, Georgia, North Carolina, South Carolina, Maryland, District of Columbia, Virginia, West Virginia, Alabama, Arkansas, Kentucky, Tennessee, Louisiana, Oklahoma, Texas, Mississippi), and West (Arizona, Colorado, Nevada, New Mexico, Utah, Wyoming, Alaska, California, Hawaii, Oregon, Washington, Montana, Idaho).

Social Media Activity Data

Social media analysis was performed for all included surgeons using a similar search protocol as previously described by Lander et al¹² and Narain et al.¹⁴ A Google Search was performed similarly for all surgeons as follows: [first name + last name + medical degree (MD/DO)]. The first 20 results from the Google Search were screened to identify the surgeon's website/practice and locate a picture to assist the rest of the search. Surgeons who were in a group practice, solo practitioner practice, hybrid academic/private practice group ("privademic"), or hospital employment were categorized as private practice physicians. Surgeons employed by a university, with or without an associated professorship as their main designation, were categorized as academic practice physicians. Surgeons who were currently in active-duty military were labeled as military practice physicians. A similar Google Search was performed for all surgeons as follows: [first name + last name + medical degree (MD/DO) + platform of interest]. The platforms of interest collected were as follows: practice group website, personal website, ResearchGate, LinkedIn, Twitter, Instagram, YouTube, and Facebook. ResearchGate profiles were included if there was a profile created

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Ethical approval was not sought for the present study.

for the surgeon and the associated number of publications at the top of the profile was recorded.

Social media accounts that were private or not publicly accessible and those that only reflected the surgeon's personal life were excluded. Social media accounts that had a combination of professional content related to the sports medicine practice and personal content were included. An active Twitter, Instagram, YouTube, or Facebook account was defined as having content posted within the previous 6 months. Activity level was not defined for personal websites, practice group websites, LinkedIn, or ResearchGate, as these platforms are inherently less interactive and not focused on regular updates or postings, as collected by Narain et al.¹⁴ A summated online presence score was then calculated from 0 to 13 based on the presence of each of the following (1 point each): practice group website, personal website, active links on personal website, ResearchGate profile, LinkedIn profile, Twitter profile, active Twitter profile, Instagram profile, active Instagram profile, YouTube profile, active YouTube profile, Facebook profile, and active Facebook profile.

Statistical Analysis

Statistical analysis and the generation of figures were performed using SPSS Statistics for Macintosh (Version 28.0; IBM) and Excel (Version 16.5; Microsoft). Binary logistic regression was used to compare dichotomous categorical variables. This included professional website, personal website, links to social media on personal website, ResearchGate account, LinkedIn account, active Twitter account, active Instagram account, active Facebook account, and active YouTube account. For this model, the absence of a professional website, personal website, links to social media on personal website, ResearchGate account, LinkedIn account, active Twitter account, active Instagram account, active Facebook account, and active YouTube account was indicated as the reference variable ("0" variable).

Negative binomial regression with a log link function was used to compare count variables. This included the number of years in practice, number of ResearchGate publications, and online presence score. This model was used because the variance was greater than the mean for these outcomes, indicating overdispersion of the data set for these 3 variables. The negative binomial regression models were used to generate an odds ratio (OR). An omnibus test was utilized to determine if the model created had an improved fit relative to the null model with no predictors. Univariate analysis was initially performed for all regression analyses. Variables demonstrating statistically significant predictivity in univariate regression models were incorporated into multivariate regression models. For all ORs, a 95% CI was calculated.

For independent variables with more than 2 subgroups (ie, region and years since residency/fellowship), the chi-square test was used to compare categorical variables. This included professional website, personal website, links to social media on personal website, ResearchGate account, LinkedIn account, active Twitter account, active Instagram

TABLE 1
Demographics of Members (n = 2870)

Variable	n (%)
Sex	
Male	2643 (92.1)
Female	227 (7.9)
Practice setting	
Private	2245 (78.2)
Academic	576 (20.1)
Military	49 (1.7)
Region	
Midwest	672 (23.4)
Northeast	634 (22.1)
South	952 (33.2)
West	612 (21.3)
Years in practice	
≤4	517 (18.0)
5-14	1136 (39.6)
15-24	699 (24.4)
≥25	518 (18.0)
Highest level of sports coverage	
Professional	1471 (51.3)
College	851 (29.7)
High school	324 (11.3)
Recreational/youth	79 (2.8)
Not listed	145 (5.1)

account, active Facebook account, and active YouTube account. For numerical variables, the Shapiro-Wilk test was performed to evaluate distribution, and no included numerical variables demonstrated a normal distribution. This was done for count data, which included the number of years in practice, number of ResearchGate publications, and online presence score. Thus, for independent variables with more than 2 subgroups, the Kruskal-Wallis test (ie, region and years since residency/fellowship) was utilized to compare numerical dependent variables, as these variables were not normally distributed. Additionally, a post hoc pairwise comparison was performed for all outcomes in which the Kruskal-Wallis test indicated a significant difference. For all tests, the threshold for significance was set at $P \leq .05$.

