How do physician demographics, training, social media usage, online presence, and wait times influence online physician review scores for spine surgeons?

Chester J. Donnally III, MD,¹ Johnathon R. McCormick, BS,² Deborah J. Li, BA,² James A. Maguire Jr., BS,² Grant P. Barker, BS,² Augustus J. Rush III, MD,¹ and Michael Y. Wang, MD³

¹Department of Orthopaedic Surgery, University of Miami Hospital; and Departments of ²Education and ³Neurological Surgery, University of Miami Leonard M. Miller School of Medicine, Miami, Florida

OBJECTIVE The purpose of this study was to assess the impact of certain demographics, social media usage, and physician review website variables for spine surgeons across Healthgrades.com (Healthgrades), Vitals.com (Vitals), and Google.com (Google).

METHODS Through a directory of registered North American Spine Society (NASS) physicians, we identified spine surgeons practicing in Texas (107 neurosurgery trained, 192 orthopedic trained). Three physician rating websites (Healthgrades, Vitals, Google) were accessed to obtain surgeon demographics, training history, practice setting, number of ratings/reviews, and overall score (January 2, 2018–January 16, 2018). Using only the first 10 search results from Google.com, we then identified whether the surgeon had a website presence or an accessible social media account on Facebook, Twitter, and/or Instagram.

RESULTS Physicians with either a personal or institutional website had a higher overall rating on Healthgrades compared to those who did not have a website ($p < 0.01$). Nearly all spine surgeons had a personal or institutional website (90.3%), and at least 1 accessible social media account was recorded for 43.5% of the spine surgeons in our study cohort (39.5% Facebook, 10.4% Twitter, 2.7% Instagram). Social media presence was not significantly associated with overall ratings across all 3 sites, but it did significantly correlate with more comments on Healthgrades. In multivariable analysis, increasing surgeon age was significantly associated with a lower overall rating across all 3 review sites ($p < 0.05$). Neurosurgeons had higher overall ratings on Vitals ($p = 0.04$). Longer wait times were significantly associated with a lower overall rating on Healthgrades ($p < 0.0001$). Overall ratings from all 3 websites correlated significantly with each other, indicating agreement between physician ratings across different platforms.

CONCLUSIONS Longer wait times, increasing physician age, and the absence of a website are indicative of lower online review scores for spine surgeons. Neurosurgery training correlated with a higher overall review score on Vitals. Having an accessible social media account does not appear to influence scores, but it is correlated with increased patient feedback on Healthgrades. Identification of ways to optimize patients' perception of care are important in the future of performance-based medicine.

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KEYWORDS social media; online patient ratings; physician review websites; spine surgeon ratings; wait times; Google; Healthgrades; Vitals

RECENT trends in medicine have shown a movement toward a physician reimbursement system that is focused on quality over quantity of service.¹³ Identification and optimization of variables that promote patient satisfaction continue to increase in importance. Similarly, physicians are more aware of the importance of reputation and marketing to advertise their services. A rapidly in-

creasing method of identifying and evaluating healthcare providers is the use of online physician review websites.⁸ Among a cohort of patients seeking a care provider who utilize online review sites, 35% chose a physician based on "good" ratings and 37% avoided a physician based on "bad" ratings.⁸ Despite no correlation to patient outcome or physician performance, patients are influenced by non-

ABBREVIATIONS NASS = North American Spine Society.

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regulated review sites. In a study of 752 orthopedic patients by Curry et al., 18%–26% of new patients used a physician review website before their consultation.³ It is clear that patients are placing an increased value on physician review sites, and potentially reimbursement modalities may follow in the near future. Within this ever-changing landscape, it is important for physicians to promote a positive online appearance.

To study the effect of social media on orthopedic surgery, Duymus et al. conducted a survey of 321 orthopedic surgeons and reported that 73% of those surveyed had Facebook accounts.⁶ Of those, 83% reported being contacted by patients on social media. In a separate survey of orthopedic patients, 34% reported online consultations with an orthopedic surgeon, and 39% said the Internet had an effect on their choice of physician.⁵ Almost half of these patients also reported their orthopedic surgeon should keep in contact with them using the Internet. As of September 2017, the numbers of active Facebook, Twitter, and Instagram users were 2.06 billion, 328 million, and 700 million, respectively (<https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/>). The staggering numbers of people using social media, coupled with patients' desires to keep in contact with their physician, are making online physician profiles more important.

The purpose of this study was to evaluate various factors associated with patient engagement (measured by the frequency of reviews and comments) and patient satisfaction (measured by overall scores). A secondary aim was to determine whether spine surgeons with a social media presence had a difference in the frequency of online ratings, or scores, compared to those without a social media presence. We hypothesize that those surgeons with a public social media presence will have higher profile scores, more comments, and more total reviews and are more likely orthopedic trained in private practice. To date this is the largest reviewed cohort of spine surgeons (299), and one of the only to include Google.com as an online physician review source.

Methods

Data Collection

Using the online "Find a Specialist" function in the member directory for the North American Spine Society (NASS), we identified all members practicing in Texas identifying as either orthopedic surgeons or neurosurgeons. This search yielded a total of 355 spine surgeons (based on December 20, 2017, access of the directory). Review determined that 28 were still in training (resident/fellow), 16 practiced outside of Texas, 7 were not actually surgeons, and 5 had retired; these individuals were excluded, leaving a total of 299 surgeons in the study cohort. Using our 3 online review sites, we confirmed that each of these physicians had completed orthopedic or neurosurgery residency and was an active spine surgeon.

