



Online patients questions regarding reverse total shoulder arthroplasty pertain to timeline of recovery, specific activities, and limitations

Kyle K. Obana, MD^{a,*}, Dane R.G. Lind, BA^b, Andrew J. Luzzi, MD^a,
Michaela J. O'Connor, MD^a, Matthew R. LeVasseur, MD^a, William N. Levine, MD^a

^aDepartment of Orthopaedic Surgery, New York-Presbyterian Hospital/Columbia University Medical Center, New York, NY, USA

^bCenter for Regenerative and Personalized Medicine, Steadman Philippon Research Institute, Vail, CO, USA

ARTICLE INFO

Keywords:

rTSA
Joint replacement
Surgery
Internet
Online
Google

Level of evidence: Survey Study; Web-Based

Background: Reverse total shoulder arthroplasty (rTSA) demonstrates favorable long-term data and has outpaced anatomic total shoulder arthroplasty and hemiarthroplasty as the most-performed shoulder arthroplasty procedure. As indications and outcomes continue to favor rTSA, patients may turn to the internet as an efficient modality to answer various questions or concerns. This study investigates online patient questions pertaining to rTSA and the quality of the websites providing information.

Hypotheses: (1) Questions will pertain to surgical indications, timeline of recovery, and postoperative restrictions; (2) the quality and transparency of online information is largely heterogenous.

Methods: Three rTSA searches were entered into the Google Web Search. Questions under the "People also ask" tab were expanded sequentially and 100 consecutive results for each query were included for analysis (300 in total). Questions were categorized based on Rothwell's Classification and subcategorized by topic. Websites were categorized by source. Website quality was evaluated by the Journal of the American Medical Association (JAMA) Benchmark Criteria.

Results: Most questions fell into the Rothwell Fact category (49.7%). The most common question topics were Timeline of Recovery (17.3%), Specific Activities (14.7%), and Restrictions (11.3%). The least common question topics were Anatomy/Function (0.0%), Cost (0.3%), and Diagnoses/Evaluation (0.3%). The most common websites were Medical Practice (45.0%), Academic (22.3%), and Single Surgeon (12.3%). PubMed articles consisted of 41.2% of Government websites. The average JAMA score for all websites was 1.48 ± 1.27 . Government websites had the highest JAMA score (3.11 ± 1.01) and constituted 55.9% of all websites with a score of 4/4. Medical Practice websites had the lowest JAMA score (0.99 ± 0.91).

Conclusion: Patients are interested in the timeline of recovery, ability to perform specific activities after surgery, and short-term and long-term restrictions following rTSA. Although all patients will benefit from education on ways to perform activities of daily living while abiding by postoperative restrictions, physicians should set preoperative expectations regarding return-to-activity following rTSA in younger, more active patients. Finally, surgeons should provide patients with physical booklets and online information available on their websites to avoid reliance on low-quality online sources.

© 2024 The Author(s). Published by Elsevier Inc. on behalf of American Shoulder and Elbow Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

The reverse total shoulder arthroplasty (rTSA) was initially approved for cuff tear arthropathy or failed anatomic total shoulder arthroplasty with a deficient rotator cuff. Due to the difficulty of subsequent revision, it was viewed as a salvage procedure, and a large proportion of early patients had undergone prior shoulder

surgery and received older prostheses. Thus, early data were biased with high complication rates and poor clinical outcomes.^{8-10,13,38} Recent advancements in rTSA techniques and designs have led to favorable long-term outcomes, expanding the clinical indications. In turn, rTSA has increased 191% in just 6 years, outpacing both hemiarthroplasty and anatomic shoulder arthroplasty as the most performed shoulder arthroplasty procedure, and is expected to increase 122% through 2025.^{24,30,37}

As indications and outcomes continue to favor rTSA, patients may present with questions rooted in older data. These questions commonly arise throughout a patient's treatment course, including

Institutional review board approval was not required for this study.

*Corresponding author: Kyle K. Obana, MD, Department of Orthopaedic Surgery, New York-Presbyterian Hospital/Columbia University Irving Medical Center, 622 West 168th St, PH-11, New York, NY 10032, USA.

E-mail address: ko2406@cumc.columbia.edu (K.K. Obana).

