

Research Article

Assessing the Current State of Twitter Usage by Spine Surgeons in the United States

Nicholas Lanzetta, BS^{1a}, Alexander Linton^{2b}, Andrew Furman, MD, MBA^{1c}, Wellington Hsu, MD^{1d}

¹ Department of Orthopaedic Surgery, Northwestern University Feinberg School of Medicine, ² Rutgers New Jersey Medical School

Keywords: Twitter, Networking, Social Media

<https://doi.org/10.60118/001c.38111>

Journal of Orthopaedic Experience & Innovation

Vol. 3, Issue 2, 2022

Background

Twitter, one of the most widely used social media platforms, allows users to post short statements, media, and weblinks available for viewing and interaction. This study sought to characterize the way in which spine surgeons leverage Twitter as a professional tool and additionally, the extent to which the platform may be currently under-utilized.

Methods

A list of neurosurgical and orthopaedic spine surgeons was randomized and the first 500 individuals from each group were searched for on Twitter. For surgeons without accounts, it was recorded if they were mentioned in others' tweets. Independent T-tests were performed for comparing quantitative variables between the two groups (tweets, number of followers, etc.) as well as comparing age with presence of account.

Results

Of all spine surgeons, 17% had accounts, 49% had no account but were mentioned, and 34% had no account but were not mentioned. There were no differences in twitter usage between genders, geographic region, nor neurosurgical and orthopaedic spine surgeons. The average age of those with and without an account was 51 and 55, respectively ($p=.0004$). While 22% of surgeons aged 50 and younger had accounts, only 14% of surgeons over 50 had accounts ($p=.003$).

Conclusions

In addition to younger surgeons being more likely to have an account, this study found a large discordance between the proportion of spine surgeons who actively engage on Twitter and those that are discussed on the platform by others.

a Nicholas Lanzetta is a fourth-year medical student at Northwestern University Feinberg School of Medicine applying to residency in Orthopaedic Surgery.

[Conflicts of Interest Statement for Mr. Lanzetta](#)

b Alexander Linton is a 4th year medical student at Rutgers New Jersey Medical School.

[Conflicts of Interest Statement for Alexander Linton](#)

c Dr. Furman is an Orthopaedic Surgery resident at Northwestern.

[Conflicts of Interest Statement for Dr. Furman](#)

d Wellington K. Hsu, MD currently serves with distinction as the Clifford C. Raisbeck, MD, Professor of Orthopaedic Surgery at the Northwestern Feinberg School of Medicine. In addition, Dr. Hsu serves as Director of Research for the Musculoskeletal Institute at Northwestern Medicine and also holds a faculty appointment in the Department of Neurological Surgery.

[Visit Dr. Hsu's Website](#)

[Visit the Open Payments Data Page for Dr. Hsu](#)

[Conflicts of Interest Statement for Dr. Hsu](#)

INTRODUCTION

Social media has proved to be a prominent information-sharing tool both in the United States and worldwide. Over the past 16 years, the percentage of US adults using at least one form of social media has increased rapidly from 5% to 72% (Pew Research Center 2021). Twitter, one of the most widely used platforms, allows users to post short statements, media, and weblinks available for viewing and interaction which are freely distributed regardless of the scope of influence the user or information may have. Conversation and connectivity are enhanced on the platform through the “hashtag” feature which organizes posts, also known as “tweets,” containing the same keywords. Physicians have recently begun to recognize the potential that social media platforms such as Twitter have for communicating with fellow medical professionals and community members including patients, of whom 80% use such modalities to obtain medical information (Saleh et al. 2012). When patients do search for health information on Twitter, the accounts of physicians are sought even more frequently than accounts of governmental agencies or health institutions (Alassiri and Alowfi 2019). Further, the platform has revealed itself as a powerful tool in the dissemination of scholarly work with scholarly journals creating their own accounts and positive correlations observed between academic citations and twitter mentions (Hughes, Hughes, and Murphy 2017; Zhang and Earp 2020; Evaniew et al. 2017; Kunze et al. 2020).