We then reviewed profiles for individual surgeons, using 3 of the more highly rated physician review websites: Healthgrades.com (Healthgrades), Vitals.com (Vitals), and Google.com (Google) (accessed from 1/02/2018 to 1/16/2018). These sites were previously recommended by

the reputation industry at rates of 88%, 94%, and 100%, respectively.² We used all 3 sites to confirm information on residency training type (orthopedic surgery vs neurosurgery), degree (medical doctorate [MD] vs doctor of osteopathic medicine [DO]), graduation year, practice zip code, and institution setting (academic vs private). From Healthgrades, we recorded age, presence of a "care philosophy" (i.e., personal profile established by the surgeon on Healthgrades), the patient-reported wait time (< 10, 10–15, 16–30, or 30+ minutes), number of ratings, and overall rating (out of 5). From Vitals we recorded: years of experience, Castle Connolly status (i.e., Vitals' specific award for their top doctors based on multiple factors), number of ratings, number of comments, and overall rating (out of 5). From Google we recorded: total reviews, comments, and overall rating (out of 5).

We searched each NASS spine surgeon on Google.com ("first name" + "last name" + "MD" + "spine") and reviewed the first 10 search results for the surgeon's website (institutional vs personal). We did not also search "DO" because: 1) patients usually do not know or search this difference in degrees; 2) "DO" is seen as the word "do" in a Google search, skewing results; 3) "MD" is equivalent for "doctor" in this context and it seems likely that a patient would also search "MD" or "doctor." To evaluate social media presence, we added our 3 social media platforms to the initial search (+ "Facebook", "Twitter", "Instagram"). We reviewed the first 10 results for any social media presence of the surgeon to simulate what a patient might view. It should be noted that if a physician did have a social media account but it was hidden/private then it would not be accessible to our team. Similarly, it would not be accessible to a potential patient. Therefore, even if a private account was suspected, it was not included because this privacy would deter interacting with patients, and so the account should not be included for the purposes of this study.

Statistical Analysis

The number of physicians in each city is reported (Table 1). Frequencies and proportions of categorical physician demographics, training, and online presence are reported. Means and standard deviations are reported for continuous variables. To test for differences reported in Table 2 variables based on social media presence, training, practice, and graduation year, Wald chi-square tests were calculated for categorical variables and one-way ANOVA tests were calculated for continuous variables. Social media presence was defined as an online presence on at least one of the following: Facebook, Twitter, or Instagram. The main outcomes of this study include overall rating scores of Healthgrades, Vitals, and Google physician rating websites. The relationship between physician demographics, training, online presence, and that of online reviews (Healthgrades, Vitals, and Google) was assessed with absolute differences and 95% confidence intervals using bivariate and multivariable linear regression analysis. Variables with a *p* value < 0.05 from the bivariate analysis were included in the multivariable model.

Pearson correlation coefficients were calculated and scatterplots generated to evaluate agreement between Healthgrades, Vitals, and Google overall rating scores. A

correlation coefficient magnitude of 0 to 0.3 was considered to be negligible, 0.3 to 0.5 low, 0.5 to 0.7 moderate, 0.7 to 0.9 high, and 0.9 to 1.0 very high.¹⁰ A p value < 0.05 was considered to be statistically significant in all calculations. All statistical analysis was performed using SAS 9.4 (SAS Institute Inc.).

Results

A total of 299 spine surgeons were included in the study. The surgeons' average age was 53.8 years and 95.3% of the cohort had MD degrees. The majority were trained in orthopedics (64.2% orthopedic, 35.8% neurosurgery) and currently work in private practice (78.5% private, 21.5% academic). More than half of the cohort graduated before the year 2000 (54.5%), while 45.5% graduated in or after 2000. Nearly all physicians had a personal or institutional website (90.3%). At least 1 publicly accessible social media account was record in 43.5% of our studied spine surgeons (39.5% Facebook, 10.4% Twitter, 2.7% Instagram). The patient-reported wait times were: 0–10 minutes for 11.2%, 10–15 minutes for 42.2%, 16–30 minutes for 38.7%, and 30+ minutes for 8.0%. The average number of ratings and comments per surgeon was 28.0 and 6.22 for Healthgrades, 34.9 and 11.8 for Vitals, and 6.8 and 5.5 for Google, respectively. The average overall rating per surgeon was 3.9 for Healthgrades, 4.1 for Vitals, and 4.1 for Google (Table 2 and Table 3).

The city with the highest number of spine surgeons was Houston (39), followed by San Antonio (38), Dallas (33), Austin (18), Fort Worth (18), and Plano (18). These 6 cities accounted for 54.8% of our cohort. Cities with 1 NASS-registered spine surgeon accounted for 42.2% of all cities with a spine surgeon in Texas (Table 1).