<https://doi.org/10.1016/j.xrrt.2024.09.005>

2666-6391/© 2024 The Author(s). Published by Elsevier Inc. on behalf of American Shoulder and Elbow Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Table I
Rothwell's Classification system categorization of questions on reverse total shoulder arthroplasty with subcategories, definitions, and examples.

	Description	Example
Rothwell's Classification		
Fact	Asks whether something is true and to what extent, objective information	What is rTSA surgery?
Policy	Asks whether a specific course of action should be taken to solve a problem (open-ended)	What is an alternative to rTSA surgery?
Value	Asks for evaluation of an idea, object, or event	How do I know if rTSA is successful?
Question classification by topic		
Fact		
Specific activities	Ability to perform a specific activity or action after surgery/injury	Will I be able to wash my back after rTSA surgery?
Restrictions	Restrictions to activity or lifestyle during recovery or indefinitely	What can't I do after rTSA?
Timeline of recovery	Specific questions regarding length of time for recovery milestones	When can I drive after rTSA?
Technical details	Details of surgical procedure	Is rTSA an open surgery?
Cost	Cost of surgery and/or rehabilitation postoperatively	How much does rTSA surgery cost?
Anatomy/function	Questions regarding structure and function of the rTSA components	How does rTSA work?
Diagnosis/evaluation	How someone is evaluated for rTSA	How do I know I have cuff tear arthropathy?
Policy		
Indications	Surgical indications and timing of surgery	When do you need rTSA surgery?
Management	Management/interventions to benefit recovery	
Risks/complications	Risks/complications during and after surgery	What are the risks of rTSA surgery?
Value		
Pain	Pertains to duration, severity, and management of pain	How much does rTSA surgery hurt?
Longevity	Specific questions regarding longevity of rTSA	How long will rTSA last?
Evaluation of surgery	Evaluation of the successfulness or invasiveness of rTSA surgery	How safe is rTSA surgery?
Injury/surgery comparison	Comparison between rTSA and other shoulder surgeries	Is rTSA worse than anatomic TSA?

rTSA, reverse total shoulder arthroplasty; TSA, total shoulder arthroplasty.

Table II
Categorization of websites with definitions and examples of each type.

Website categorization	Definition	Examples (based on prior literature)
Academic	Institution with clear academic mandate, including universities, academic medical centers, and academic societies	AAOS, Mayo Clinic
Commercial	Commercial organization that positions itself as a source of health information, includes medical device and pharmaceutical companies	WebMD, Everyday Health
Government	Websites ending in .gov or maintained by a national government	Medline, PubMed
Medical Practice	Local hospital or orthopedic practice without an academic affiliation	New York Orthopedics
Single Surgeon	Website built and maintained by individual surgeon. Excludes biography pages on institutional websites	EdwinSu.com, DrRMarx.com
Social Media	Websites maintained by nonmedical organization primarily designed for information sharing between internet users. Includes health blogs, internet forums, and support groups	YouTube

AAOS, American Academy of Orthopaedic Surgeons.

postinjury, preoperatively, and postoperatively. However, with limited accessibility to healthcare providers, patients may not have the opportunity to ask these questions. Expectedly, more than 60% of adults access the internet for convenient orthopedic information and more than 80% using Google as the primary source.^{1,11,33} To facilitate the user's experience, Google incorporates an algorithm to present frequently asked questions and corresponding websites based on the user's initial query. However, recent studies demonstrate that the available online orthopedic information is of heterogeneous quality and transparency.^{1,2,4,5,28,29,34,35}

Understanding various patient concerns and the quality of online information pertaining to rTSA will help physicians better guide expectations. The objective of this study is to analyze the most common online patient questions regarding rTSA and the quality of available information. The authors hypothesize that the online information will be of low quality and patient questions will pertain primarily to surgical indications, timeline of recovery, and postoperative restrictions.