RESULTS

Demographics

A total of 3334 members were queried from the AOSSM database. Of these 3334 members, 2870 were orthopaedic sports medicine surgeons who currently practice within the United States. The demographics of these surgeons are presented in Table 1.

Utilization of Social Media Platforms

The distribution of sports medicine surgeons using each included online platform is summarized as pie charts. The presence and activity level of YouTube, Twitter, Instagram, and Facebook accounts as well as the presence of a

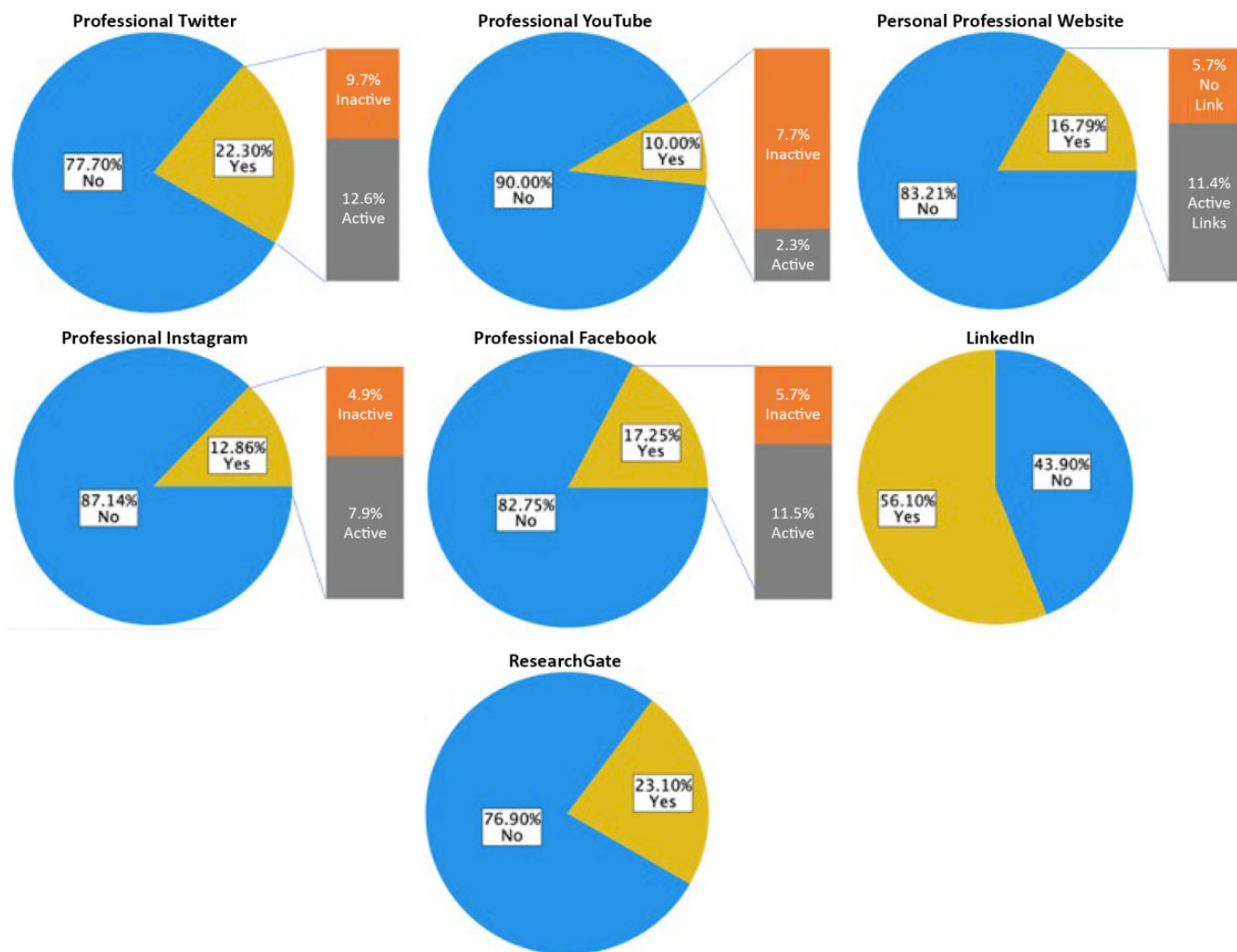


Figure 1. Pie chart distribution of sports medicine surgeons using each included online platform. For Twitter, YouTube, Instagram, and Facebook, an active account was defined as usage within the previous 6 months. Activity level was not defined for personal websites, practice group websites, LinkedIn, or ResearchGate, as these platforms are inherently less interactive and not focused on regular updates or postings.

professional website, LinkedIn account, and ResearchGate account are detailed in Figure 1.