Physician Demographics, Online Presence, and Rating Scores by Social Media Presence, Training, and Practice Setting

Spine surgeons with a social media presence had a significantly higher number of comments on Healthgrades compared to those without a social media presence (mean 7.5 vs. 5.2, $p = 0.01$). They were also more likely to have a personal or institutional website ($p < 0.0001$) and a customized care philosophy listed on their Healthgrades website ($p = 0.02$). Surgeons with a social media presence were more likely to have graduated recently (after 2000) compared to those without a social media presence ($p = 0.04$). Age, MD/DO degree, training, practice type, wait times, Castle Connolly status (Vitals), number of comments on Vitals and Google, number of ratings on Healthgrades/Vitals/Google, and overall rating on Healthgrades/Vitals/Google were not significantly associated with a physician's social media presence (Tables 2 and 3).

Neurosurgery-trained surgeons had a higher overall rating on Vitals compared to orthopedic surgeons ($p = 0.04$). Orthopedic surgeons were more likely to have a social media account on Twitter compared to neurosurgeons ($p = 0.02$). Age, MD/DO degree, training, practice type, graduation year, wait times, social media presence on Facebook or Instagram, Castle Connolly status (Vitals), listing of a care philosophy (Healthgrades), number of comments and

TABLE 1. Number of spine surgeons in each city

City	No. of Spine Surgeons
Houston	39
San Antonio	38
Dallas	33
Austin	18
Fort Worth	18
Plano	18
El Paso	11
Tyler	8
Arlington	7
Amarillo	5
Lubbock	5
The Woodlands	5
Addison	4
Beaumont	4
McAllen	4
Odessa	4
Bellaire	3
Flower Mound	3
Hurst	3
Irving	3
Round Rock	3
Southlake	3
Sugar Land	3
Temple	3
Allen	2
Corpus Christi	2
Denton	2
Frisco	2
Grapevine	2
Lewisville	2
Longview	2
Mansfield	2
McKinney	2
San Angelo	2
Shenandoah	2
Sherman	2
Wichita Falls	2
Abilene	1
Baytown	1
Bedford	1
Burleson	1
Carrollton	1
College Station	1
Conroe	1
Edinburg	1
Ford Hood	1
Galveston	1
Garland	1
Georgetown	1

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TABLE 1. Number of spine surgeons in each city

City	No. of Spine Surgeons
Granbury	1
JBSA Fort Sam Houston	1
Katy	1
Pasadena	1
Port Arthur	1
Richardson	1
Richmond	1
Rockwall	1
San Marcos	1
Shavano Park	1
Spring	1
Tomball	1
Waco	1
Webster	1
West Lake Hills	1

Total: 299 surgeons. Surgeons' practice addresses were obtained from the North American Spine Society membership directory.

ratings, and overall rating on Healthgrades and Google were not significantly associated with the residency training type (Tables 2 and 3).

Spine surgeons in private practice were on average older (mean 55 vs 51 years, $p = 0.03$) and graduated more recently ($p = 0.02$) compared to physicians in academic practice. Those in private practice were also more likely to have a social media presence on Facebook compared to academic physicians (83% vs 16%, $p = 0.04$). Private practice physicians had a significantly higher number of reviews and comments on Healthgrades (mean 39 vs 17, $p = 0.0001$), but a lower overall rating (mean 3.8 vs 4.1, $p = 0.05$). They were also more likely to have longer wait times compared to academic physicians ($p = 0.003$). Surgeons in private practice had a higher frequency of ratings on Google ($p = 0.04$) and Vitals ($p = 0.005$) and a higher number of comments on Vitals (mean 13 vs 8, $p = 0.03$). MD/DO degree, training, website, Twitter and Instagram social media, Castle Connolly status (Vitals), listing a care philosophy (Healthgrades), and overall rating on Healthgrades/Vitals/Google was not significantly associated with practice type (Tables 2 and 3).

Physicians graduating in or after the year 2000 had a higher overall rating on Healthgrades (3.7 vs 4.2, $p < 0.0001$), Vitals (3.9 vs 4.3, $p = 0.002$), and Google (3.9 vs 4.2, $p = 0.01$), and a higher number of comments on Healthgrades ($p < 0.0001$) compared to physicians who graduated before the year 2000. The more recent graduates were more likely to be working in an academic setting ($p = 0.02$), list a care philosophy (Healthgrades) ($p = 0.01$), and have a social media presence on Facebook ($p = 0.01$), as well as more likely to have a social media presence of any type ($p = 0.04$). Surgeons who graduated prior to 2000 had a shorter average wait time than surgeons who graduated more recently ($p = 0.004$). MD/DO degree, training, website, social media presence on Twitter

and Instagram, Castle Connolly status (Vitals), number of comments on Vitals and Google, and number of ratings on Healthgrades/Vitals/Google were not significantly associated with the year of graduation (Tables 2 and 3).

Bivariate and Multivariable Linear Regression of Healthgrades, Vitals, and Google Overall Scores

Linear regression models were constructed with overall ratings (on Healthgrades, Vitals, and Google) as the outcome measures (Tables 4 and 5). In both bivariate and multivariable analysis, older surgeons had a significantly lower overall rating across all 3 sites ($p < 0.05$). For example, on Healthgrades and Vitals, age correlated with a -0.02 in overall score, and so for every 10-year increase in age there is a 0.2-point decrease in overall rating. A greater number of comments on Healthgrades was associated with a higher overall rating across Healthgrades, Vitals, and Google in bivariate analysis ($p < 0.05$) but was not found to be significant in the multivariable model. A higher number of ratings on Healthgrades was also associated with a higher Healthgrades overall rating only in bivariate analysis ($p = 0.01$). Longer patient wait time was significantly associated with a lower overall rating on Healthgrades in both bivariate and multivariable analysis ($p < 0.0001$).