Materials and methods

Data collection

This study did not require Institutional Review Board approval. A clean Google Chrome browser was used for data collection to avoid personalized search algorithms biasing the results. The Google

search algorithm incorporates prior searches, evaluates the usability of the sites, removes duplicates, and evaluates the content to find the results that are most relevant to the search query.^{17,16} The search terms "reverse total shoulder arthroplasty," "reverse total shoulder replacement," and "reverse total shoulder surgery" were entered into the Google Web Search (www.google.com). In concordance with prior studies, questions listed under the "People also ask" tab were expanded sequentially until approximately 300 questions were generated for each query.^{19,25,34} Scraper (version 1.7), a data mining web browser extension, was used to extract the questions and corresponding webpages to a spreadsheet for further analysis.

Exclusion criteria

If the question or corresponding website was unrelated to the topic of rTSA, then both were excluded from the dataset (eg, shoulder arthroscopy, rotator cuff repair, labral repair). Repeat questions within each of the 3 main queries were excluded. The first 100 questions for each query that met inclusion criteria were included for analysis.

Classifications

Two authors (K. K. O. and D. R. G. L.) separately evaluated each question and website. All discrepancies between the 2 authors were discussed and if not resolved, were brought to the third

Table III
Journal of the American Medical Association (JAMA) benchmark criteria.

JAMA benchmark criteria	Definition
Authorship	Clearly identifiable author and contributors with affiliations and relevant credentials present
Attribution	References and sources clearly listed with any copyright information disclosed
Currency	Clearly identifiable posting date of any content as well as the date of any revisions
Disclosure	Website ownership is clearly disclosed along with any sponsorship, advertising, underwriting, and financial support

JAMA, Journal of the American Medical Association.

author (A. J. L.) for subsequent determination. First, questions were categorized into 1 of 3 main classifications according to Rothwell's Classification of Questions: Fact, Policy, or Value.^{18,19,32,34} Questions were subcategorized into 1 of 16 topics under the Rothwell's Classifications specific to rTSA: Anatomy/Function, Cost, Diagnosis/Evaluation, Indications, Injury Comparison, Longevity, Management, Pain, Restrictions, Risks/Complications, Specific Activities, Surgical Evaluation, Surgical Technique, or Timeline of Recovery (Table I).

Websites were categorized based on the source: Academic, Commercial, Government, Private Medical Practice, Single Surgeon, or Social Media (Table II). Academic websites were organizations that reflected a clear academic mandate. Commercial websites were maintained by a for-profit entity that was not directly involved in patient care. Government websites were managed by a national government organization (eg, National Institutes of Health, National Health Service). Private Medical Practice websites were maintained by private medical groups without an academic affiliation. Single Surgeon websites were associated with a single surgeon and were independent from any affiliation with a larger organization or group medical practice. Social media websites were websites maintained by nonmedical organizations with the goal of information dissemination.

The Journal of the American Medical Association (JAMA) Benchmark Criteria has been used in prior studies to evaluate the quality of available online health information.^{2,19,21,25,27,34} The authors evaluated websites based on the 4 categories: Authorship, Attribution, Currency, and Disclosure (Table III). A website was assigned 1 point for each criterion met, with the highest possible score being a 4.

Statistical analysis

Pearson's chi-squared tests were used to analyze categorical data. Inter-rater reliability was assessed based on Cohen's kappa. All statistical analyses were performed using STATA/MP Software 13.0 (StataCorp, College Station, TX, USA).

Results

A total of 300 questions were included in the present study (100 unique questions and websites within each query). The Rothwell Fact category constituted 49.7% of questions, Value constituted 27.3%, and Policy constituted 23.0% (Table IV). The 3 most frequently asked question topics were Timeline of Recovery (17.3%), Specific Activities (14.7%), and Restrictions (11.3%) (Table V). The 3 least asked question topics were Anatomy/Function (0.0%), Cost (0.3%), and Diagnoses/Evaluation (0.3%). The most common website categories were Medical Practice (45.0%), Academic (22.3%), and

Table IV
Distribution of Rothwell's Classification categories within each search query and total percentage of each category.

Search query	Rothwell's Classification		
	Fact	Policy	Value
Reverse total shoulder arthroplasty	54	23	23
Reverse total shoulder replacement	46	19	35
Reverse total shoulder surgery	49	27	24
Percentage of each	49.7%	23.0%	27.3%

Single Surgeon (12.3%) (Table VI). PubMed articles consisted of 41.2% of Government websites.