Despite the proliferation of social media, the digital footprint of physicians including spine surgeons remains unclear. Beyond their potential presence, it is unknown how often they tweet, how long they have been active on the platform, and how they might interact with other users. Factors such as age, geographic region, gender, and training in neurosurgery vs. orthopaedics have also not been studied in their relation to Twitter activity. As it is known that patients use Twitter to discuss medical information and treatment, it is curiously unclear how often spine surgeons are mentioned by other users on the platform (Saleh et al. 2012). Should these questions reveal that spine surgeons have a low activity on the site, especially in contrast with their potential patients, it may lead them to taking fuller advantage of Twitter resulting in better patient communication, increased promulgation of research advancements, and more efficient building of a professional profile.

Proper utilization of Twitter necessitates a presence on the site sufficient to match the general population that may be attempting to engage with them. Under this premise, we hypothesized that spine surgeons do not sufficiently utilize the platform, and specifically, predicted that they are more likely to be mentioned by other users than to have accounts themselves. In this case, spine surgeons would be unable to interact with those attempting to engage with them. We also postulated that similar to the dynamic of the general population, younger surgeons would be more likely to be on the platform than older surgeons (Wojcik and Hughes 2019). In addition to answering these questions, we sought to objectively characterize the way in which these physicians utilize

Twitter as a professional tool by associating usage (number of tweets, accounts followed, etc.) with type of training (neurosurgical versus orthopaedic). Presence on Twitter was further analyzed by geographic regions and genders. We rounded out our study by documenting the most common hashtags used and the percentage of all tweets posted by the most prolific users. We believe that these data may lead to changes in behavior amongst spine surgeons to increase the size of their digital footprint (Donnally et al. 2020; Bernstein et al. 2021).

METHODS

As all information was publicly available, this study did not necessitate approval from an institutional review board (IRB). This was a cross-sectional study examining Twitter use as of August 2021. The name, gender, medical school graduation year, and current geographic location of spine surgeons (SS) in the United States were compiled from the National Downloadable File spreadsheet found on the Centers for Medicare and Medicaid Services website at [CMS.gov](https://www.cms.gov) (The Centers for Medicare and Medicaid Services 2021). Spine-fellowship trained surgeons were then identified through cross-referencing with the American Association of Neurological Surgeons (AANS) and American Academy of Orthopaedic Surgeons (AAOS) search tools to be categorized into neurological and orthopaedic spine surgeons (NSS and OSS, respectively) with 942 NSS and 1,395 OSS identified. Both groups were randomized on Microsoft Excel by attaching a randomly generated number to each physician via the RAND function. The groups were then ordered numerically by the randomly assigned number and the first 500 physicians were selected as samples for both NSS and OSS. Estimated current age was calculated by utilizing the published graduation year from medical school and assuming age at graduation was 26 years old.

Searches were completed on Twitter’s website using computers with cleared cache and search history. The presence of a SS on Twitter was checked via Twitter’s “people” category, searching the surgeon’s first and last name along with the terms “MD”, “Dr.” and “spine”. The first 30 profiles were considered for each individual search. Data collected for each SS included presence of a Twitter account, and if so, account name, date joined, number of followers, accounts following, tweets, tweets with media, likes, and whether the individual identified as a physician in their account name or bio. A followers-to-following ratio was calculated for each account after excluding SS following 0 accounts (which would create an infinite ratio). Accounts were also checked for “verified status” which is a designation given to well-known users after undergoing an authentication process and is marked by a blue check mark next to the account’s name. A third-party analytics site, foller.me, was then used to obtain the most common hashtags posted by NSS and OSS with accounts (Foller.me 2021). For all SS without accounts, the same search process was repeated using Twitter’s “top” and “latest” search categories to document the first 30 appearing tweets. These searches thus revealed not profiles, but tweets from any public user men-



©2022 Pacira Pharmaceuticals, Inc., a wholly owned subsidiary of Pacira Biosciences, Inc. All rights reserved. PP-NP-US-1328 05/22

*Advertisement

[Click here to learn more about Pacira](#)

tioning the SS by name. It was then recorded if a SS's name was mentioned in others' tweets at least once during those searches.

STATISTICAL METHODS

All statistics were performed using Statistical Package for the Social Sciences (SPSS) version 23 (IBM, Corp., Armonk, New York, USA). Independent T-tests were performed for comparing age with presence of an account and comparing quantitative variables between NSS and OSS such as age, year joined, number of followers, accounts followed, tweets, tweets with media, likes, and followers to following ratio. Chi-square tests were performed for comparing OSS and NSS by proportions of account holders, identification as a physician in bio or account name, and mention on the site despite not having an account as well as determining association between gender and account presence. Finally, a multivariable logistic regression analysis was performed to determine if there were differences in proportion of SS with accounts between different geographic regions of the US.

