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Original article

The impact of social media presence, age, and patient reported wait times on physician review websites for sports medicine surgeons☆

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ABSTRACT

Background: When choosing physicians, patients often review options online via physician review websites, which may influence decisions on providers.
Purpose: The purpose of this study is to investigate the impacts of social media usage, age, and patient reported wait times on online ratings for three popular review websites.
Study design: Cross-sectional study.
Methods: The American Orthopaedic Society for Sports Medicine database was used to extract demographic information for all listed sports medicine surgeons in Florida. Overall ratings, number of ratings and comments, and patient reported wait-times were recorded from three leading review websites (Healthgrades.com, Vitals.com, Google.com). Professionally focused SM accounts were searched for each physician on Facebook.com, Twitter.com, Instagram, and LinkedIn.com.
Results: 102 orthopaedic sports medicine surgeons were included. At least one form of social media was used by 62.4% of our cohort. Those with social media had higher overall online physician ratings out of 5.00 across all review websites (Google:4.65vs4.44, $p = 0.05$; Healthgrades:4.41vs4.15, $p = 0.03$; Vitals:4.43vs4.14, $p = 0.01$). In bivariate analysis, older age was associated with lower ratings on Health Grades (Absolute difference (AD) −0.26, $p < 0.0001$), and social media was linked to higher ratings (Google: AD 0.21, $p = 0.05$; Healthgrades: AD 0.26, $p = 0.03$; Vitals: AD 0.29, $p = 0.008$). Longer wait times were associated with lower ratings in a dose-dependent manner in both bivariate and multivariable analysis.
Conclusions: Social media use among sports medicine surgeons correlated with higher overall physician ratings. Potentially, younger surgeons increase social media use because of a heightened concern for online image, whereas older surgeons may have less value in using online platforms to capitalize on an online presence. Older age and increased patient reported wait times in office had a negative correlation with online reviews, which highlights that factors beyond the surgeon's skill sets can influence overall ratings.

Introduction

With the emergence of physician review websites (PRWs), the act of rating physicians online has steadily increased and is now a common tool for the modern healthcare consumer.[1] Despite recent literature revealing no correlation between online physician ratings and quality of care, PRW ratings have been shown to play an important role in a patient's choice of physician.[2,3] A recent study revealed that 37% of patients avoided a physician due to poor

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ratings, while 35% selected those with favorable ratings.[4] In addition, 28.1% of patients strongly agreed that a positive review from a PRW alone would influence them to seek care.[5] With the United States (US) healthcare system shifting towards a quality-centered reimbursement structure, there is great potential for PRWs to directly affect the livelihood of physicians.[6,7]

This trend has been demonstrated within the field of orthopaedics, as a study of the 30 most populated US cities revealed 94.3% of practicing orthopaedic surgeons possessed an online PRW rating.[8] Among orthopaedic patients, 39.4% reported the internet having an influence on their choice of physician and 18–26% reported the use of a PRW before selecting an orthopaedic surgeon for an initial visit.[9,10] Characteristics like office wait time, bedside manner, staff interactions, time with patients, and ease of scheduling have been established as the most influential factors of a physician's online rating.[8,11,12] It has also been demonstrated that older age and the absence of a website correlate with lower online ratings.[13]

As a result, research has been directed towards the effects of social media (SM), and its nearly 3 billion users, on PRW ratings.[14] Recent studies have shown that a SM presence was correlated with more comments and ratings on PRWs and that accessible SM accounts are associated with higher ratings on PRWs.[15,16] Another study revealed that over 50% of orthopaedic patients utilize SM, concluding that those who do use SM are more likely to be younger in age, research their condition before arriving for their appointment, and travel a greater than average distance to see a physician.[9]

When compared to other orthopaedic subspecialties, sports medicine patients were found to have the highest SM usage.[9] Our study examines the effects of SM presence, PRWs, age, and other factors reported within PRWs on online ratings of sports medicine physicians. We hypothesize that a SM presence is associated with higher overall PRW ratings.

Materials and methods

Data collection

A cohort of 102 sports medicine surgeons was identified from the American Orthopaedic Society for Sports Medicine (AOSSM) database (accessed January 05, 2020). This list was filtered to include only physicians with a practicing location in Florida. Both allopathic and osteopathic surgeons were included. Name, sex, training background, practice name and location, and type of practice (private vs. academic) were obtained from the AOSSM database. Other demographic data points collected include age and fellowship training.