The average JAMA Benchmark Criteria score was 1.48 ± 1.27 (Table VII). Government websites had the highest score of 3.11 ± 1.01 and constituted 55.9% of all websites with a score of 4/4. Comparatively, Medical Practice and Single Surgeon websites had the lowest JAMA scores of 0.99 ± 0.91 and 1.03 ± 0.90 , respectively. Additionally, 97.3% of Single Surgeon websites and 96.3% of Medical Practice websites had a score of 3 or lower (Table VIII).

Single Surgeon and Academic websites were mainly associated with Timeline of Recovery questions (35.1% and 23.9%, respectively) (Table IX). Commercial websites were mainly associated with Risks/Complications questions (22.7%). Government websites were mainly associated with Restrictions questions (20.6%). Social Media and Medical Practice websites were mainly associated with Specific Activity questions (80.0% and 17.0%, respectively).

Cohen's kappa for inter-rater reliability demonstrated a very high level of agreement for categorization of websites (0.90), Rothwell questions (0.88), and question topics (0.81).

Discussion

Utilization of rTSA has grown tremendously in recent years in concordance with expanded indications and advancements in both technology and techniques. Understanding patient questions and concerns regarding rTSA amidst the growing popularity will help guide expectations and improve clinical outcomes. This study demonstrates that the available online information is of low quality and patients are primarily concerned with Timeline of Recovery, Specific Activities, and Restrictions.

The average overall JAMA score for websites was 1.48 of 4, reflecting low quality of online information. This is consistent with recent orthopedic studies demonstrating an overall JAMA score ranging from 1.0 to 2.4.^{19,25,28,29,34} Not surprisingly, 81.3% of articles had a JAMA score of ≤ 2 and 88.6% had a score of ≤ 3 . Medical Practice websites had the lowest JAMA scores (0.99) but constituted the largest proportion of websites (45.0%). Additionally, Single Surgeon websites had the second lowest JAMA score (1.03) and constituted the third largest proportion of websites (12.3%). Similarly, prior studies using different evaluative methods found a low quality of online information pertaining to rTSA.^{15,26} However, these studies evaluated websites using different metrics than the JAMA score and did not analyze corresponding frequently asked questions. The overall low quality of information may be attributed to the goal of many websites to attract business rather than provide high-quality medical education to the public. Many organizations pay online search platforms advertising fees to promote content and attract patients, which can reach up to 31% of advertising expenditures.⁷ Despite the low quality of online health information, patients derive benefit from online information.⁶ Furthermore, patient trust and confidence in online orthopedic information has

Table V

Distribution of Rothwell's Classification subcategories based on each search query.

	Reverse total shoulder arthroplasty	Reverse total shoulder replacement	Reverse total shoulder surgery	Total N	Overall %
Fact					
Timeline of recovery	18	16	18	52	17.3
Specific activities	16	15	13	44	14.7
Restrictions	12	9	13	34	11.3
Technical details	7	5	5	17	5.7
Cost	0	1	0	1	0.3
Diagnosis/evaluation	1	0	0	1	0.3
Anatomy/function	0	0	0	0	0.0
Policy					
Risks/complications	9	7	12	28	9.3
Management	11	6	6	23	7.7
Indications	3	6	9	18	6.0
Value					
Pain	13	12	8	33	11.0
Injury comparison	8	9	8	25	8.3
Evaluation of surgery	1	8	8	17	5.7
Longevity	1	6	0	7	2.3

Table VI

Distribution of website category.

Website category	N	%
Medical practice	135	45.0
Academic	67	22.3
Single surgeon	37	12.3
Government	34	11.3
Commercial	22	7.3
Social media	5	1.7
Total	300	100.0

Table VII

Average JAMA benchmark criteria score for each website category.

Website category	Average JAMA benchmark criteria score
Government	3.11 ± 1.01
Commercial	2.95 ± 1.40
Social media	2.00 ± 0.0
Academic	1.36 ± 1.30
Single surgeon	1.03 ± 0.90
Medical practice	0.99 ± 0.91

JAMA, Journal of the American Medical Association.

increased in recent years.¹⁴ Patient reliance on the internet as an alternative source of health information is growing despite unawareness that much of available information is potentially out of date, inaccurate, or biased. Treating surgeons should have information booklets to hand patients at the end of each visit and high quality, up-to-date information available on their websites to avoid patient reliance on poor online sources.