Spine surgeons who completed a neurosurgery residency had higher overall ratings on Vitals compared to orthopedic surgeons in bivariate and multivariable analysis ($p = 0.04$). On bivariate analysis, spine surgeons who graduated after the year 2000 had a significantly higher overall rating across all 3 sites compared to physicians who graduated before 2000 ($p < 0.001$), but the relationship was not found to be significant in multivariable analysis. Compared to physicians with no website, physicians with a personal or institutional website had higher overall scores on all 3 review sites in bivariate analysis ($p < 0.05$), yet this significance was only maintained by Healthgrades ($p < 0.01$) in multivariate analysis.

MD/DO degree, practice type, social media presence (Facebook/Twitter/Instagram), number of ratings and comments on Google, number of ratings and comments on Vitals, and Castle Connolly status (Vitals) were not significantly associated with overall ratings on Healthgrades, Vitals, or Google and were not included in the multivariable model for analysis.

Healthgrades, Vitals, and Google Correlations

The 3 online physician rating websites had a significant positive correlation with one another on overall rating scores (Fig. 1). Healthgrades had a weak positive correlation with Vitals overall rating ($r = 0.34$; 95% CI 0.23–0.44; $p < 0.0001$). Healthgrades had a weak positive correlation with Google overall rating ($r = 0.37$; 95% CI 0.24–0.47; $p < 0.0001$). Vitals had a negligible positive correlation with Google overall rating ($r = 0.15$; 95% CI 0.02–0.28; $p = 0.03$).

Discussion

It is most likely that surgeons' online scores are influenced by a combination of factors, such as clinical outcomes, physician character/likability, office staff, and billing. Physician availability and personality are less tangible

TABLE 2. Physician characteristics based on training, practice type, graduation year, and social media presence

Characteristic	Social Media Presence			Training			Practice			Graduation Yr		
	Total (n = 299)	No (n = 169)	Yes (n = 130)	p Value	Ortho (n = 192)	Neuro (n = 107)	Academic (n = 64)	Private (n = 234)	p Value	<2000 (n = 163)	≥2000 (n = 136)	p Value
Age in yrs, mean	53.8 ± 11.7	55.0 ± 11.7	52.4 ± 11.6	0.05	54.1 ± 11.9	53.4 ± 11.3	51.0 ± 12.7	54.6 ± 11.3	0.03	62.5 ± 7.76	43.5 ± 5.5	<0.0001
Degree				0.55					0.56			0.15
MD	285 (95.3)	160 (94.7)	125 (96.2)		182 (94.8)	103 (96.3)	62 (96.9)	223 (95.3)		158 (96.9)	127 (93.4)	
DO	14 (4.7)	9 (5.3)	5 (3.9)		10 (5.2)	4 (3.7)	2 (3.1)	11 (4.7)		5 (3.1)	9 (6.6)	
Training				0.54					0.37			0.57
Ortho	192 (64.2)	106 (62.7)	86 (66.2)		—	—	38 (59.4)	153 (65.4)		107 (65.6)	85 (62.5)	
Neuro	107 (35.8)	63 (37.3)	44 (33.9)		—	—	26 (40.6)	81 (34.6)		56 (34.4)	51 (37.5)	
Practice				0.06					0.37			0.02
Academic	64 (21.5)	43 (25.4)	21 (16.3)		38 (19.9)	26 (24.3)	—	—		27 (16.6)	37 (27.4)	
Private	234 (78.5)	126 (74.6)	108 (83.7)		153 (80.1)	81 (75.7)	—	—		136 (83.4)	98 (72.6)	
Graduation yr				0.04					0.57			—
<2000	163 (54.5)	101 (59.8)	62 (47.7)		107 (55.7)	56 (52.3)	27 (42.2)	136 (58.1)		—	—	—
≥2000	136 (45.5)	68 (40.2)	68 (52.3)		85 (44.3)	51 (47.7)	37 (57.8)	98 (41.9)		—	—	—
Website				<0.0001					0.91			0.08
None	29 (9.7)	26 (15.4)	3 (2.3)		19 (9.9)	10 (9.4)	9 (14.1)	20 (8.6)		21 (12.9)	8 (5.9)	
Institution	202 (67.6)	116 (68.6)	86 (66.2)		127 (66.2)	75 (70.1)	45 (70.3)	157 (67.1)		102 (62.6)	100 (73.5)	
Personal	31 (10.4)	10 (5.9)	21 (16.2)		21 (10.9)	10 (9.4)	5 (7.8)	25 (10.7)		16 (9.8)	15 (11.0)	
Both	37 (12.4)	17 (10.1)	20 (15.4)		25 (13.0)	12 (11.2)	5 (7.8)	32 (13.7)		24 (14.7)	13 (9.6)	
Facebook				—					0.85			0.01
No	181 (60.5)	—	—		117 (60.9)	64 (59.8)	46 (71.9)	135 (57.7)		109 (66.9)	72 (52.9)	
Yes	118 (39.5)	—	—		75 (39.1)	43 (40.2)	18 (28.1)	99 (42.3)		54 (33.1)	64 (47.1)	
Twitter				—					0.02			0.99
No	267 (89.6)	—	—		165 (86.4)	102 (95.3)	61 (95.3)	206 (88.4)		146 (89.6)	121 (89.6)	
Yes	31 (10.4)	—	—		26 (13.6)	5 (4.7)	3 (4.7)	27 (11.6)		17 (10.4)	14 (10.4)	
Instagram				—					0.16			0.24
No	291 (97.3)	—	—		185 (96.4)	106 (99.1)	61 (95.3)	229 (97.9)		157 (96.3)	134 (98.5)	
Yes	8 (2.7)	—	—		7 (3.7)	1 (0.9)	3 (4.7)	5 (2.1)		6 (3.7)	2 (1.5)	
Any social media?				—					0.54			0.04
No	169 (56.5)	—	—		106 (55.2)	63 (58.9)	43 (67.2)	126 (53.9)		101 (62.0)	68 (50.0)	
Yes	130 (43.5)	—	—		86 (44.8)	44 (41.1)	21 (32.8)	108 (46.2)		62 (38.0)	68 (50.0)	