Professional SM presence and online rating information for each surgeon was recorded. SM sites of interest included Facebook.com (F), Instagram (IG), Twitter.com (T), and LinkedIn.com (L). Personal SM websites were not included in the study, and a SM account was only considered to be "professional" if it was promoting the surgeon themselves as a medical practitioner. The PRWs included for analysis were Google.com (G), Healthgrades.com (HG), and Vitals.com (V). These three were determined to be the most widely used review websites and were selected because the majority of physicians reviewed (>65%) had ratings data in all three websites. Each of the PRWs include scaled ratings (0.0–5.0 points) and a patient comments section. The overall average rating, number of ratings, and number of comments were recorded for G, HG, and V.

Additionally, the presence of a "care philosophy", physician age, year of graduation from residency (recorded as before the year 2000 or during/after 2000) and patient reported wait times (ranges: <10, 10–15, 16–30, 31–45, and 45+ minutes) were lso recorded from each HG page. The care philosophy section is an area written directly by the physician where they can describe their practice values. This was recorded because it reflects a direct input by the physician to better shape their online presence. Castle Connolly award status was also recorded. This award is given by physician-led teams to the most outstanding physicians.

To find demographic and review website data, Google searches were conducted. Searches consisted of each name, degree (M.D. or D.O.), and "sports medicine" (i.e. "John Doe MD sports medicine"). The first 20 results were reviewed. This formula was used to locate the presence of a physician biography page (either personal and/or institutional website), online curriculum vitae (CV), practice information, and PRW data. The SM Google input was "Physician Name (+) (M.D. or D.O.) + Name of Social Media Platform". If this did not yield results, the physician's name was directly inputted into each SM site and the results were scanned for a match.

Statistical analysis

Physician demographic data, training, and online presence frequencies and proportions are reported with p-values generated from chi-square tests/Fisher exact tests for the categorical variables, and one-way ANOVA tests for continuous variables. Means and standard deviations (SD) of continuous physician rating scores are also reported. The relationship between physician demographics, training, online presence, and reported wait times compared to online reviews was assessed with absolute differences (AD) and 95% confidence intervals (95% CI) using bivariate and multivariable linear regression analysis. For bivariate linear regression analysis, the physician's age, number of comments for HG/V/G, and number of ratings for HG/V/G were all divided by 10 prior to analysis to move the decimal over by one. Variables with a p-value <0.05 in the bivariate analysis were included in the multivariable model. Age, number of comments for HG, and number of ratings for HG were divided by 10 before multivariable linear regression analysis. Pearson correlation coefficients were calculated to evaluate agreement between HG, V, G overall rating scores. A p-value of <0.05 was considered to be statistically significant. All analysis was performed using SAS 9.4 (SAS institute Inc. Cary, NC).

Results

Demographics, online presence, and rating scores by social media presence

The majority of orthopaedic surgeons included were Sports Fellowship trained (92.1%) (Table 1). A higher frequency of surgeons graduating residency during or after the year 2000 were sports fellowship trained (98.1%) compared to those graduating before 2000 (83.3%) ($p = 0.02$). Only one individual that completed a fellowship was not sports fellowship trained. Of the sports medicine surgeons practicing in Florida, 96.0% were male compared to 4.0% female. More than half of the physicians included graduated residency after the year 2000 (62.7%) with an average age of 50 years old. Additionally, more sports medicine surgeons were in private practice (85.3%) compared to academic practice (14.7%).

At least one form of SM was used by 62.4% of this cohort, with L as the most popular platform (37.3%) (Table 1). F was the second most used site in this cohort (22.6%), followed by T (17.7%) and IG (9.8%). Institutional webpages were more common than personal sites (76.2%). Most of the cohort had either a personal webpage *or* an institutional webpage (94.1%), and 17.8% of the cohort had both. A higher percentage of academic sports medicine surgeons in Florida use at least one form of SM compared to private practicing surgeons (73.3% vs 60.5%), however there were far fewer academic

Table 1
Physician demographic frequencies (chi-square p-value) and means (ANOVA p-values) by social media presence, practice, and graduation year.