RESULTS

A database of 1000 spinal surgeons, 500 NSS and 500 OSS, was compiled. The average age in years was 56 for all NSS and 53 for all OSS ($p < 0.001$). Of all SS, 97% (970/1000) were male and 3% (30/1000) were female. Within the samples of NSS and OSS, 4% (20/500) and 2% (10/500) of surgeons were females, respectively. SS were found to be spread throughout the United States with Northeast claiming the highest proportion of those sampled at 23.8% (238/1000) and the noncontinental United States claiming the lowest proportion at 0.8% (8/1000) (Table 1).

Of all spine surgeons, 17.5% (175/1000) had accounts, 48.8% (488/1000) had no account but were mentioned, and 33.7% (337/1000) had no account and were not mentioned (Figure 1). For all spine surgeons, the average age of those

with and without an account was 51 and 55 years, respectively ($p = 0.0004$) (Table 2). While 22% (85/386) of surgeons aged 50 years and younger had accounts, only 14% (90/614) of surgeons over 50 had accounts ($p = 0.003$).

17% (85/500) of NSS and 18% (90/500) of OSS had Twitter accounts ($p = 0.677$). 46.4% (232/500) and 51.2% (256/500) of NSS and OSS, respectively, did not have accounts and were mentioned at least once by other users on Twitter ($p = 0.129$). 36.6% (183/500) and 30.8% (154/500) of NSS and OSS, respectively, did not have accounts and were not mentioned at least once by other users on Twitter ($p = 0.129$). Neurosurgeons, on average, joined Twitter in 2014, followed 211 accounts, had 241 followers, 411 tweets, 43 tweets with media, 464 likes, and a followers-to-following ratio of 1.64. Orthopaedic spine surgeons, on average, joined in 2014, followed 186 accounts, had 284 followers, 340 tweets, 48 tweets with media, 150 likes, and a followers-to-following ratio of 1.29, which were not significantly different from neurosurgeons. No accounts were verified in either group. The proportion of accounts with physician identifiers was 84.7% (72/85) for NSS and 93.3% (84/90) for OSS ($p = 0.067$) (Table 3).

No significant differences were found in the proportion of SS with accounts in different geographic regions of the country (Figure 2). 26.7% (8/30) of female SS had accounts compared to 17.2% (167/970) of male SS ($p = 0.180$) (Table 4). "Spine" and "neurosurgery" were tied for the most common hashtag used by NSS, followed by "brain", "back pain", and "covid19". "Spine" was the most common hashtag used by OSS, followed by "back pain", "scoliosis", and "surgery". The top 10 most prolific OSS and NSS accounts accounted for 88.8% (27,244/30,680) and 82.3% (28,773/34,961), respectively, of total tweets among accounts sampled within each specialty.

BE A PART OF BETTER ORTHOPAEDIC CARE.
CLICK HERE TO LEARN HOW.

THE ORTHOPAEDIC IMPLANT COMPANY



*Advertisement

[Click here to learn more about The Orthopaedic Implant Company](#)

	OSS	NSS	SS
Age (Years)	53.4*	55.7*	54.6
Gender (Male)	490 (98%)	480 (96%)	970 (97%)
(Female)	10 (2%)	20 (4%)	30 (3%)
Region 1 (Noncontinental)	4 (0.8%)	4 (0.8%)	8 (0.8%)
2 (Northeast)	126 (25.2%)	112 (22.4%)	238 (23.8%)
3 (South)	106 (21.2%)	120 (24%)	226 (22.6%)
4 (Midwest)	109 (21.8%)	108 (21.6%)	217 (21.7%)
5 (Mountain)	21 (4.2%)	23 (4.6%)	44 (4.4%)
6 (Southwest)	57 (11.4%)	72 (14.4%)	129 (12.9%)
7 (West)	77 (15.4%)	61 (12.2%)	138 (13.8%)

Table 1. Demographic features of OSS, NSS, and all SS.