Ortho = orthopedic surgery; neuro = neurosurgery.

Data are presented as n (%) unless otherwise indicated. Means are presented with SDs. Boldface type indicates statistical significance (p < 0.05). Statistical significance was determined by means of chi-square for categorical variables (frequencies) and ANOVA for continuous variables (means). Social media presence is defined for purposes of this study as having a Facebook, Twitter, or Instagram account appearing in the first 10 Google search results.

TABLE 3. Online review sites frequencies and means based on social media presence, training, practice type, and graduation year

Site & Variable	Social Media Presence			Training			Practice			Graduation Yr		
	Total (n = 299)	No (n = 169)	Yes (n = 130)	p Value	Ortho (n = 192)	Neuro (n = 107)	p Value	Academic (n = 64)	Private (n = 234)	p Value	<2000 (n = 163)	≥2000 (n = 136)
Google												
Mean overall rating	4.05 ± 1.02	4.02 ± 1.01	4.09 ± 1.04	0.60	4.06 ± 0.98	4.04 ± 1.12	0.89	4.24 ± 1.01	4.01 ± 1.02	0.18	3.90 ± 1.09	4.24 ± 0.89
Mean no. of ratings	6.84 ± 8.22	6.08 ± 5.72	7.71 ± 10.3	0.14	7.17 ± 9.14	6.22 ± 6.12	0.41	4.53 ± 4.06	7.37 ± 8.87	0.04	6.62 ± 8.30	7.13 ± 8.14
Mean no. of comments	5.48 ± 7.03	4.86 ± 5.01	6.18 ± 8.77	0.16	5.71 ± 7.76	5.04 ± 5.39	0.50	3.70 ± 3.62	5.88 ± 7.58	0.07	5.36 ± 7.24	5.62 ± 6.79
Healthgrades												
Mean overall rating	3.90 ± 0.81	3.93 ± 0.85	3.87 ± 0.76	0.58	3.85 ± 0.83	3.99 ± 0.76	0.18	4.08 ± 0.87	3.85 ± 0.79	0.05	3.68 ± 0.88	4.17 ± 0.62
Mean no. of ratings	28.0 ± 28.3	25.2 ± 21.9	31.5 ± 34.5	0.07	28.1 ± 30.4	27.9 ± 24.1	0.97	17.1 ± 15.0	30.9 ± 30.3	0.001	27.4 ± 29.1	28.8 ± 27.5
Mean no. of comments	6.22 ± 7.35	5.20 ± 5.71	7.50 ± 8.86	0.01	6.21 ± 7.44	6.25 ± 7.23	0.97	3.36 ± 3.72	6.97 ± 7.89	0.001	5.02 ± 6.67	7.66 ± 7.88
Care philosophy				0.02			0.52			0.22		0.01
Not listed	173 (59.0)	107 (64.9)	66 (51.6)		109 (57.7)	64 (61.5)		42 (65.6)	130 (57.0)		104 (65.8)	69 (51.1)
Listed	120 (41.0)	58 (35.2)	62 (48.4)		80 (42.3)	40 (38.5)		22 (34.4)	98 (43.0)		54 (34.2)	66 (48.9)
Wait time				0.05			0.62			0.003		0.004
0–10 mins	32 (11.2)	24 (14.8)	8 (6.4)		19 (10.3)	13 (12.8)		14 (22.6)	17 (7.6)		13 (8.4)	19 (14.4)
10–15 mins	121 (42.2)	65 (40.1)	56 (44.8)		83 (44.9)	38 (37.3)		28 (45.2)	93 (41.5)		57 (36.8)	64 (48.5)
16–30 mins	111 (38.7)	64 (39.5)	47 (37.6)		68 (36.8)	43 (42.2)		17 (27.4)	94 (42.0)		66 (42.6)	45 (34.1)
30+ mins	23 (8.0)	9 (5.6)	14 (11.2)		15 (8.1)	8 (7.8)		3 (4.8)	20 (8.9)		19 (12.3)	4 (3.0)
Vitals												
Mean overall rating	4.08 ± 1.16	4.11 ± 1.46	4.04 ± 0.57	0.64	3.98 ± 0.61	4.27 ± 1.77	0.04	4.07 ± 0.68	4.08 ± 1.26	0.93	3.89 ± 0.63	4.33 ± 1.58
Mean no. of ratings	34.9 ± 31.3	32.9 ± 27.1	37.6 ± 36.1	0.20	33.7 ± 33.4	37.3 ± 27.0	0.35	24.6 ± 20.1	37.5 ± 33.1	0.005	35.9 ± 29.8	33.6 ± 33.2
Mean no. of comments	11.8 ± 16.1	10.3 ± 10.8	13.7 ± 21.1	0.08	11.6 ± 18.1	12.2 ± 11.6	0.75	7.65 ± 7.42	12.9 ± 17.5	0.03	12.9 ± 17.9	10.4 ± 13.4
Castle Connolly				0.47			0.62			0.17		0.10
No	257 (87.4)	148 (88.6)	109 (85.8)		163 (86.7)	94 (86.7)		51 (82.3)	205 (88.7)		137 (84.6)	120 (90.9)
Yes	37 (12.6)	19 (11.4)	18 (14.2)		25 (13.3)	12 (11.3)		11 (17.7)	26 (11.3)		25 (55.1)	12 (9.1)

