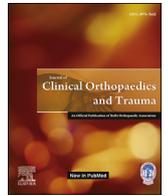




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## Use of a custom website by orthopaedic sports medicine surgical patients: If you build it, will they come?



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### ABSTRACT

**Background:** Internet use is nearly ubiquitous, and orthopaedic patients are increasingly utilizing the Internet for medical information. The quality of resources available to patients is variable, and patients may benefit from physician guidance. A recent study showed only 11% of orthopaedic trauma patients accessed a custom-designed website developed by a physician. The purpose of this study was to determine whether orthopaedic sports medicine patients would use a custom-designed website and what factors would be associated with website use.

**Methods:** A prospective study was conducted of patients undergoing eight common orthopaedic sports medicine procedures from April 2017 to December 2017. 108 patients were enrolled and provided access to the website that allowed tracking of each patient's website use. The sports medicine cohort was compared to a previously published trauma cohort using the same methodology in a similar population at the same institution. The custom-designed website was replicated from the previous trauma study, but with the patient information now focused on sports medicine conditions and procedures. Patients' access to the website, tracking of website use, data collection, and analysis was identical to the previous trauma cohort. Bivariate and multivariate analyses were performed to determine which patient factors were associated with website use.

**Results:** 33 orthopaedic sports medicine patients (31%) accessed the website, and of those, 96% found the website helpful or very helpful. Orthopaedic sports medicine patients were nearly 3 times more likely to use the designated website than orthopaedic trauma patients (31% vs. 11%;  $p = 0.0004$ ). Higher education predicted website use ( $p = 0.006$ ). Age, gender, race, employment status, and household income were not predictive of use ( $p = 0.49, 0.27, 0.23, 0.15, 0.58$ ; respectively). Anterior cruciate ligament (ACL) reconstruction was associated with website use as compared to meniscus and cartilage surgery (42% vs. 20%;  $p = 0.037$ ). Nominal logistic regression analysis confirmed higher level of education ( $p = 0.00001$ ) and ACL reconstruction ( $p = 0.0005$ ) independently predicted website use.

**Conclusion:** Orthopaedic sports medicine surgical patients are more likely to use a custom-designed informational website than orthopaedic trauma patients. However, only 31% of sports medicine patients accessed the website. Inherent differences between groups may account for the differences in website use. Higher level of education is predictive of website use, as is ACL reconstruction for knee surgery patients. Physicians should work to direct patients to high quality Internet resources given the vast amount of potentially unreliable information available.

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## 1. Introduction

Internet use has become nearly ubiquitous in the United States with 88% of adults using the Internet in 2016.<sup>1</sup> The reports of Internet usage by orthopaedic patients as a source of medical information are variable, but in recent years have ranged from 44 to

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65%.<sup>2–5</sup> Given the prevalence of patient use of the Internet, it is important to have reliable and accurate information available. The quality of the information accessed on the Internet is poor across multiple subspecialties of orthopaedics, and the reading level is frequently higher than the average patient's reading level.<sup>6–9</sup> Sports medicine patient information studies on anterior cruciate ligament reconstruction, elbow ulnar collateral ligament reconstruction, and hip arthroscopy have found similar low quality of the information.<sup>10–12</sup>

In addition to the high rates of Internet use, multiple studies have shown that patients find it useful and important to have Internet-based medical information.<sup>2,13,14</sup> Most patients are open to being directed to or provided with appropriate Internet resources, but many patients are distrustful of the information they find on the Internet.<sup>15</sup> Studies have shown nearly universal interest in being provided an Internet-based informational resource.<sup>5,16</sup>

Despite this interest, little is known if such a website would be successful. A previous report in the trauma population demonstrated that only 11% of patients utilized a provided resource, despite 95% stating they would use the website.<sup>16</sup> The purpose of this study was to determine whether orthopaedic sports medicine surgical patients would use a designated custom-designed informational website, and which factors are associated with website usage. Our hypothesis is that orthopaedic sports medicine patients will use a custom-designed informational website more than orthopaedic trauma patients.

## 2. Methods

We conducted a prospective cohort study of patients undergoing eight common orthopaedic sports medicine procedures by one of two Sports Medicine fellowship-trained faculty surgeons at an academic medical system from April 2017 to December 2017. The institutional review board approved the study (HP-00054288), and all patients provided informed consent. Patients were offered enrollment in the study after electing operative intervention for anterior cruciate ligament (ACL) tear, meniscus tear, articular cartilage injury, patellar instability, shoulder instability, acromioclavicular joint injury, subacromial bursitis or impingement, or rotator cuff tear. Inclusion criteria included age 18 years or older, English speaking, ability to consent, and electing one of the above procedures. Exclusion criteria included non-English speaking, age less than 18 years, and unwilling to consent or participate.