	Total (n = 102)	Social Media Presence			Practice			Graduation Year		
		Yes (n = 63)	No (n = 38)	p-value	Academic (n = 15)	Private (n = 87)	p-value	<2000 (n = 35)	≥2000 (n = 59)	p-value
Age	50.0 ± 11.2	48.6 ± 11.5	52.2 ± 10.6	0.15	53.7 ± 15.0	49.4 ± 10.5	0.24	–	–	–
Gender				0.58			1.00¥			1.00¥
Male	97 (96.0)	59 (95.2)	37 (97.4)		15 (100)	82 (95.4)		34 (91.1)	55 (94.8)	
Female	4 (4.0)	3 (4.8)	1 (2.6)		0	4 (4.7)		1 (2.9)	3 (5.2)	
Sports Fellowship				0.24¥			0.60¥			0.02¥
Yes	82 (92.1)	54 (94.7)	27 (87.1)		15 (100)	67 (90.5)		25 (83.3)	51 (98.1)	
No	7 (7.9)	3 (5.3)	4 (12.9)		0	7 (9.5)		5 (16.7)	1 (1.9)	
Practice				0.34			–			0.36
Academic	15 (14.7)	11 (17.5)	4 (10.5)		–	–		4 (11.4)	11 (18.6)	
Private	87 (85.3)	52 (82.5)	34 (89.5)		–	–		31 (88.6)	48 (81.4)	
Graduation Year				0.02			0.36			–
<2000	35 (37.2)	17 (28.8)	18 (52.9)		4 (26.7)	31 (39.2)		–	–	
≥2000	59 (62.8)	42 (71.2)	16 (47.1)		11 (73.3)	48 (60.8)		–	–	
Website				0.09¥			0.15¥			0.35¥
None	6 (5.9)	5 (7.9)	1 (2.7)		1 (7.1)	5 (5.8)		3 (8.6)	2 (3.5)	
Institutional	77 (76.2)	44 (69.8)	33 (89.2)		13 (92.9)	64 (73.6)		24 (68.6)	46 (79.3)	
Personal or Both	18 (17.8)	14 (22.2)	3 (8.1)		0	18 (20.7)		8 (22.9)	10 (17.2)	
Facebook				–			0.02¥			0.78
Yes	23 (22.6)	–	–		0	23 (26.4)		8 (22.9)	15 (25.4)	
No	79 (77.5)	–	–		15 (100)	64 (73.6)		27 (77.1)	44 (74.6)	
Twitter				–			0.30¥			0.36
Yes	18 (17.7)	–	–		4 (26.7)	14 (16.1)		5 (14.3)	13 (22.0)	
No	84 (82.4)	–	–		11 (73.3)	73 (83.9)		30 (85.7)	46 (78.0)	
Instagram				–			0.64¥			0.08¥
Yes	10 (9.8)	–	–		2 (13.3)	8 (9.2)		1 (2.9)	9 (15.3)	
No	92 (90.2)	–	–		13 (86.7)	79 (90.8)		34 (97.1)	50 (84.8)	
LinkedIn				–			0.16			0.04
Yes	38 (37.3)	–	–		8 (53.3)	30 (34.5)		8 (22.9)	26 (44.1)	
No	64 (62.8)	–	–		7 (46.7)	57 (65.5)		27 (77.1)	33 (55.9)	
Any Social Media?				–			0.34			0.02
Yes	63 (62.4)	–	–		11 (73.3)	52 (60.5)		17 (48.6)	42 (72.4)	
No	38 (37.6)	–	–		4 (26.7)	34 (39.5)		18 (51.4)	16 (27.6)	

¢Social media presence defined as having a Facebook, Twitter, Instagram or LinkedIn account located in the 1st ten Google search results.
¥Fischer-Exact tests were used in place of chi-square tests where >25% of cells have expected counts <5 in order to obtain a p-value

surgeons in total (15 academic vs 87 private practice). Of note, a higher percentage of private practice sports medicine surgeons had F (26.4%) compared to academic surgeons (0.0%) (p = 0.02). Type of practice was not significantly correlated with having a professional IG, T, or L.

Of those that graduated residency during or after the year 2000, 72.4% of surgeons had SM, which is noticeably larger than the percentage of those with SM that graduated before the year 2000 (48.6%) (p = 0.02) (Table 1). Specifically, a higher frequency of sports medicine surgeons graduating during or after 2000 had L (44.1%) compared to those graduating before 2000 (22.9%) (p = 0.04). Practice type, gender, completing a sports medicine fellowship, or having an institutional/personal webpage were not significantly correlated with having SM.