NSS were found to be significantly older than OSS (* $p < 0.001$). (OSS=orthopaedic spinal surgeons, NSS=neurosurgical spinal surgeons, SS=spinal surgeons)

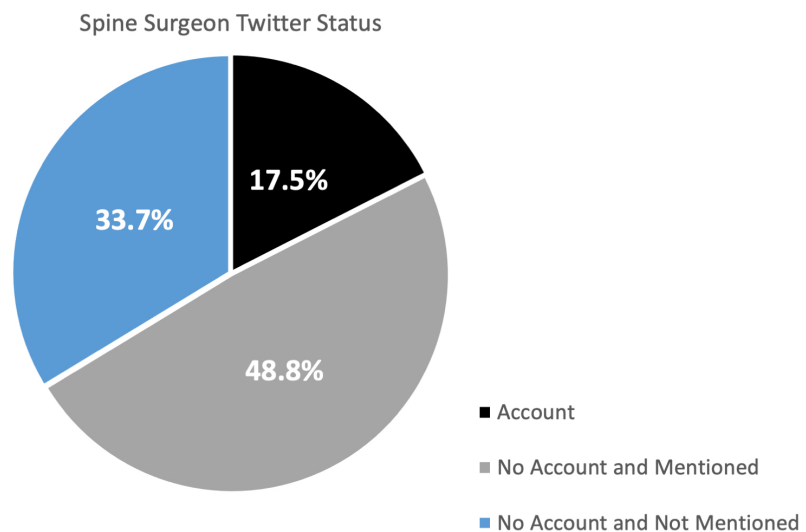


Figure 1. Percentage of spine surgeons with a Twitter account, without an account but mentioned by others on the platform, and without an account and not mentioned by others on the platform.

DISCUSSION

In conjunction with perfecting their clinical expertise, surgeons often have many related career goals. These include conducting and disseminating impactful research, networking professionally, building recognition within their field and the general community, mentoring, curbing misinformation, and educating others. In today's environment, rapidly changing in part due to the growth of the Internet, it is critical for surgeons to be adaptable in the ways they

pursue their objectives. Social media, including Twitter, offers a free and convenient way to reach patients, colleagues, and the public community in a place they already frequently visit. It has thus become a novel and powerful resource for surgeons to achieve each of these aforementioned goals.

The data from our study suggest our hypothesis is correct and that spine surgeons are grossly underutilizing major social media platform technologies such as Twitter. We found that only 17.5% (175/1000) of SS have registered

	With Account Age (Years)	Without Account Age (Years)	p-value
SS	51.9	55.1	0.0004
OSS	51.3	53.8	0.031
NSS	52.5	56.4	0.006

Table 2. Comparisons of ages between those with and without Twitter accounts subdivided by OSS, NSS, and all SS.

Within each group, those without accounts were significantly older than those with accounts. (OSS=orthopaedic spinal surgeons, NSS=neurosurgical spinal surgeons, SS=spinal surgeons)

	OSS	NSS	p-value	SS
Percent with Account	18%	17%	0.677	17.5%
Percent with Physician Identifier	93.3%	84.7%	0.067	89%
Year Joined	2014	2014	0.552	2014
Tweets	341	411	0.691	376
Tweets with Media	48	44	0.838	46
Likes	151	464	0.792	307.5
Followers	285	241	0.777	263
Following	187	211	0.759	199
Percent Without Account Mentioned	51.2%	46.4%	0.129	48.8%
Percent Without Account Not Mentioned	30.8%	36.6%	0.129	33.7%

Table 3. Percentages of OSS, NSS, and SS with accounts, without accounts but mentioned by others on the platform, and without accounts and not mentioned by others.

For those with accounts, twitter usage is characterized with p values for comparisons between OSS and NSS. (OSS=orthopaedic spinal surgeons, NSS=neurosurgical spinal surgeons, SS=spinal surgeons)

Twitter accounts, which has been supported by other published studies (Donnelly et al. 2020; Bernstein et al. 2021). Since its founding in 2006, Twitter has grown to include 397 million users in 2021 and has been on pace to grow by 11% each year (Dean 2021). It is for this reason thousands of medical professionals and health care organizations like the Center for Disease Control, which boasts 4.3 million followers, have joined the platform over this time (Centers for Disease Control and Prevention 2021). It is also for this reason that many patients are discussing spine surgeons on Twitter. The data from our study demonstrate that spine surgeons are more likely to be mentioned on Twitter by others than they are to have an account themselves.