Enrolled patients completed a preoperative survey of demographics, Internet use, type of device used to access the Internet, and intent to use the provided website. Patients were given a keychain with a unique access code and the web address to our website. Patients were encouraged to use the website, but were not reminded to do so after enrollment. Patients were allowed access to the website from the time of enrollment in the study until at a minimum of 3 months postoperatively. A custom-designed website was created by one of our authors and included information from our institutional website and the American Academy of Orthopaedic Surgeons patient information website. The website contained information about the surgeons, anatomy, conditions and procedures, postoperative rehabilitation, and frequently asked questions. Patients completed a postoperative survey of their use and opinion of the provided website, as well as any other Internet sources used.

Data was collected on the patients' use of the website, including number of visits, webpages viewed, and time spent on the website. User interaction was determined with a novel Asynchronous Java Script and XML technique as developed by one of our authors to make a connection between the participant and our web server. The connection was ended when the participant navigated away

from the website or closed the web browser. The participants' information was not linked from web browsing history for privacy. Browser cookies, Java applets and executable files on the participants' web device were not used.

The surgical sports medicine cohort was compared to the previously published trauma cohort using the same methodology in a similar population at our institution.<sup>16</sup> The custom-designed website for this study was the same as the previously published trauma cohort, but with patient information now focused on sports medicine conditions instead of trauma conditions. Methodology was the same between studies with regards to providing the patients access to the website preoperatively, subsequently tracking the rates of use, data collection, and analysis. The patient cohorts were both drawn from the same urban, academic medical system.

Based on the 11% website use by orthopaedic trauma patients, a sample size of 102 patients would be required to detect at least 15% greater website use with alpha 0.05 and power of 80%. 113 patients were screened for enrollment in the study. 108 patients were eligible and enrolled (96% of eligible patients). Two were not undergoing one of the eight specific procedures that were included, two declined participation, and one was non-English speaking. All patients completed the preoperative survey. 80 of the 108 patients (74%) completed the postoperative survey.

Statistical software JMP Pro, Version 13 software (JMP®, Version 13. SAS Institute Inc., Cary, North Carolina) and GraphPad QuickCalcs (GraphPad Software, ©2018, La Jolla, California) were used for analyses. Descriptive statistics (mean, standard deviation, and frequency) were used to summarize all study variables. Patients who accessed the website were compared to those who did not. Then, the surgical sports medicine cohort was compared to the previously published trauma cohort using the same methodology in a similar population at our institution.<sup>16</sup> Categorical data was analyzed using the Fisher's Exact test (for expected values less than 5) and the Pearson Chi-square test for larger values. Continuous data was analyzed using the Student's t-test. Multivariate analysis was performed using a nominal logistic regression analysis to assess for possible confounding and determine significant independent predictors of website use. Variables considered clinically significant (*a priori*) included age, gender, race, highest level of education, household income, device used to access the Internet, and injury or condition.

## 3. Results

The mean age was 35.6±13.8 years (Table 1). 66% of the study population were male and 34% were female. 50% were Caucasian, 25% were African American, 12% were Hispanic, and 8% were Asian. There were no statistically significant differences between those who used the website and those who did not with regards to age, gender, race, employment status, and household income (Table 1). When comparing all 5 groups of education level, those with higher level of education had a significantly greater use of the provided website ( $p = 0.006$ ).

The most common procedures were meniscus surgery (31%), ACL reconstruction (25%), combined ACL and meniscus or cartilage surgery (15%), and cartilage surgery (7%) (Table 2). There was no statistically significant difference in website usage based on procedure when analyzing all the procedures ( $p = 0.29$ ). However, when comparing ACL reconstruction patients with meniscus and cartilage knee surgeries, ACL reconstructions patients were more likely to utilize the website (42% vs 20%;  $p = 0.022$ ).

There was no significant difference in usage of the provided website based on Internet access, device used, or prior Internet use for medical information (Table 3). 101 patients (98%) reported having access to the Internet to research their medical information.