Mean rating scores were greater than 4.0 for all three rating sites. G ratings showed the highest average rating score (4.57 points out of 5) compared to HG (4.32) and V (4.33) (Table 2). The average number of ratings per physician varied across PRWs, with G at 27.6 ratings, HG at 46.1 ratings, and V at 34.6 ratings per physician. The average number of comments per physician per website followed a similar trend with HG being utilized most frequently (G at 15.7 comments, HG at 23.1 comments, and V at 14.0 comments per surgeon). Sports medicine surgeons with SM had on average higher overall online physician ratings across all three sites (G: 4.65 vs 4.44, p = 0.05; HG: 4.41 vs 4.15, p = 0.03; V: 4.43 vs 4.14, p = 0.01) (Table 2). Similar trends connecting SM usage and improved online scores were seen for the number of ratings and comments on rating websites, however they were not found to be statistically significant. Interestingly, sports medicine surgeons graduating during or after the year 2000 had on average higher overall rating scores on HG (4.64 vs 4.08, p = 0.002), but those graduating before the year 2000 had more ratings on V (45.4 vs 29.3, p = 0.02) and more comments on G (19.8 vs 11.5, p = 0.05).

The most common average reported wait time for patients to be seen was 10–15 min (59.0%), followed by 30+ minutes (28.4%), 0–10 min (8.4%), and 16–30 min (4.2%) (Table 2). Furthermore, 58.3% of surgeons within the 10–15 min wait time group had SM compared to 33.3% in the 16–30 min group, 8.3% in 30+ min, and 0.0% in the 0–10min group (p = 0.04).

Within this cohort, 20.8% percent of physicians were awarded the Castle Connolly award (Table 2). Of note, a larger proportion of surgeons graduating residency before the year 2000 received Castle Connolly compared to those graduating during or after 2000 (42.9% vs 10.3%, p = 0.0003). Being awarded the Castle Connolly award was not significantly correlated with SM presence or type of practice. Listing a Care Philosophy on HG was not found to be statistically significant when looking at whether a physician had SM, if they were in private or academic practice, or when they graduated residency.

Bivariate and multivariable linear regression of HG, V, and G overall scores

Linear regression models were constructed with overall HG, V, and G ratings as the outcome measures (Tables 3 and 4). In bivariate analysis, completing a sports medicine fellowship correlated with an overall higher online rating score in both G and HG by 0.55 and 0.57 points respectively of the total 5 (G p = 0.03, HG p = 0.01) compared to those without a sports fellowship. Older age was associated with lower ratings on HG, with an increase in age by 10

Table 2
Google, Healthgrades, and Vitals frequencies (chi-square p-value) and means (anova p-values) by social media presence, practice, and grad year.