For the spine surgeons who do not have an account, more than half were mentioned on Twitter, often by a healthcare organization, medical conference, patient, or colleague. This represents “missed opportunities” to connect with medical professionals, patients, and the general

community who have interest in them. While other entities such as medical journals have elevated their presence on social media as its influence has risen, SS have been slow to do the same. In fact, orthopaedic journals may be more than four times as likely to have a Twitter account than SS themselves (Hughes, Hughes, and Murphy 2017). Finally, the proportion of these surgeons actively engaging on Twitter in a meaningful way is likely to be overestimated by our methods as many users had accounts and thus were counted, but showed extremely low usage. This wide range in activity is underscored by our finding that the 10 most prolific OSS and NSS users accounted for 88.8% (27,244/30,680) and 82.3% (28,773/34,961), respectively, of total tweets among accounts sampled in each specialty.

Not surprisingly, our data show that younger age is associated with increased likelihood of having a Twitter account. In fact, those aged 50 or younger were 50% more likely to have an account compared to those over age 50,

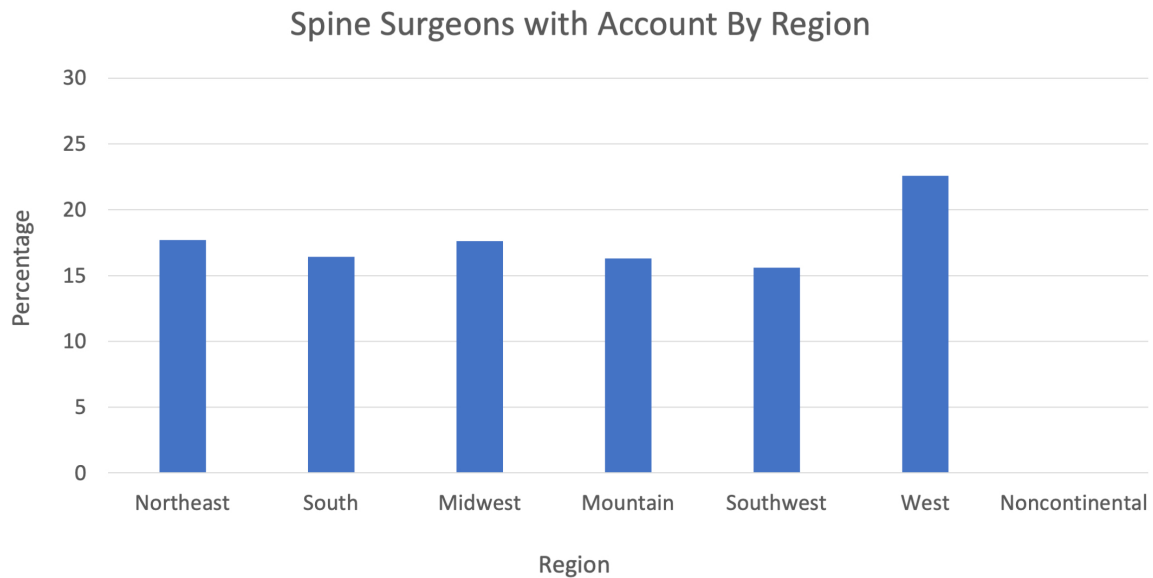


Figure 2. Percentage of spine surgeons with a Twitter account by geographic region.

No significant differences in account presence were found between regions.

	Females With Account (%)	Males With Account (%)	p-value
SS	26.7%	17.2%	0.180
OSS	30%	17.6%	0.318
NSS	25%	16.7%	0.331

Table 4. Comparisons of proportions of females and males with Twitter accounts subdivided by OSS, NSS, and all SS.

(OSS=orthopaedic spinal surgeons, NSS=neurosurgical spinal surgeons, SS=spinal surgeons)



stryker

Is there anything better than a balanced knee?

Because isn't a balanced knee what it's all about?

Learn more about

VeraSense® for Triathlon® Sensor Technology

A surgeon must always rely on his or her own professional clinical judgment when deciding whether to use a particular product when treating a particular patient. Stryker does not dispense medical advice and recommends that surgeons be trained in the use of any particular product before using it in surgery. The information presented is intended to demonstrate the breadth of Stryker's product offerings. A surgeon must always refer to the package insert, product label and/or instructions for use before using any of Stryker's products.

Products may not be available in all markets because product availability is subject to the regulatory and/or medical practices in individual markets. Please contact your sales representative if you have questions about the availability of products in your area. Stryker Corporation or its divisions or other corporate affiliated entities own, use or have applied for the following trademarks or service marks: Stryker, Triathlon, VeraSense.