**Table 1**  
Demographics and socioeconomic status.

	N (%)	Visited Website	Did Not Visit Website	p-value
<b>Total Number of Patients Enrolled</b>	108	33 (31%)	75 (69%)	
<b>Mean Age, Years (+/- SD)</b>	35.6 (±13.8)	34.2 (±13.2)	36.2 (±14.1)	0.49
<b>Gender</b>				
Male	71 (66)	19	52	0.27
Female	37 (34)	14	23	
<b>Race</b>				
Caucasian	51 (50)	19	32	0.23
African American	26 (25)	6	20	
Hispanic	12 (12)	2	10	
Asian	8 (8)	2	6	
Other	5 (5)	3	2	
<b>Highest Level of Education</b>				
Graduate degree or higher	16 (16)	10	6	<b>0.006</b>
Bachelor's degree	23 (23)	9	14	
Associate's degree or some college	40 (39)	11	29	
High school graduate	20 (20)	1	19	
Did not graduate high school	3 (3)	1	2	
<b>Employment Status</b>				
Employed	72 (73)	24	48	0.15
Unemployed/Seeking Employment	17 (17)	3	14	
Disabled	5 (5)	0	5	
Retired	4 (4)	2	2	
Homemaker	1 (1)	1	0	
<b>Total Household Income</b>				
\$100,000 or more	41 (40)	17	24	0.57
\$75,000–99,999	9 (9)	2	7	
\$50,000–74,999	18 (18)	6	12	
\$25,000–49,999	22 (22)	4	18	
Less than \$25,000	12 (12)	3	9	

**Table 2**  
Association between condition and designated website use.

	N (%)	Visited Website	Did Not Visit Website	p-value	
<b>All Conditions</b>					
Meniscus tear	34 (31)	8	26	0.29*	
ACL tear	27 (25)	9	18		
Combined ACL and meniscus or cartilage	16 (15)	9	7		
Knee articular cartilage injury	8 (7)	0	8		
Shoulder instability	7 (6)	2	5		
AC joint injury, subacromial bursitis, or impingement	5 (4)	2	3		
Combined meniscus and cartilage	4 (4)	1	3		
Rotator cuff tear	3 (3)	1	2		
Patellar instability	3 (3)	1	2		
Shoulder instability and rotator cuff tear	1 (1)	0	1		
<b>Knee Conditions</b>					
ACL	43 (40)	18	25		<b>0.022**</b>
Meniscus or Cartilage	46 (43)	9	37		

Cell phone was the most common device used to access the Internet (48%), followed by laptop computer (37%), and desktop computer (12%). 95% of patients reported previous use of the Internet for medical information. Prior to the preoperative visit, 80 patients (78%) used the Internet for information on their condition or injury, and 53 patients (51%) searched for information on their surgeon. 101 patients (94%) stated that they would use our provided custom-designed informational website.

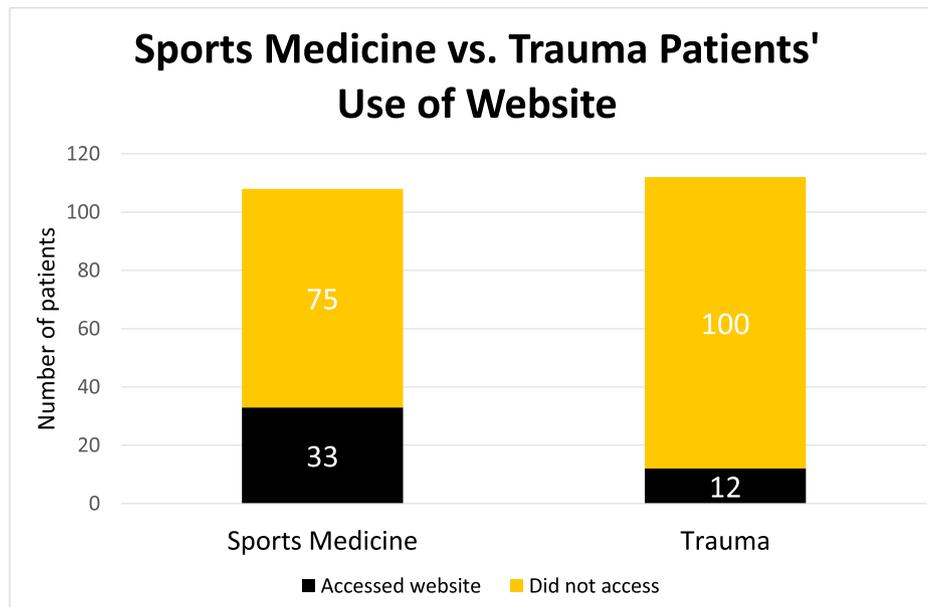
Orthopaedic sports medicine patients used the website at a significantly greater rate than the previously reported orthopaedic trauma patients (31% vs. 11%,  $p = 0.0005$ ) (Fig. 1). 33 patients (31%) accessed the provided website at least once (Table 4). Of these, 14 patients used the website more than once. 516 webpages, other than the home page, were visited. The average number of webpages

viewed per visitor was 7.8 webpages ( $\pm 7.2$  webpages), and the average time spend per webpage was 1 min and 19 s. The most frequently accessed pages were Information “Body Area: Knee” (15%), “Frequently Asked Questions” (13%), “Rehabilitation Protocols” (8%), and “Information About the Surgeon” (8%). The most common “Frequently Asked Questions” were what to do when the office was not open for questions, when are sutures removed, when to shower or bathe, what does weight bearing mean, and when able to fly on an airplane.