	Total (n = 102)	Social Media Presence			Practice			Graduation Year		
		Yes (n = 63)	No (n = 38)	p-value	Academic (n = 15)	Private (n = 87)	p-value	<2000 (n = 35)	≥2000 (n = 59)	p-value
Google										
Overall Rating	4.57 ± 0.48	4.65 ± 0.41	4.44 ± 0.55	0.05	4.55 ± 0.53	4.58 ± 0.47	0.85	4.47 ± 0.54	4.62 ± 0.43	0.18
# Ratings	27.6 ± 53.7	32.3 ± 62.4	21.5 ± 37.9	0.38	8.08 ± 6.80	31.0 ± 57.5	0.17	26.4 ± 26.9	25.5 ± 61.6	0.94
# Comments	15.7 ± 20.9	16.8 ± 22.4	14.7 ± 18.9	0.66	6.25 ± 5.45	17.4 ± 22.1	0.09	19.8 ± 21.7	11.5 ± 14.9	0.05
Healthgrades										
Overall Rating	4.32 ± 0.59	4.41 ± 0.50	4.15 ± 0.68	0.03	4.19 ± 0.49	4.35 ± 0.60	0.35	4.08 ± 0.61	4.64 ± 0.51	0.002
# Ratings	46.1 ± 67.8	48.6 ± 74.4	39.8 ± 55.4	0.53	36.7 ± 51.7	47.7 ± 70.4	0.58	42.9 ± 39.8	44.3 ± 73.2	0.92
# Comments	23.1 ± 40.2	25.2 ± 40.8	20.3 ± 39.9	0.57	13.3 ± 29.5	24.8 ± 41.6	0.32	19.4 ± 28.1	21.9 ± 37.1	0.74
Care Philosophy				0.83			0.31			0.67
Not Listed	53 (54.6)	32 (53.3)	20 (55.6)		10 (66.7)	43 (52.4)		20 (57.1)	31 (52.5)	
Listed	44 (45.4)	28 (46.7)	16 (44.4)		5 (33.3)	39 (47.6)		15 (42.9)	28 (47.5)	
Wait Time				0.04¥			0.49¥			0.007¥
0–10 min	8 (8.4)	0	8 (13.8)		0	8 (9.9)		1 (2.9)	7 (12.1)	
10–15 min	56 (59.0)	21 (58.3)	34 (58.6)		11 (78.6)	45 (55.6)		16 (47.1)	39 (67.2)	
16–30 min	4 (4.2)	12 (33.3)	15 (25.9)		3 (21.4)	24 (29.6)		14 (41.2)	12 (20.7)	
30+ min	27 (28.4)	3 (8.3)	1 (1.7)		0	4 (4.9)		3 (8.8)	0	
Vitals										
Overall Rating	4.33 ± 0.53	4.43 ± 0.44	4.14 ± 0.61	0.01	4.29 ± 0.45	4.33 ± 0.55	0.80	4.29 ± 0.36	4.38 ± 0.63	0.46
# Ratings	34.6 ± 30.4	33.9 ± 30.7	35.4 ± 30.7	0.82	30.3 ± 19.3	35.3 ± 31.9	0.59	45.5 ± 32.6	29.3 ± 28.6	0.02
# Comments	14.0 ± 15.4	14.6 ± 16.6	12.8 ± 13.5	0.57	9.69 ± 10.0	14.7 ± 16.0	0.28	17.8 ± 17.3	12.4 ± 14.5	0.12
Castle Connolly				0.62			0.16¥			0.0003
No	80 (79.2)	48 (77.4)	31 (81.6)		9 (64.3)	71 (81.6)		20 (57.1)	52 (89.7)	
Yes	21 (20.8)	14 (22.6)	7 (18.4)		5 (35.7)	16 (18.4)		15 (42.9)	6 (10.3)	

¢Social media presence defined as having a Facebook, Twitter, Instagram or LinkedIn account located in the 1st ten Google search results.
¥Fischer-Exact tests were used in place of chi-square tests where >25% of cells have expected counts <5 in order to obtain a p-value.

years corresponding to a decrease in overall rating by 0.26 points (AD -0.26, $p < 0.0001$). Similarly, graduating during or after the year 2000 showed a higher score on HG ratings by 0.39 points (AD 0.39, $p = 0.001$).

For bivariate analysis, having SM was linked to having higher overall ratings on all three rating sites (G: AD 0.21, $p = 0.05$; HG: AD 0.26, $p = 0.03$; V: 0.29AD, $p = 0.008$). In isolation, having F was linked with higher overall ratings on V (AD 0.27, $p = 0.04$). An increase of 10 ratings on HG correlated with an increase in overall HG rating by 0.02 ($p = 0.006$), and an increase of 10 comments on HG correlated with an increase in overall HG rating by 0.04 ($p = 0.004$). An increase in ratings or comments in G or V were not found to be statistically significant with an increase in overall G or V ratings.

Longer wait times were associated with lower ratings in a dose dependent manner. The data shows a decrease in overall V ratings by 0.4 rating points when patients report waiting 10–15 min ($p = 0.05$) compared to waiting 0–10 min, a decrease in HG ratings by 0.72 points ($p = 0.0003$) and a decrease of 0.57 rating points on V ($p = 0.01$) when waiting 16–30 min, and a decrease by 1.44 points on HG ($p < 0.0001$) and a decrease of 1.60 points on G ($p = 0.02$) when patients reported waiting 30+ minutes.

In multivariable linear regression analysis, an increase of age by 10 years was associated with a lower overall rating on HG by 0.01 ($p = 0.003$) (Table 4). Furthermore, patient reported office wait times had a significant effect on overall ratings. Longer wait times were associated with lower ratings in a dose dependent manner. Compared to 0–10 min, a patient reported wait time of 16–30 min correlated with a decrease in overall ratings by 0.49 points on HG ($p = 0.02$) and 0.48 points on V ($p = 0.03$), and a wait time of 30+ minutes correlated with a decrease in overall ratings by 0.78 points on G ($p = 0.05$) and 1.03 points on HG ($p = 0.001$).