Social Media Usage by Sex

Male surgeons were more likely to have a greater number of years in practice than their female counterparts (OR, 0.705 [95% CI, 0.636-0.782]). For a majority of the social media platforms (professional website, personal website, ResearchGate, LinkedIn), there was no significant relationship between sex and an active online presence. When comparing ResearchGate publications, male surgeons had a median of 28 publications compared to 21 by female surgeons, and sex was predictive of the number of ResearchGate publications (OR, 0.514 [95% CI, 0.367-0.718]). Male surgeons were more likely to actively use Twitter (OR, 1.444 [95% CI, 1.000-2.085]), Instagram (OR, 1.572 [95% CI, 1.019-2.423]), and Facebook (OR, 1.568 [95% CI, 1.080-2.276]).

The online presence score was not different between the 2 groups (Table 2).

There was a significant relationship between female surgeons and practice duration, with female surgeons typically more recently beginning practice than their male counterparts. Because practice duration and sex were 2 primary independent variables assessed in this study, we performed a subsequent multivariate analysis to determine if there was a confounding relationship between practice duration and sex with 4 of our primary outcome measures: active Twitter, active Instagram, active YouTube, and active Facebook accounts (Table 3). The results of this multivariate analysis determined that surgeons in the earlier stages of practice were more likely to have active Twitter (OR, 0.973 [95% CI, 0.962-0.985]), Instagram (OR, 0.946 [95% CI, 0.930-0.962]), and Facebook accounts (OR, 0.987 [95% CI, 0.975-0.999]). This analysis also determined that female surgeons were more likely to have an active Facebook

TABLE 2
Sex Distribution of Active Online Media Presence^a

Variable	Male Surgeons	Female Surgeons	OR (95% CI)	P Value
Years in practice, mean ± SD	14.9 ± 10.3	10.5 ± 8.3	0.705 (0.636-0.782)	<.001
Professional website	2538 (96.0)	214 (94.3)	0.681 (0.376-1.232)	.204
Personal website	444 (16.8)	38 (16.7)	0.996 (0.693-1.432)	.982
Links to social media on personal website	301 (11.4)	27 (11.9)	1.050 (0.691-1.598)	.818
ResearchGate account	603 (22.8)	60 (26.4)	1.215 (0.893-1.655)	.215
No. of publications on ResearchGate, median (range)	28 (0-69)	21 (0-167)	0.514 (0.367-0.718)	<.001
LinkedIn account	1480 (56.0)	130 (57.3)	1.053 (0.801-1.385)	.711
Twitter account	323 (12.2)	38 (16.7)	1.444 (1.000-2.085)	.050
Instagram account	201 (7.6)	26 (11.5)	1.572 (1.019-2.423)	.041
YouTube account	63 (2.4)	2 (0.9)	0.364 (0.088-1.497)	.161
Facebook account	292 (11.0)	37 (16.3)	1.568 (1.080-2.276)	.018
Online presence score, mean ± SD	2.98 ± 2.517	3.22 ± 2.651	1.079 (0.973-1.196)	.149

^aData are reported as n (%) unless otherwise indicated. Boldface P values indicate a statistically significant difference between groups ($P \leq .05$). OR, odds ratio.

TABLE 3
Relationship Between Sex/Years in Practice and Social Media Activity^a

Variable	Active Twitter	Active Instagram	Active YouTube	Active Facebook
Sex				
OR (95% CI)	1.298 (0.896-1.881)	1.294 (0.834-2.007)	0.331 (0.080-1.360)	1.484 (1.019-2.161)
P value	.168	.250	.127	.039
Years in practice				
OR (95% CI)	0.973 (0.962-0.985)	0.946 (0.930-0.962)	0.977 (0.951-1.003)	0.987 (0.975-0.999)
P value	<.001	<.001	.080	.029

^aBoldface P values indicate statistical significance ($P \leq .05$). OR, odds ratio.

account (OR, 1.484 [95% CI, 1.019-2.161]), but there was no relationship between sex and active Twitter, Instagram, or YouTube accounts.