80 patients (74%) completed the postoperative follow-up survey. There were no differences between those who completed the postoperative survey and those who did not with regards to demographics, procedure, and Internet use. On the postoperative survey, 36 patients (47%) reported using other sources on the

**Table 3**  
Baseline internet use prior to study.

	N (%)	Visited Website	Did Not Visit Website	p-value*
<b>Access to the Internet</b>				
Yes	101 (98)	31	70	0.53
No	2 (2)	1	1	
<b>Device used for access</b>				
Cell phone	49 (48)	15	34	0.22
Laptop computer	38 (37)	14	24	
Desktop computer	12 (12)	1	11	
Tablet	3 (3)	1	2	
<b>Used Internet in the past for medical information</b>				
Yes	97 (95)	32	65	0.32
No	5 (5)	0	5	
<b>Used Internet prior to visit to research current condition</b>				
Yes	80 (78)	27	53	0.32
No	23 (22)	5	18	
<b>Used Internet prior to visit to research the surgeon</b>				
Yes	53 (51)	17	36	0.83
No	50 (49)	15	35	
<b>Do you plan to use the provided informational website</b>				
Yes	101 (99)	32	69	1.00
No	1 (1)	0	1	

**Figure 1.** Sports medicine versus trauma patients' use of provided informational website. \* $p = 0.0004$ ; Fisher's exact.**Table 4**  
Perioperative usage of the provided website.

	N (%)
<b>Total number of patients accessing the website</b>	33 (31)
Number of patients visiting more than once	14 (13)
<b>Total number of webpages viewed (other than home page)</b>	516
<b>Specific webpages viewed:</b>	
Information "Body Area: Knee"	78 (15)
Frequently Asked Questions	69 (13)
Rehabilitation Protocols	39 (8)
Information About the Surgeon	39 (8)
Study Information and Consent Form	15 (3)
Information "Body Area: Shoulder"	14 (3)
Information "Knee Arthroscopy"	14 (3)
Information "ACL Tear"	11 (2)
<b>Average number of webpages viewed per visit</b>	7.8 ( $\pm 7.2$ )
<b>Average time spent per webpage</b>	1 min, 19 s

Internet, whereas 41 patients (53%) did not. Google (29%), Wikipedia (24%), and WebMD (22%) were the most common other websites viewed (Table 5). Among the patients who used the provided website, the reviews were positive. 96% of patients reported the website was helpful or very helpful (Table 5). Regarding how likely one would be to recommend the website, patients reported an average of 7.6 points on a scale of 1–10 with 1 being least likely and 10 being most likely. Only 28% thought there was information missing from the website. The most common reasons for not using the provided website were forgetting the website was available to them (59%), not having time to access the website (26%), and losing the access code (21%).

Nominal logistic regression analysis confirmed that higher level of education independently predicted website use ( $p < 0.05$ ). ACL reconstruction, as compared to meniscus and cartilage surgery, was also confirmed on multivariate analysis to be predictive of website use ( $p < 0.05$ ).

**Table 5**  
Postoperative assessment of internet usage.

	N (%)
<b>How helpful was the provided website</b>	
Very helpful	13 (30)
Helpful	29 (66)
Not helpful	2 (5)
<b>How likely (1–10) are you to recommend the provided website, mean (+/– SD)</b>	7.6 (±2.3)
<b>Was there information that you wish were included</b>	
Yes	12 (28)
No	31 (72)
<b>Did you use other sources on the Internet</b>	
Yes	36 (47)
No	41 (53)
<b>What other sources did you use (multiple responses allowed)</b>	
Google	13 (29)
Wikipedia	11 (24)
WebMD	10 (22)
Mayoclinic.org	5 (11)
MedlinePlus	3 (7)
Other	8 (18)
<b>Why did you not use the provided website (multiple response allowed)</b>	
Forgot	20 (59)
Did not have time	9 (26)
Lost access code	7 (21)
Other	6 (18)

#### 4. Discussion

This study found that orthopaedic sports medicine surgical patients used a designated custom informational website nearly three times more than the previously reported orthopaedic trauma cohort,<sup>16</sup> confirming our hypothesis. However, only 31% of patients in this surgical sports medicine cohort accessed the website. Patients who accessed the website found it useful and spent significant time reviewing the informational material. A higher level of education was associated with website usage, but otherwise demographics and previous Internet use did not predict website use. Within the group undergoing knee surgery, ACL reconstruction was associated with increased website use. Multivariate analysis confirmed these two variables were independent predictors of website use.