HG, V and G correlations

All three physician rating websites had a positive correlation with each other on Pearson Correlation analysis. HG had a more moderately positive correlation with V ($r = 0.45$ (0.14, 0.53)) and a weak positive correlation with G ($r = 0.35$ (0.25, 0.59)). V had a weak positive correlation with G ($r = 0.25$ (0.02, 0.45)).

Discussion

The influence of SM continues to grow. Due to the exponentially growing number of users and unhindered reach, it has become a necessity to understand how SM affects the practice of medicine, and a physician's image. This image is created via a number of factors, but of growing importance has been the use of PRWs. Studies have shown approximately 80% of patients will obtain health information via the internet in their lifetime and suggest that the use of PRWs will continue to increase.[17,18] This paired with a lack of public access to reliable physician quality metrics, suggest that patients will continue to turn to PRWs when making decisions about their physician.[19,20]

This study aimed at examining SM use among sports medicine physicians and its impact on PRW ratings. The findings revealed that SM use among the group correlated with higher overall ratings across the PRWs. Interestingly, there is an isolated correlation among Facebook and higher ratings on Vitals.com. These findings expand upon previous studies which demonstrate the power of SM to influence PRWs among spine and joint replacement surgeons.[13,15,16,21] These results present SM as a tool for physicians to help shape his/her online image, which may prove to be an influential factor in the acquisition of new patients. The potential influence of the online physician review was demonstrated in a study which examined the effects of a single positive review posted to a social media website, on a clinic's cosmetic surgery volume. A year after posting the positive review, the clinic observed a 30% increase in case volume, demonstrating the power of SM to improve marketing and practice accessibility.[22] Within sports medicine, the impact of SM and PRW ratings may play an even greater role as an older study by Curry et al. observed that sports medicine patients were the most computer competent, with 35.9% of patients being active social networking users compared to other orthopaedic services at 9.8–17.9%.[9] Overall, these platforms not only provide physicians with opportunities to effectively market their practice

Table 3
Bivariate linear regression of Healthgrades, Vitals, and Google overall ratings.

	Google Overall Rating		Healthgrades Overall Rating		Vitals Overall Rating	
	AD (95% CI)	p-value	AD (95% CI)	p-value	AD (95% CI)	p-value
Age*	−0.01 (−0.01, 0.09)	0.78	−0.26 (−0.36, −0.16)	<.0001	−0.09 (−0.19, 0.01)	0.09
Gender						
Male	0		0		0	
Female	0.03 (−0.52, 0.58)	0.92	0.21 (−0.37, 0.80)	0.47	0.29 (−0.24, 0.82)	0.28
Sports Fellowship						
Yes	0.55 (0.06, 1.03)	0.03	0.57 (0.13, 1.00)	0.01	0.20 (−0.28, 0.67)	0.42
No	0		0			
Practice						
Academic	0		0		0	
Private	0.03 (−0.26, 0.32)	0.85	0.16 (−0.17, 0.49)	0.34	0.04 (−0.27, 0.35)	0.80
Graduation Year						
<2000	0		0		0	
≥2000	0.15 (−0.06, 0.36)	0.17	0.39 (0.16, 0.61)	0.001	0.09 (−0.14, 0.32)	0.46
Website						
None	0		0		0	
Institutional	0.16 (−0.38, 0.70)	0.55	−0.15 (−0.67, 0.37)	0.57	−0.06 (−0.54, 0.42)	0.81
Personal or Both	0.13 (−0.44, 0.71)	0.65	−0.16 (−0.73, 0.41)	0.57	−0.02 (−0.55, 0.51)	0.94
Facebook						
Yes	0.16 (−0.09 0.41)	0.21	0.26 (−0.01, 0.53)	0.06	0.27 (0.01, 0.52)	0.04
No	0		0		0	
Twitter						
Yes	0.13 (−0.12, 0.39)	0.31	−0.06 (−0.36, 0.24)	0.69	0.09 (−0.18, 0.36)	0.51
No	0		0		0	
Instagram						
Yes	0.01 (−0.33, 0.36)	0.93	0.12 (−0.26, 0.50)	0.54	0.21 (−0.14, 0.55)	0.25
No	0		0		0	
LinkedIn						
Yes	0.14 (−0.08, 0.35)	0.21	0.13 (−0.12, 0.37)	0.31	0.11 (−0.11, 0.34)	0.33
No	0		0		0	
Any Social Media?						
Yes	0.21 (0.001 0.42)	0.05	0.26 (0.02, 0.50)	0.03	0.29 (0.07, 0.50)	0.008
No	0		0			
Google*						
# Ratings	0.01 (−0.01, 0.03)	0.25	0.01 (−0.01, 0.04)	0.32	−0.003 (−0.03, 0.02)	0.78
# Comments	0.01 (−0.04, 0.06)	0.73	0.05 (−0.01, 0.12)	0.09	0.006 (−0.05, 0.06)	0.85
Healthgrades *						
# Ratings	0.01 (−0.002, 0.03)	0.09	0.02 (0.01, 0.04)	0.006	0.01 (−0.01, 0.03)	0.19
# Comments	0.02 (−0.003, 0.05)	0.08	0.04 (0.01, 0.07)	0.004	0.01 (−0.02, 0.04)	0.49
Care Philosophy						
Not Listed	0		0		0	
Listed	−0.04 (−0.25, 0.17)	0.73	0.12 (−0.11, 0.35)	0.32	−0.03 (−0.25, 0.20)	0.81
Wait Time						
0–10 min	0		0		0	
10–15 min	−0.33 (−0.86, 0.20)	0.22	−0.27 (−0.63, 0.10)	0.15	−0.40 (−0.81, 0.01)	0.05
16–30 min	−0.45 (−1.00, 0.10)	0.11	−0.72 (−1.11, −0.33)	0.0003	−0.57 (−1.00, −0.14)	0.01
30+ min	−0.87 (−1.60, −0.14)	0.02	−1.44 (−2.03, −0.85)	<.0001	−0.54 (−1.35, 0.27)	0.19
Vitals*						
# Ratings	−0.01 (−0.04, 0.02)	0.55	0.01 (−0.04, 0.04)	0.78	0.02 (−0.02, 0.06)	0.26
# Comments	−0.004 (−0.06, 0.06)	0.90	0.01 (−0.07, 0.09)	0.80	0.05 (−0.02, 0.12)	0.18
Castle Connolly						
No	0		0		0	
Yes	−0.20 (−0.43, 0.03)	0.10	−0.27 (−0.55, 0.01)	0.06	0.03 (−0.23, 0.30)	0.83