Social Media Usage by Practice Type

By percentage, academic surgeons had a larger social media presence on nearly every platform except personal websites, Facebook, and YouTube. There was a significant association with practice type and activity on Twitter (OR, 3.134 [95% CI, 2.476-3.968]) and Instagram (OR, 1.456 [95% CI, 1.067-1.987]). Academic surgeons were also more likely to have a LinkedIn account (OR, 1.486 [95% CI, 1.230-1.795]), a ResearchGate profile (OR, 5.061 [95% CI, 4.151-6.170]), and a social media link on their personal website (OR, 1.355 [95% CI, 1.036-1.773]). Academic surgeons were more likely to have a larger number of publications on ResearchGate compared to private practice surgeons (OR, 1.757 [95% CI, 1.459-2.117]). There was no significant association between mean years in practice of academic and private practice surgeons. When calculating the overall online presence score, academic surgeons were more likely to have a higher overall online presence (OR, 1.175 [95% CI, 1.106-1.249]) (Table 4).

For both sex and practice type, univariate regression analysis demonstrated that there was a significant

predictive relationship with the number of publications on ResearchGate, an active Twitter account, and an active Instagram account. A subsequent multivariate regression analysis was then performed for the respective variables (Table 5). The results demonstrated that there was a significant predictive relationship between the number of ResearchGate publications and both male sex and academic practice type ($P < .001$ for both), an active Twitter account and academic practice type ($P < .001$), and an active Instagram account and academic practice type ($P = .029$). This subsequent multivariate analysis demonstrated no significant relationship between sex and an active Twitter account ($P = .283$) or an active Instagram account ($P = .062$).

Social Media Usage by Region of Practice

There was no significant difference in the presence of personal websites, links to social media on personal websites, active Instagram accounts, active YouTube accounts, or active Facebook accounts when stratified by region of practice. When examining years in practice, surgeons with an active online presence in the Northeast were in practice for more years compared to surgeons in other geographical regions ($P = .022$). Surgeons in the Midwest had a higher online presence on professional websites compared to those

TABLE 4
Practice Type Distribution of Active Online Media Presence^a

Variable	Academic Practice	Private Practice	OR (95% CI)	P Value
Years in practice, mean ± SD	14.08 ± 10.6	12.54 ± 10.3	0.949 (0.893-1.009)	.093
Professional website	572 (99.3)	2165 (96.4)	5.284 (1.928-14.485)	.001
Personal website	109 (18.9)	372 (16.6)	1.175 (0.928-1.488)	.181
Links to social media on personal website	82 (14.2)	245 (10.9)	1.355 (1.036-1.773)	.027
ResearchGate account	285 (49.5)	364 (16.2)	5.061 (4.151-6.170)	<.001
No. of publications on ResearchGate, median (range)	60.0 (0-528)	17.5 (0-699)	1.757 (1.459-2.117)	<.001
LinkedIn account	367 (63.7)	1216 (54.2)	1.486 (1.230-1.795)	<.001
Twitter account	143 (24.8)	214 (9.5)	3.134 (2.476-3.968)	<.001
Instagram account	60 (10.4)	166 (7.4)	1.456 (1.067-1.987)	.018
YouTube account	18 (3.1)	47 (2.1)	1.509 (0.869-1.009)	.093
Facebook account	72 (12.5)	256 (11.4)	1.110 (0.840-1.467)	.464
Online presence score, mean ± SD	3.77 ± 2.826	2.83 ± 2.421	1.175 (1.106-1.249)	<.001

^aData are reported as n (%) unless otherwise indicated. Boldface *P* values indicate a statistically significant difference between groups (*P* ≤ .05). OR, odds ratio.

TABLE 5
Relationship Between Number of Publications on ResearchGate/Social Media Activity and Sex/Practice Type^a

Variable	Sex	Practice Type
No. of publications on ResearchGate		
OR (95% CI)	0.421 (0.302-0.586)	2.065 (1.703-2.503)
<i>P</i> value	<.001	<.001
Active Twitter		
OR (95% CI)	1.230 (0.843-1.795)	3.095 (2.442-3.992)
<i>P</i> value	.283	<.001
Active Instagram		
OR (95% CI)	1.515 (0.979-2.345)	1.415 (1.035-1.935)
<i>P</i> value	.062	.029

^aBoldface *P* values indicate statistical significance (*P* ≤ .05). OR, odds ratio.

in the South and West regions, while there were no other significant differences between the groups (*P* = .015). Regarding ResearchGate accounts, surgeons in the Northeast had the highest percentage of ResearchGate accounts (*P* < .001), those in the West had a higher percentage of ResearchGate accounts than those in the South (*P* = .028), and no other significant differences existed between the groups. For ResearchGate publications, surgeons in the Northeast had a significantly higher median number of publications compared to those in all other groups (*P* < .001), and there were no other differences observed between the 3 remaining regions. For LinkedIn, surgeons in the Northeast had a significantly higher percentage of accounts compared to those in other regions (*P* < .001). Surgeons in the Midwest (*P* = .004) and Northeast (*P* = .016) each had a significantly higher active presence on Twitter relative to surgeons in the West, but no other differences were found among the remaining regions. Lastly, when examining the overall online social media presence, surgeons in the Northeast had a significantly higher online presence score relative to those in all other groups (*P* = .017) (Table 6).