Matuszewski et al. enrolled 112 patients with acute operative fractures and 11% used their provided custom-designed website.<sup>16</sup> This investigation was performed at our institution, drawing from a similar patient population, utilizing the existing website framework modified for sports medicine surgical patients. Interestingly, a similarly high number of patients reported interest in using a custom website in both studies (95% trauma and 99% sports medicine). This is the first study to compare the use of a designated informational Internet resource for orthopaedic information between subspecialties. The increased use of the website by orthopaedic sports medicine surgical patients may be attributable to the elective nature of the surgeries. Elective patients may inherently be more committed to researching their injury or condition. It is also possible that age or socioeconomic status plays a role, but in this study only higher level of education, and neither age nor other socioeconomic factors, were associated with website use.

We also found overall higher rates of Internet access and use for medical information than what has been previously reported in the literature. According to the Pew Research Center, 88% of adults in the United States use the Internet,<sup>1</sup> but 98% of our patients reported having Internet access. Additionally, 95% of our patients reported using the Internet at some point in the past for medical information, and 78% had used the Internet to research their current condition or injury. This is in comparison to the reported rates of Internet use for medical information in the orthopaedic literature

of 20–65%.<sup>2–5,17</sup> Most recently, Tyrrell Burrus et al. reported 65% of patients used the Internet for medical information and Rao et al. found 45%.<sup>2,18</sup> The difference may be explained by the fact that our cohort is specifically surgical patients, who may be more inclined to research their condition or surgery on the Internet than a general orthopaedic clinic patient population.

Orthopaedic patients have high rates of Internet use for medical information, but lower rates of use of a designated custom-designed website in both this study and the previous trauma study.<sup>16</sup> These patients expressed an interest in being provided with the appropriate resource, but their actual use of the website was limited. There is a plethora of patient information available on the Internet, but many websites are not reliable.<sup>6–9</sup> It is important for physicians to try to direct patients to high quality websites that provide good information because patient education has the potential to improve outcomes and patient satisfaction. In a similar effort, a randomized controlled trial assessed patient knowledge and satisfaction after being provided an informational website to assist in the informed consent process.<sup>19</sup> The patients provided with the resource showed improvement in knowledge and satisfaction. In contrast, Fanjiang et al. provided patients with a web-based physician data resource to assist in choosing a primary care physician and found only 17% visited the website.<sup>20</sup> There may be a role in focusing website design around preoperative information rather than postoperative as 78% of our patients had researched their condition online prior to being evaluated in our clinic and enrolling in our study, as compared to the 31% who used our website after evaluation and enrollment. This early focus may have benefits with regards to patient understanding, as well as marketing.

This study has several limitations. We enrolled orthopaedic sports medicine patients presenting to one sports medicine practice at an urban academic health system. This is a diverse socioeconomic group that may not be applicable to all patient populations. This diversity is important to provide a broad description of Internet use, and this may be a population that would benefit the most from additional information. In the comparison of sports medicine and trauma patients, it must be considered that these are different patient profiles and inherent differences in the patients may account for the different rates of

website use. Logistical barriers to access the website could potentially account for the low utilization. Patients were required to log into the website using a unique access code, and many patients forgot that the website was available or lost the access code key-chain. It is also possible that the approach to preoperative counseling may be thorough enough that additional information is unnecessary for many patients, but we certainly do not believe that to be the case.

## 5. Conclusions

Orthopaedic sports medicine surgical patients are more likely to use a designated website than trauma patients. Inherent differences in these patient groups may account for the different website use rates. Higher level of education is predictive of website use, as is ACL reconstruction for knee surgery patients. Patients are receptive to Internet-based information and those that used the website found it to be very successful. Physicians should work to direct patients to high quality Internet resources given the vast amount of potentially unreliable information available.

## Disclosures and Declaration of competing interest

MPS, ET, SK, VN have no disclosures. SJM is a board or committee member of AOSSM. PEM has received research support from Stryker. JDP is a board or committee member of AAOS and AOSSM. RFH has received research support from Arthrex, Inc.

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## Approval

This study was approved by the Institutional Review Board (IRB) Committee at the University of Maryland, Baltimore (HP-00054288).

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