*Age, number of comments for Healthgrades/Vitals, and number of ratings for Healthgrades/Vitals/Google were divided by 10 before bivariate linear regression analysis.

and services, but offer a new outlet to connect with and engage patient populations.

SM usage, and its effects on PRW ratings, was also examined in relation to physician age and residency graduation year. This study revealed that of those graduating during or after the year 2000, 71.2% had a SM presence and higher HG ratings compared to those before 2000 (28.8%). We also found that older physician age was correlated with lower ratings on HG, supporting previous studies among spine surgeons.[13] Sports medicine surgeons who graduated residency before the year 2000 had more ratings on Vitals.com and more comments on Google.com. It is likely that these findings are a consequence of increased length of time in practice, and subsequently, more time to accumulate patient input, as the overall ratings were not higher for this cohort. Among surgeons graduating residency before the year 2000, our study also observed a significantly higher proportion of physicians awarded the Castle Connolly award. This is an interesting finding in that it contrasts the inverse relationship observed with age and PRW ratings and may highlight a discrepancy between how patients view a particular physician and how other physicians view that same physician. This discrepancy illustrates the need for a standardized assessment of physician quality of care.

With respect to wait times, our study found that over half of surgeons with a reported 10–15-min wait time possessed SM, which was greater than surgeons with longer wait times. We discovered a significant negative correlation between office wait time and HG, V, and G ratings, with an increasing rate of score decrease as office wait time increased.

We observed more SM use among sports medicine physicians in academic practice compared to private practice. In previous studies,

Table 4
Multivariable linear regression of Healthgrades, Vitals, and Google overall ratings.