Data are presented as n (%) unless otherwise indicated. Means are presented with SDs. Boldface type indicates statistical significance ($p < 0.05$). Statistical significance was determined by means of chi-square for categorical variables (frequencies) and ANOVA for continuous variables (means). Social media presence is defined for purposes of this study as having a Facebook, Twitter, or Instagram account appearing in the first 10 Google search results. Some surgeons were not located on certain online review sites.

TABLE 4. Bivariate linear regression of Healthgrades, Vitals, and Google overall ratings

Variable	Healthgrades Overall Rating		Vitals Overall Rating		Google Overall Rating	
	AD (95% CI)	p Value	AD (95% CI)	p Value	AD (95% CI)	p Value
Age	-0.03 (-0.04 to -0.02)	<0.0001	-0.03 (-0.04 to -0.01)	<0.0001	-0.02 (-0.03 to -0.01)	0.0004
Degree						
MD	0		0		0	
DO	0.01 (-0.42 to 0.45)	0.95	-0.05 (-0.70 to 0.59)	0.87	-0.04 (-0.65 to 0.58)	0.91
Training						
Ortho	0		0		0	
Neuro	0.14 (-0.07 to 0.34)	0.17	0.29 (0.01 to 0.57)	0.04	-0.02 (-0.30 to 0.26)	0.89
Practice						
Academic	0		0		0	
Private	-0.23 (-0.46 to 0)	0.05	0.02 (-0.03 to 0.35)	0.93	-0.23 (-0.57 to 0.11)	0.18
Graduation yr						
<2000	0		0		0	
≥2000	0.49 (0.31–0.67)	<0.0001	0.43 (0.17–0.70)	0.001	0.34 (0.08–0.61)	0.01
Website						
None	0		0		0	
Institution	0.73 (0.39–1.08)	<0.0001	0.45 (-0.01 to 0.92)	0.05	0.76 (0.19–1.33)	0.009
Personal	0.60 (0.16–1.03)	0.007	0.36 (-0.24 to 0.96)	0.24	0.84 (0.17–1.50)	0.01
Both	0.53 (0.12–0.95)	0.01	0.36 (-0.22 to 0.94)	0.22	0.72 (0.07–1.37)	0.03
Facebook						
No	0		0		0	
Yes	-0.02 (-0.22 to 0.17)	0.81	-0.02 (-0.30 to 0.25)	0.87	0.04 (-0.23 to 0.31)	0.76
Twitter						
No	0		0		0	
Yes	-0.03 (-0.33 to 0.28)	0.86	-0.17 (-0.60 to 0.26)	0.44	-0.24 (-0.65 to 0.17)	0.25
Instagram						
No	0		0		0	
Yes	0.32 (-0.25 to 0.89)	0.27	0.10 (-0.71 to 0.92)	0.80	0.02 (-0.70 to 0.75)	0.95
Any social media						
No	0		0		0	
Yes	-0.05 (-0.24 to 0.14)	0.58	-0.07 (-0.34 to 0.21)	0.64	0.07 (-0.20 to 0.34)	0.60
Google						
No. of ratings	0.01 (0–0.02)	0.13	0.01 (-0.02 to 0.03)	0.63	0.005 (-0.01 to 0.02)	0.57
No. of comments	0.01 (0–0.02)	0.16	0.01 (-0.02 to 0.03)	0.58	0.004 (-0.01 to 0.02)	0.65
Healthgrades						
No. of ratings	0.004 (0–0.01)	0.01	0.002 (-0.003 to 0.01)	0.50	0.001 (-0.003 to 0.01)	0.64
No. of comments	0.03 (0.01–0.04)	<0.0001	0.03 (0.01–0.05)	0.002	0.02 (0–0.03)	0.04
Care philosophy						
Not listed	0		0		0	
Listed	0.33 (0.14–0.52)	0.0005	0.09 (-0.18 to 0.36)	0.53	0.25 (-0.02 to 0.51)	0.07
Wait time						
0–10 mins	0		0		0	
10–15 mins	-0.62 (-0.94 to -0.31)	0.0001	-0.20 (-0.69 to 0.29)	0.43	-0.07 (-0.65 to 0.50)	0.80
16–30 mins	-1.16 (-1.48 to -0.84)	<0.0001	-0.17 (-0.67 to 0.32)	0.49	-0.17 (-0.74 to 0.41)	0.57
31+ mins	-1.47 (-1.88 to -1.06)	<0.0001	-0.56 (-1.21 to 0.09)	0.09	-0.33 (-1.06 to 0.39)	0.37
Vitals						
No. of ratings	0.002 (-0.001 to 0.005)	0.31	-0.001 (-0.01 to 0.003)	0.57	0.0001 (-0.004 to 0.004)	0.97
No. of comments	0.004 (0–0.01)	0.21	-0.001 (-0.01 to 0.01)	0.90	0.001 (-0.007 to 0.009)	0.77