Social Media Usage by Years of Practice

There were no significant differences in the use of professional websites, personal websites, LinkedIn accounts, active YouTube accounts, or active Facebook accounts between surgeons at any experience level. There was a significant difference between the percentage of surgeons who had links to social media on their personal website among the groups (*P* = .015). Group 2 had a significantly higher percentage of links present compared to group 3 (*P* = .045) and group 4 (*P* = .003). When examining ResearchGate accounts, group 1 had a significantly higher percentage of surgeons with accounts compared to all other groups (*P* < .001), and group 2 had a significantly higher percentage of surgeons with accounts compared to group 3 (*P* = .018). Regarding ResearchGate publications, there was a statistically significant difference in the median number of publications between each group (*P* < .001). For each experience-level group, more senior surgeons had a significantly larger median number of publications than less experienced groups, and less experienced surgeons had a significantly smaller number of publications than the more senior groups. For Twitter, group 4 had a significantly lower percentage of active users relative to all other groups (*P* < .001), and group 2 had a significantly higher percentage of active users than group 3 (*P* = .016). Group 1 had a significantly higher percentage of active Instagram users than all other groups (*P* < .001), and group 2 had a significantly higher percentage of active Instagram users than group 3 (*P* < .001) and group 4 (*P* < .001). Regarding the overall online presence score, groups 1 and 2 had significantly higher online presence scores than groups 3 and 4 (*P* < .001). There was no difference between groups 1 and 2 or between groups 3 and 4 (Table 7).

DISCUSSION

As the use of social media continues to grow among the United States public, it is important to understand the current trends of social media usage within different

TABLE 6
Regional Distribution of Active Online Media Presence^a

Variable	Midwest	Northeast	South	West	P Value
Years in practice, mean ± SD	12.70 ± 11.14	14.24 ± 10.73	12.70 ± 9.77	12.74 ± 10.04	.022
Professional website	657 (97.8)	611 (96.3)	902 (94.7)	582 (95.1)	.015
Personal website	100 (14.9)	109 (17.2)	151 (15.9)	122 (19.9)	.081
Links to social media on personal website	68 (10.1)	78 (12.3)	102 (10.7)	80 (13.1)	.292
ResearchGate account	154 (22.9)	180 (28.4)	183 (19.2)	146 (23.4)	<.001
No. of publications on ResearchGate, median (range)	24.0 (0-685)	40.0 (0-699)	21.5 (0-401)	25.0 (0-574)	<.001
LinkedIn account	380 (56.5)	397 (62.6)	499 (52.4)	334 (54.5)	<.001
Twitter account	100 (14.9)	89 (14.0)	113 (11.9)	59 (9.6)	.021
Instagram account	46 (6.8)	58 (9.1)	79 (8.3)	49 (7.2)	.390
YouTube account	17 (2.5)	16 (2.5)	17 (1.8)	15 (2.5)	.685
Facebook account	73 (10.9)	69 (10.9)	113 (12.0)	74 (12.1)	.839
Online presence score, mean ± SD	2.96 ± 2.539	3.19 ± 2.574	2.90 ± 2.418	2.98 ± 2.628	.017

^aData are reported as n (%) unless otherwise indicated. Boldface P values indicate a statistically significant difference between groups ($P \leq .05$).

TABLE 7
Practice Duration Distribution of Active Online Media Presence^a

Variable	Group 1 (≤ 4 y)	Group 2 (5-14 y)	Group 3 (15-24 y)	Group 4 (≥ 25 y)	P Value
Professional website	495 (95.7)	1088 (95.8)	674 (96.4)	495 (95.6)	.870
Personal website	77 (14.9)	207 (18.2)	115 (16.5)	83 (16.0)	.352
Links to social media on personal website	60 (11.6)	153 (13.5)	72 (10.3)	43 (8.3)	.015
ResearchGate account	165 (31.9)	261 (23.0)	128 (18.3)	109 (21.0)	<.001
No. of publications on ResearchGate, median (range)	16.0 (0-508)	24.0 (0-574)	41.5 (0-471)	61.0 (0-699)	<.001
LinkedIn account	298 (57.6)	647 (57.0)	393 (56.2)	272 (52.5)	.315
Twitter account	74 (14.3)	172 (15.1)	78 (11.1)	37 (7.1)	<.001
Instagram account	79 (15.3)	93 (8.2)	35 (5.0)	20 (3.9)	<.001
YouTube account	13 (2.5)	30 (2.6)	15 (2.1)	7 (1.4)	.426
Facebook account	61 (11.8)	148 (13.0)	75 (10.7)	45 (8.7)	.071
Online presence score, mean ± SD	3.22 ± 2.654	3.20 ± 2.702	2.82 ± 2.426	2.59 ± 2.029	<.001