VERAS-AD-9_33611 Copyright© Stryker 2022

***Advertisement**

[Click here to learn more about VeraSense](#)

which is supported by other studies (Donnally et al. 2018). Despite this finding, Twitter use should be encouraged for surgeons of all ages, regardless of how well they have established their practice. In fact, older surgeons with more advanced careers may have even more to gain as they attract a larger following of patients and peers. They may use this greater influence for educating others, including younger physicians and residents seeking advice, and promoting new advances in their field. They might enjoy the opportunity to reconnect with colleagues from years past or collaborate with new ones. Some surgeons are now even taking advantage of Twitter's own "journal clubs" where users can converse with each other by responding to tweets from one centralized account which posts articles with discussion points (Thangasamy et al. 2014). By following accounts of scientific journals, physicians can stay more current with new medical knowledge as relevant posts show up directly on their feed.

Twitter has revolutionized information-sharing and even been shown to increase patient satisfaction when used effectively by physicians. The hashtag feature specifically has been shown to aid in uniting physicians across diverse geographic areas, which is especially important for the networking of SS who are a part of a relatively smaller subspecialty. One study examining tweets containing "#colorectalsurgery" found that after encouraging use of the hashtag at an annual conference, total views on tweets containing the hashtag rose by 8 million, demonstrating both the utility of hashtags and the general receptivity of physicians to using Twitter professionally (Brady et al. 2017). Further, an online profile may also directly increase patient satisfaction as recent literature has found that accessible social media accounts are correlated with more favorable online reviews for SS (Donnally et al. 2020, 2018). SS should do all that they can to maintain highly rated online reviews as up to 26% of orthopaedic patients check such websites before choosing a physician (Curry et al. 2014). By building an effective presence on Twitter now, physicians will be better equipped for their roles as educators, researchers, and clinicians as social media continues to grow.

There are some limitations to this study which reflect the nature of public Twitter accounts. Surgeons who did not use their name in their profile or were mentioned by a private user could not be recorded. In the first case, the surgeon using a private profile would still be underutilizing Twitter as they would be less able to communicate with others and in the second case, the percentage of surgeons

mentioned would only be potentially higher, further strengthening our conclusion. Possible sampling bias cannot be excluded in our selections of surgeons from the Centers for Medicare and Medicaid Services database as those that do not accept these programs would not be included. Similarly, NSS and OSS not listed on the AANS and AAOS databases could not be included. Our methods therefore may be biased if surgeons found on these databases skewed towards a particular type of geographic region, practice, or institutional affiliation. We attempted to mitigate this bias by both using the most inclusive database available and a large sample size.

Our study was limited in its basic, yet valid definition of Twitter underutilization as not having an account. Further studies may further characterize the extent of social media utilization looking at different platforms (LinkedIn, Facebook, etc.), extent of communication with others, and content of posts (discussing research, patient outreach, conferences, etc.). Additionally, future studies may build on our findings by classifying the sentiments expressed (positive, neutral, or negative) on posts mentioning spine surgeons or posts sharing spine-related hashtags. Although we subdivided data by relevant factors such as age, gender, and geographic region, other groups could build on these results by analyzing practice type (private vs. public), research output, and physician rating. Our work represents an interesting start to the characterization of Twitter use among spine surgeons but leaves plenty of potential study questions available.

CONCLUSION

This study has demonstrated that there is a large discordance between the proportion of spine surgeons who actively engage on Twitter and those that are discussed on the platform by others. Should more spine surgeons join Twitter, they would be able to connect with patients and colleagues that are evidently discussing them and their work on the site, leading to better patient communication, community outreach, and academic networking. Our results suggest that social media platforms such as Twitter represent an easily accessible, widely distributed, and up-to-date resource for many spine surgeons as a medium for patient and professional contact.

Submitted: May 27, 2022 EDT, Accepted: September 05, 2022 EDT



This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY-NC-ND-4.0). View this license's legal deed at <https://creativecommons.org/licenses/by-nc-nd/4.0> and legal code at <https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode> for more information.