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TABLE 4. Bivariate linear regression of Healthgrades, Vitals, and Google overall ratings

Variable	Healthgrades Overall Rating		Vitals Overall Rating		Google Overall Rating	
	AD (95% CI)	p Value	AD (95% CI)	p Value	AD (95% CI)	p Value
<i>Vitals (continued)</i>						
Castle Connolly						
No	0		0		0	
Yes	-0.03 (-0.31 to 0.25)	0.82	-0.04 (-0.44 to 0.37)	0.86	0.10 (-0.29 to 0.48)	0.62

AD = absolute difference.

Social media presence defined as having a Facebook, Twitter, or Instagram account located in the first 10 Google search results; boldface type indicates statistical significance ($p < 0.05$).

factors that patients admire. While maybe seeming trivial 10 years ago, social media are just as deeply incorporated into the professional world as corporate websites, and social media outreach helps organizations and providers communicate and interact with clients. We found that those with social media were also more likely to have a personal website than those without social media. This correlation might indicate that those attempting to market themselves using a personal website would also be the surgeons using social media as a marketing platform.

Interestingly, we noted an increase in the number of total comments on Healthgrades for those physicians with

social media accounts. It is possible that surgeons using social media to interact with patients are also the same ones asking patients to share their experiences online compared to those without social media. These physicians were also more likely to have personalized their Healthgrades accounts with a “care philosophy” giving insight into what drives their practice. These findings indicate that physicians with social media accounts are more “cyber” engaged with their patients, a trait that needs future study. Even so, presence (or absence) of a public social media account did not affect the overall physician rating on any of the review sites studied. This may indicate that the reviews

TABLE 5. Multivariable linear regression of Healthgrades, Vitals, and Google overall ratings

Variable	Healthgrades Overall Rating		Vitals Overall Rating		Google Overall Rating	
	AD (95% CI)	p Value	AD (95% CI)	p Value	AD (95% CI)	p Value
Age	-0.02 (0.03 to -0.01)	0.004	-0.03 (-0.05 to -0.01)	0.008	-0.02 (-0.04 to -0.001)	0.04
Training						
Ortho	—		0		—	
Neuro	—	—	0.30 (0.02–0.58)	0.04	—	—
Graduation yr						
<2000	0		0		0	
≥2000	-0.05 (-0.31 to 0.21)	0.70	-0.12 (-0.57 to 0.33)	0.60	-0.09 (-0.53 to 0.35)	0.69
Website						
None	0		—		0	
Institution	0.61 (0.31–0.91)	<0.0001	—	—	0.49 (-0.10 to 1.07)	0.10
Personal	0.46 (0.09–0.84)	0.01	—	—	0.59 (-0.09 to 1.27)	0.09
Both	0.46 (0.09–0.82)	0.01	—	—	0.45 (-0.21 to 1.11)	0.18
Healthgrades						
No. of ratings	-0.001 (-0.01 to 0.003)	0.80	—	—	—	—
No. of comments	0.01 (-0.01 to 0.03)	0.17	0.02 (0–0.04)	0.06	0.01 (-0.01 to 0.02)	0.48
Care philosophy						
Not listed	0		—	—	—	—
Listed	0.08 (-0.09 to 0.25)	0.35	—	—	—	—
Wait time						
0–10 mins	0	—	—	—	—	—
10–15 mins	-0.74 (-1.03 to -0.45)	<0.0001	—	—	—	—
16–30 mins	-1.18 (-1.47 to -0.89)	<0.0001	—	—	—	—
31+ mins	-1.34 (-1.72 to -0.96)	<0.0001	—	—	—	—

Boldface type indicates statistical significance ($p < 0.05$).

on these sites are based on physician ability and personality and less on marketing outreach.

Another effective way to market oneself online is through the use of a personal or institutional website. Websites allow physicians to tailor what information a prospective patient sees and better advertise their skill set as to what conditions they typically manage. In a bivariate model, we found that being easily accessible on your institutional website was correlated with an increase in all 3 physician review site ratings. These findings held true in a multivariate model for Healthgrades. It may be that patients are better able to find a physician who fits their needs when searching online, leading to higher ratings for these physicians.