^aData are reported as n (%) unless otherwise indicated. Boldface P values indicate a statistically significant difference between groups ($P \leq .05$).

subspecialties of medicine and surgery.¹⁶ The aim of our study was to utilize the AOSSM database to explore the scope of the online social media presence of sports medicine surgeons currently practicing in the United States as well as evaluate differences that may exist between subgroups. In this study, we found LinkedIn to be the most commonly used platform (56.1%), and female surgeons were more likely to have an active online presence than male surgeons for Twitter, Instagram, and Facebook. Yet, there was no significant difference in the overall online presence when stratified by sex. Academic surgeons were found more likely to have an online social media presence than their private practice counterparts, while surgeons practicing in the Northeast had a significantly greater social media presence than those in any other region. Sports medicine surgeons in the early stages of practice (0-14 years of practice) were more likely to utilize social media than their more senior colleagues (≥ 15 years of practice). On multivariate analysis, surgeons in the earlier stages of practice were more likely to have active Twitter, Instagram, and Facebook accounts, and female surgeons were more likely to have an active Facebook account. Additionally,

multivariate analysis revealed that a greater number of ResearchGate publications were associated with male sex and being in academic practice. Comparatively, active Twitter and Instagram use was associated with being in academic practice.

Consistent with prior studies on social media usage, LinkedIn was the most frequently reported social media platform utilized, with 56.1% of the sports medicine surgeons included in our study having a LinkedIn account. Bernstein et al³ performed a similar analysis of CSRS members and found that 56% of surgeons had a LinkedIn account, while Narain et al¹⁴ similarly reported that 61% of shoulder and elbow surgeons had a LinkedIn account. Lander et al¹² reported a slightly lower presence on LinkedIn (36.8%) among fellowship-trained pediatric orthopaedic surgeons; however, LinkedIn was still the most popular platform reported after professional webpages. In our study, the overall popularity of LinkedIn may be explained in part by the “resume” content of the platform, which resonates with a very broad population and facilitates more direct communication and connections with employees across different industries.¹⁰ By nature of being

a network based on employment, LinkedIn provides surgeons with an opportunity to share details about their education, previous jobs, and other credentials. There are also opportunities on LinkedIn for private niche groups such as an orthopaedic surgery group that may resonate with surgeons.¹⁰ LinkedIn is also a relatively static platform that does not require active content creation once the details of a resume are uploaded onto the platform. Contrarily, the unpopularity of YouTube accounts among orthopaedic sports medicine surgeons might be attributed to the time and effort required to produce educational and marketing material, as YouTube is a platform dedicated to video-based multimedia. Further, although data in the literature are limited on the subject, YouTube may not appeal or be as effective in relaying information to the demographic of patients commonly treated by sports medicine physicians. For example, in the Lander et al¹² study, 33% of pediatric orthopaedic surgeons produced at least 1 YouTube video related to their practice. It was noted that the prevalence on this platform among pediatric surgeons was because of some practices requiring physicians to develop content geared to expand their online presence and supplement health care knowledge from initiatives tailored to pediatric patients and their families.¹²

In this study, despite no significant association in the overall online presence score between sexes, female surgeons had a significantly higher likelihood of having active Twitter, Facebook, and Instagram accounts. A potential reason for this may be that female surgeons in our study reported, on average, a significantly fewer number of years in practice than male surgeons (10.5 vs 14.9 years, respectively; $P < .001$). Further analysis of our data demonstrated that those with 0 to 14 years of practice had a significantly higher overall online presence score than those with ≥ 15 years of practice. Female physicians have been historically underrepresented within the field of orthopaedics and sports medicine as a whole.¹⁵ As evidenced by the greater percentage of analyzed female surgeons in the early stages of their career, there is an ongoing shift in orthopaedics, transitioning from a traditionally male-dominated field. This study provides a reference point for assessing changes as more women enter the field and increase their usage of more accessible social media platforms such as Twitter, Facebook, and Instagram to market their respective practices.