REFERENCES

- Alassiri, Shareefah, and Areej Alowfi. 2019. "Public's Attitudes Toward Health Information on Twitter: A Cross-Sectional Survey Based on the Saudi Population." *Cureus* 11 (10): e5863. <https://doi.org/10.7759/cureus.5863>.
- Bernstein, David N., Giresse Melone, Ayodeji Jubril, Jun Zhang, and Addisu Mesfin. 2021. "Evaluating Social Media Use Among Active American Members of the Cervical Spine Research Society." *Clinical Spine Surgery* 34 (6): E337–41. <https://doi.org/10.1097/bsd.0000000000001127>.
- Brady, R., S. Chapman, S. Atallah, M. Chand, J. Mayol, A. Lacy, and S. Wexner. 2017. "#colorectalsurgery." *British Journal of Surgery* 104 (11): 1470–76. <https://doi.org/10.1002/bjs.10615>.
- Centers for Disease Control and Prevention. 2021. "@CDCgov." Centers for Disease Control and Prevention. 2021. https://twitter.com/CDCgov?ref_src=twsrc%5Egoogle%7Ctwcamp%5Eserp%7CTwgr%5Aauthor.
- Curry, E., X. Li, J. Nguyen, and E. Matzkin. 2014. "Prevalence of Internet and Social Media Usage in Orthopedic Surgery." *Orthop Rev (Pavia)* 6 (3): 5483.
- Dean, Brian. 2021. "How Many People Use Twitter in 2021?" Backlinko. 2021. <https://backlinko.com/twitter-users>.
- Donnally, C., D. Li, J. Maguire, E. Roth, G. Barker, J. McCormick, et al. 2018. "How Social Media, Training, and Demographics Influence Online Reviews across Three Leading Review Websites for Spine Surgeons." *Spine J* 18 (11): 2081–90.
- Donnally, C., J. McCormick, M. Pastore, A. Sama, N. Schiller, D. Li, et al. 2020. "Social Media Presence Correlated with Improved Online Review Scores for Spine Surgeons." *World Neurosurg* 141:e18–25.
- Evaniew, N., A. Adili, M. Ghert, M. Khan, K. Madden, C. Smith, et al. 2017. "The Scholarly Influence of Orthopaedic Research According to Conventional and Alternative Metrics." *A Systematic Review. JBJS Rev* 5 (5): 5.
- Foller.me. 2021. "Twitter Analytics." Foller.Me. 2021. <https://foller.me>.
- Hughes, Hannah, Andrew Hughes, and Colin Murphy. 2017. "The Use of Twitter by the Trauma and Orthopaedic Surgery Journals: Twitter Activity, Impact Factor, and Alternative Metrics." *Cureus* 9 (12): e1931. <https://doi.org/10.7759/cureus.1931>.
- Kunze, K., E. Polce, A. Vadhera, B. Williams, B. Nwachukwu, S. Nho, et al. 2020. "What Is the Predictive Ability and Academic Impact of the Altmetrics Score and Social Media Attention?" *Am J Sports Med* 48 (5): 1056–62.
- Pew Research Center. 2021. "Social Media Fact Sheet." Pew Research Center. 2021. <https://www.pewresearch.org/internet/fact-sheet/social-media/>.
- Saleh, Jenine, Brooke S. Robinson, Nathan W. Kugler, Kenneth D. Illingworth, Pranay Patel, and Khaled J. Saleh. 2012. "Effect of Social Media in Health Care and Orthopedic Surgery." *Orthopedics* 35 (4): 294–97. <https://doi.org/10.3928/01477447-20120327-05>.
- Thangasamy, I., M. Leveridge, B. Davies, A. Finelli, B. Stork, and H. Woo. 2014. "International Urology Journal Club via Twitter: 12-Month Experience." *Eur Urol* 66 (1): 112–17.
- The Centers for Medicare and Medicaid Services. 2021. "National Downloadable File." *The Centers for Medicare and Medicaid Services*. <https://data.cms.gov/provider-data/dataset/mj5m-pzi6>.
- Wojcik, Stefan, and Adam Hughes. 2019. "Sizing up Twitter Users." Pew Research Center. 2019. <https://www.pewresearch.org/internet/2019/04/24/sizing-up-twitter-users/>.
- Zhang, Dafang, and Brandon Earp. 2020. "Correlation Between Social Media Posts and Academic Citations of Orthopaedic Research." *JAAOS: Global Research and Reviews* 4 (9): e20.00151. <https://doi.org/10.5435/jaaosglobal-d-20-00151>.