Our group also investigated the effect of physician age on patient reviews online. Curry et al. found that 51% of orthopedic patients use social media, and of those who do not, 92% were above the age of 40.³ Another study of Internet review trends for surgeons reported that those who have been in practice for less than 10 years were reviewed more often than those who have been in practice longer.⁹ In our study, we found this correlation to hold true on Healthgrades, but it was statistically insignificant for the other 2 review sites. To separate our cohort based on experience, we compared those who graduated from residency before the year 2000 with those graduating during or after 2000. Interestingly, those in the prior-to-2000 cohort on average had lower overall ratings across all 3 review sites as well as longer wait times in a bivariate model ($p < 0.05$), but this significance was lost in multivariate analysis. One potential explanation of favorable ratings associated with more recent graduates is the encouragement of those with favorable outcomes to leave a review online to further boost the physician's appearance.

A "care philosophy" is a way for physicians to personalize their Healthgrades page and potentially target a specific patient population. Younger physicians were more likely than older physicians to post a "care philosophy" on Healthgrades, again showing a likely desire to interact with their patients and indirectly help market their young career. In a bivariate model, having a posted care philosophy is associated with an increased Healthgrades score. It is unclear whether the posted care philosophy has any impact on patients selecting a care provider, but it can be argued that this customization may influence a patient to later leave a rating, knowing that the surgeon has similarly valued this review site.

The single most predictive factor for the surgeons' overall rating on Healthgrades was patient-reported wait times, with longer times being associated with worse scores. Similar studies evaluating physician online reviews found similar results of increasing wait time correlating with a decreasing online rating.^{1,12,15} Trehan et al. found that negative reviews are more likely to be caused by surgeon-independent factors, while positive reviews were more likely to be due to the surgeon's ability.¹⁴ Factors such as wait time, staff friendliness, and office environment are important to maintain in order to avoid poor reviews online. Of course the surgeon's clinic wait time likely has little correlation with his or her outcomes, which should really be the driver of online scores. Even so, decreasing patient wait times

FIG. 1. Pearson correlation scatterplots. **A:** Healthgrades versus Vitals ($r = 0.34$, 95% CI 0.23–0.44, $p < 0.0001$). **B:** Healthgrades versus Google ($r = 0.37$, 95% CI 0.24–0.47, $p < 0.0001$). **C:** Vitals versus Google ($r = 0.15$, 95% CI 0.02–0.28, $p = 0.03$). v = versus. Figure is available in color online only.

should be a priority for any physician, as it may negatively affect one's perception online. Other studies should further evaluate the impact of comment types and reported outcomes with online scores.⁴

The ratings on Healthgrades, Vitals, and Google were all found to be significantly positively correlated. To date, our group is the first to compare ratings for both neurosurgeon and orthopedic surgeons practicing on the spine on all 3 of these websites. The general agreement of physician ratings across these 3 separate platforms lends validity to our findings and generalizability to our results across these 3 websites.

One of the limitations of our study is that the results may not be applicable to spine surgeons in other geographic regions. We also reviewed only spine surgeons who had registered with NASS and reported their practice to be in our studied region. We therefore relied on surgeons updating their profile with current practice locations. Those who registered many years prior and have not yet updated their profile since moving into our studied region were not included. We also cannot confirm that the patients were even aware of a surgeon's social media account, but would argue that surgeons with a public social media are probably also promoting their practice in additional ways not fully captured in this review. Additionally, while we chose the review websites based on these three being seen as very reputable, there are other online review sites that potentially are more indicative of patient engagement and satisfaction. Ratings may also be affected by patient variables such as age and insurance status.⁷ It may also benefit all parties if review sites listed certain demographic parameters about the reviewer. Another limitation is for surgeons with few reviews in that they lack a critical mass at which a fair overall score should be determined. For example, one negative review may skew the overall review for a physician who has few reviews versus one who has many.¹¹ It is also unclear if all of the posted reviews were performed by actual patients. It is feasible that competitors or patient family members may maliciously post negative reviews. In subsequent studies one could examine the actual patient reviews collected by insurance agencies, which would verify that the reviews were from treated patients.

Conclusions

Our study demonstrates that online physician interaction, in the form of Web presence, may have a positive impact on review site scores, and therefore, overall physician perception. At first glance, these results may demonstrate a push toward increased online presence and focus; however, the association between increasing review scores and shorter wait times also reiterates the value of the physical doctor-patient relationship, even in this digital age. A balance between Internet presence and clinic efficiency appears to be crucial in maintaining high patient satisfaction and may be the key to physician success in the ever more digitized medical landscape.

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Author Contributions

Conception and design: Donnally, Rush, Wang. Acquisition of data: McCormick, Li, Maguire, Barker. Analysis and interpretation of data: McCormick, Li, Maguire, Barker, Rush. Drafting the article: Donnally, McCormick, Rush. Critically revising the article: Donnally, McCormick, Rush, Wang. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Donnally. Statistical analysis: Donnally. Administrative/technical/material support: Donnally. Study supervision: Donnally, Rush, Wang.

Correspondence

Chester J. Donnally III: University of Miami Hospital, Miami, FL. chester.donnally@jhsMiami.org.