Orthopaedic sports medicine surgeons who practiced in an academic setting were more likely to have a higher overall online presence score than those in private practice (OR, 1.175 [95% CI, 1.106-1.249]). Because a large part of academic practices is often dedicated to research endeavors and scientific advancement, these results highlight the potential benefit of higher social media usage and its ability for surgeons to share medical knowledge, ideas, and techniques with colleagues.² Social media also provides direct and cost-effective avenues to educate patients and the public. However, these differences in the social media presence between academic and private practice surgeons were not observed in the previous literature on CSRS members or shoulder and elbow surgeons.^{3,14}

When comparing different regions of the United States, we found a statistically significant greater online presence score for the Northeast compared to the other regions. The Northeast had the fewest number of states than any other region, but the number of surgeons was comparable to other regions. Chan et al⁴ evaluated 466 unique job listings posted on 9 orthopaedic career center databases in 2019, of which 352 listings were for fellowship-trained surgeons. They found that the Northeast had the smallest available number of fellowship job positions regardless of subspecialty (21%), while a greater number of fellowship-trained jobs were in urban settings (65%). When the authors adjusted for the workforce size of each orthopaedic specialty based on the number of fellowship positions filled, they found that the subspecialty with the largest number of fellows per job listing was sports medicine (number of available jobs = 6.3), followed by shoulder and elbow (number of available jobs = 5.8). This study highlights the extent of competition that exists and speaks to the saturation of the job market for orthopaedic sports medicine surgeons in the Northeast region of the United States. Consequently, there exists competition among these surgeons in many different domains, including patient recruitment, job openings, and academic advancement. A larger social media presence may offer an advantage for surgeons practicing in this arena to effectively promote themselves in a competitive market, and thus, some surgeons may feel that it is worthwhile to invest time and energy on these platforms to remain competitive. A study examining 102 sports medicine surgeons by Sama et al¹⁸ demonstrated the effectiveness of an increased social media presence on higher overall physician ratings on Google, Healthgrades, and Vitals. It is believed that an increased social media presence provides surgeons with an opportunity to shape their own image and acquire new patients. This notion was supported by a retrospective study that showed that a single positive online review increased the case volume of cosmetic clinics by 30%.¹⁹

Social media presence was also assessed through the number of years in practice, and we found a significantly higher online presence score among sports medicine surgeons with less than 15 years of practice compared to more senior surgeons. Aside from early-career surgeons overall being more comfortable with these platforms as a result of the recent advent of social media, establishing a practice early in one's career is a universal challenge regardless of an academic, private, or hospital-employed setting. Administrative fees, staff salaries, and overhead are all costs associated with starting a practice, and a steady volume of patients is required to maintain these expenses.^{7,13} However, surgeons early in their career are often faced with competition from more experienced and distinguished senior surgeons who have already established a patient population, reputation in the community, and referral relationships with colleagues. Early-career surgeons who are potentially seeing fewer patients may also have more time to devote to building their social media presence. A recent survey by the Pew Research Center reported that 80% of internet users (93 million Americans) had recently searched for a health-related topic online.¹⁶ A social media

presence may provide less experienced surgeons with a medium to engage patients and demonstrate the skill set and services that they are able to provide.^{5,11} Furthermore, social media platforms by the nature of design, including word limits and the integration of images, increase readability and as a result can target a larger audience.

Limitations

This study is not without limitations. The inherent nature of this cross-sectional study design precludes any ability to determine causality. There is also the potential that social media profiles for surgeons were created after our data collection time frame and were excluded from our analysis. Using ResearchGate as a proxy for academic research productivity also has its flaws because the list of citations does not always accurately reflect the entirety of a physician's academic productivity. Further, several limitations are inherent to the AOSSM database. The highest level of sports event coverage based on information reported in a given surgeon's AOSSM profile may not accurately reflect the frequency that surgeons interact with certain athletic levels, especially professional sports. Furthermore, we categorically labeled each surgeon as either in private or academic practice, which does not encompass a large number of surgeons who practice in a hybrid model such as "privademic" practice. We also did not dissect differences in the variety of private practice models such as hospital employment, sole practitioner, or group practice as it relates to social media presence. In regard to LinkedIn and ResearchGate, we did not track the activity level of these platforms to mimic the previously described study by Narain et al,¹⁴ which may have provided information on the full utility of these platforms for sports medicine surgeons. Data collection for this study occurred during the middle of the COVID pandemic, and thus, our snapshot of social media activity may have varied in comparison to before the pandemic's onset. Moreover, it is possible that professional social media platforms with private settings were not accounted for during the current study. There is also a possibility that surgeons in large group practices had the added benefit of more resources available for social media investment, which was not able to be accounted for in the current study. Another limitation to the current study is that we focused on the quantity of publications as a proxy for surgeon academic productivity rather than assessing a ResearchGate index. Although indices may provide more insight into surgeon productivity, we wanted to focus on this platform through the lens of a patient who may not have a concrete understanding of the utility of these scoring systems and research productivity.¹ Lastly, we are unable to make concrete claims on the success or advantages of an increased social media presence on productivity, operative volume, or quality metrics, as this is outside the scope of our investigation to characterize and identify trends in usage. Future research on the impact of social media on the surgeon-patient relationship would be beneficial to better evaluate any link between online presence scores and patient recruitment, patient satisfaction, volume of patients, physician accolades, and physician

health grades and reviews and allow an overall assessment of the effect on the daily operations of their practice.