	Google Overall Rating		Healthgrades Overall Rating		Vitals Overall Rating	
	AD (95% CI)	p-value	AD (95% CI)	p-value	AD (95% CI)	p-value
Age*	–	–	−0.01 (−0.02, −0.01)	0.003	–	–
Sports Fellowship						
Yes	0.46 (−0.05, 0.97)	0.08	0.33 (−0.03 0.70)	0.07	–	–
No	0		0		–	
Graduation Year						
<2000	0		–		0	
≥2000	0.01 (−0.26, 0.29)	0.92	–	–	−0.03 (−0.27, 0.21)	0.81
Facebook						
Yes	–	–	–	–	0.18 (−0.10, 0.47)	0.21
No	–		–		0	
Any Social Media?						
Yes	0.11 (−0.14, 0.36)	0.38	0.05 (−0.16, 0.27)	0.62	0.13 (−0.13, 0.39)	0.34
No	0		0		0	
Healthgrades *						
# Ratings	–	–	0.02 (−0.02, 0.06)		–	–
# Comments	–	–	0.01 (−0.05, 0.07)	0.73	–	–
Wait Time						
0–10 min	0		0		0	
10–15 min	−0.31 (−0.86, 0.24)	0.27	−0.19 (−0.57, 0.20)	0.34	−0.36 (−0.78, 0.05)	0.09
16–30 min	−0.33 (−0.92, 0.26)	0.27	−0.49 (−0.89, −0.08)	0.02	−0.48 (−0.93, −0.04)	0.03
30+ min	−0.78 (−1.57, 0.02)	0.05	−1.03 (−1.66, −0.40)	0.001	−0.55 (−1.38, 0.29)	0.20
			*Age, number of comments for Healthgrades, and number of ratings for Healthgrades were divided by 10 before multivariable linear regression analysis.			

orthopaedic surgeons and physicians of other specialties practicing in academic settings were shown to have higher PRW patient satisfaction scores compared to those in private practice.[8,16] Physician's employed by academic institutions may benefit from the marketing efforts of their university hospital systems, which in turn could enhance their online presence. Further investigation could be done here.

Sports fellowship trained surgeons received higher ratings in both G and HG. A previous study examined online reviews among spinal surgeons and revealed similar results, where the level of training correlated with differences in PRW ratings, with neurosurgery trained physicians receiving higher grades when compared to those who were orthopaedic trained.[13]

The three PRWs investigated were positively correlated with one another. The weak to moderate Pearson correlation observed between them indicates that the ratings for a physician on one website do not necessarily correlate strongly to their rating on another rating website. This may be because patients who review a physician on one PRW are likely not re-reviewing them on another. However, the positive correlation still indicates that the PRWs are related, in that a physician that is overall given well-reviews on one website will likely be well reviewed as a whole across all sites. The sites agree that SM presence may influence patient feedback. Future studies should explore patient comments on these sites to understand additional factors that may optimize a patient's experience.

There are some limitations to the study. There is potential for some SM profiles to have gone unreported, as some physicians may use altered versions of their name or practice, as their username. Additionally, we did not assess the level of activity on the accounts, potentially including some accounts which may not be actively used. Another potential limitation is generalization, as we examined a cohort of physicians residing in Florida and registered through the AOSSM. However, previous studies have revealed no significant difference among online physician reviews and geographical area.[8,23] Additionally, the AOSSM site is a physician reported database which may not be up to date or current for all physicians at the time of data collection. With respect to the use of PRWs, there are inherent limitations in the validity of the online review process.[24] A systematic review of PRWs discovered that PRWs have low sample sizes, insufficient evidence of true patient outcomes, incomplete databases, and a lack of validation of reviews.[25] In addition, it has been demonstrated that bias in the review process exists, with patient demographics and type of insurance coverage affecting the likelihood of one to review a physician online.[17] Despite limitations of PRWs, their influence in the decision making process of the consumer continues to grow. We caution patients when making their decisions from potentially skewed information that may not reflect the true quality of care offered and encourage physicians to explore options like SM in order to help improve their online image.

Conclusions

Our study revealed that SM use was correlated with higher physician ratings across all three of the PRWs examined among sports medicine surgeons. In addition, those graduating residency before or during the year 2000 had higher ratings and SM usage, while increasing age correlated with lower ratings. Furthermore, our results demonstrated a significant effect of patient reported wait times on PRW ratings. These findings suggest the importance of SM use by physicians to enhance their professional online image. Future studies should examine the level of activity on SM platforms to determine if increased activity results in greater changes to PRW ratings, compare how this trend differs across specialties and countries, and whether using social media professionally improves reviews longitudinally.

Declaration of competing interest

We confirm that this current manuscript has not been published elsewhere and is not under consideration by another journal. All authors have approved the manuscript and agree with its submission. The corresponding author of the manuscript has full access to all of the data in the study and takes responsibility for the integrity of the data and accuracy of the data analysis as well as the decision to submit for publication.

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