CONCLUSION

Although the effects of social media usage on practice patterns, patient outcomes, and surgical volume are unknown, the most used platform from this surgeon population was LinkedIn. Orthopaedic surgeons in academic practice, female surgeons, those early in their career, and those practicing in the Northeast highlight a subset of the sports medicine community who were more likely to have an active online presence compared to the rest of the AOSSM. On multivariate analysis, surgeons in the earlier stages of practice were more likely to have active Twitter, Instagram, and Facebook accounts, and female surgeons were more likely to have an active Facebook account. Additionally, multivariate analysis revealed that a greater number of ResearchGate publications were associated with male sex and being in academic practice. Comparatively, active Twitter and Instagram use was associated with being in academic practice.

REFERENCES

1. Abghari MS, Takemoto R, Sadiq A, et al. Patient perceptions and preferences when choosing an orthopaedic surgeon. *Iowa Orthop J*. 2014;34:204-208.
2. Antheunis ML, Tates K, Nieboer TE. Patients' and health professionals' use of social media in health care: motives, barriers and expectations. *Patient Educ Couns*. 2013;92(3):426-431.
3. Bernstein DN, Melone G, Jubril A, Zhang J, Mesfin A. Evaluating social media use among active American members of the Cervical Spine Research Society. *Clin Spine Surg*. 2021;34(6):E337-E341.
4. Chan JY, Charlton TP, Thordarson DB. Analysis of orthopaedic job availability in the United States based on subspecialty. *J Am Acad Orthop Surg Glob Res Rev*. 2020;4(11): e20.
5. Damodar D, Donnally CJ 3rd, McCormick JR, et al. How wait-times, social media, and surgeon demographics influence online reviews on leading review websites for joint replacement surgeons. *J Clin Orthop Trauma*. 2019;10(4):761-767.
6. Earp BE, Kuo K, Shoji MK, et al. Evaluating the online presence of orthopaedic surgeons. *J Am Acad Orthop Surg*. 2020;28(2):e86-e91.
7. Edlow RC. Practice consolidation: forces not of nature, but of government, demographics, economics, and technology. *J Med Pract Manag*. 2016;31(5):313-316.
8. Grandizio LC, Pavis EJ, Caselli ME, et al. Technology, social media, and telemedicine utilization for rural hand and upper-extremity patients. *J Hand Surg Am*. 2021;46(4):301-308.e1.
9. Haeberle HS, Bartschat NI, Navarro SM, et al. Hip arthroscopy: a social media analysis of patient perception. *Orthop J Sports Med*. 2019;7(6):2325967119854188.
10. Jildeh TR, Okoroafor KR, Guthrie ST, Parsons TW 3rd. Social media use for orthopaedic surgeons. *JBJs Rev*. 2019;7(3):e7.
11. Kouten J. In healthcare public relations, start with the patient. JFK Communications. Accessed August 25, 2021. Available at: <https://www.jfkhealth.com/blog/in-healthcare-public-relations-start-with-the-patient>.
12. Lander ST, Sanders JO, Cook PC, O'Malley NT. Social media in pediatric orthopaedics. *J Pediatr Orthop*. 2017;37(7):e436-e439.
13. McClelland WB Jr, McCollam SM. Impact of the current United States health care environment on practice: a private practice viewpoint. *Hand Clin*. 2020;36(2):155-163.

14. Narain AS, Dhayalan A, Weinberg M, et al. Social media utilization among shoulder and elbow surgeons. *J Am Acad Orthop Surg.* 2021;29(3):123-130.
15. O'Reilly OC, Day MA, Cates WT, Baron J, Westermann RW. The gender divide: are female team physicians adequately represented in professional and collegiate athletics? *Orthop J Sports Med.* 2019; 7(7)(suppl 5):2325967119S00402.
16. Pew Research Center. Social media fact sheet. Available at: <https://www.pewresearch.org/internet/fact-sheet/social-media/>.
17. Ramkumar PN, La T Jr, Fisch E, et al. Integrating social media and anterior cruciate ligament surgery: an analysis of patient, surgeon, and hospital use. *Arthroscopy.* 2017;33(3):579-585.
18. Sama AJ, Matchak DP, Schiller NC, et al. The impact of social media presence, age, and patient reported wait times on physician review websites for sports medicine surgeons. *J Clin Orthop Trauma.* 2021;21:101502.
19. Sanati-Mehrziy P, Margulies IG, Sayegh F, Ingargiola MJ, Taub PJ. The "RealSelf effect": can patient reviews on social media impact clinic volume? *Ann Plast Surg.* 2020;85(4):352-357.