Interestingly, Commercial websites had an average JAMA score of 2.95 and comprised 45.5% of websites with 4/4 JAMA criteria. This contrasts prior studies and can be attributed to for-profit websites hiring physicians and other providers to publish articles pertaining to various healthcare topics.²⁸ These articles are formatted similarly to research articles (author, date, disclosures, and references) and subsequently fulfill the JAMA criteria. Expectedly, Government websites had the highest JAMA score (3.11), which is consistent with prior studies.^{25,28,29,34} This can be attributed to the indexing of PubMed research articles (41.2% of Government websites), which incorporate strict publication standards that consistently fulfill the JAMA criteria. Although Government websites accounted for 55.9% of websites with 4 of 4 JAMA criteria, they only comprised 11.3% of all websites in the study. Clinician

Table VIII

Distribution of websites as a percentage for each JAMA benchmark criteria score (0 to 4).

Website type	JAMA benchmark criteria					Total (%)
	0	1	2	3	4	
Academic	37.3	16.4	26.9	11.9	7.5	100
Commercial	13.6	4.5	0.0	36.4	45.5	100
Government	0.0	0.0	44.1	0.0	55.9	100
Medical practice	29.6	45.2	21.5	3.7	0.0	100
Single surgeon	35.1	29.7	32.4	2.7	0.0	100
Social media	0.0	0.0	100.0	0.0	0.0	100

JAMA, Journal of the American Medical Association.

scientists should be mindful that although the research is tailored to physicians within that respective specialty, many individuals with limited medical knowledge may be accessing these articles for further understanding. Thus, Commercial websites serve as an example of patient-tailored information that is reviewed for content and accuracy, like that of a research article. Since medicine is an everchanging field with advancements in surgical techniques, indications, and technology, it is important for websites to be routinely updated with information rooted in high-quality, evidence-based literature.

Timeline of Recovery (17.3%) and Specific Activities (14.7%) were the 2 most common question topics. The postoperative course for rTSA immobilizes the upper extremity and restricts shoulder internal rotation, adduction, and extension due to the risk of dislocation.³ This requires strict immobilization in a sling and abduction brace for 6 weeks with progressive strengthening and range of motion.³⁹ Furthermore, patients may not attain native range of motion due to altered kinematics of the shoulder and lack of rotator cuff muscles. Since rTSA is primarily performed in the elderly population (ie, aged ≥65 years), many of these questions pertained to basic movements and activities of daily living (eg, “Can you put your arm behind your back after reverse total shoulder replacement?” “How do you shower after a reverse total shoulder replacement?” “How do I shave my armpits after reverse shoulder replacement?”) compared to return-to-sport questions as seen in prior studies.²⁸ It is important for physicians to consider how daily living will be impacted and provide patients with adequate information on ways to perform activities of daily living while abiding by postoperative protocols. Furthermore, a recent study found that patients undergoing rTSA had lower preoperative expectations to exercise compared to patients undergoing anatomic TSA despite no

Table IX
Distribution of Rothwell's Classification subcategories based on websites.

	Academic	Commercial	Government	Medical practice	Single surgeon	Social media
Fact						
Timeline of recovery	23.9	18.2	11.8	11.1	35.1	0.0
Specific activities	9.0	9.1	8.8	17.9	16.2	80.0
Restrictions	6.0	18.2	20.6	11.1	8.1	20.0
Technical details	10.4	9.1	0.0	5.2	2.7	0.0
Cost	0.0	0.0	2.9	0.0	0.0	0.0
Diagnosis/evaluation	0.0	0.0	2.9	0.0	0.0	0.0
Anatomy/function	0.0	0.0	0.0	0.0	0.0	0.0
Policy						
Risks/complications	17.9	22.7	14.7	4.4	0.0	0.0
Management	4.5	9.1	2.9	11.1	5.4	0.0
Indications	3.0	0.0	5.9	10.4	0.0	0.0
Value						
Pain	9.0	4.5	11.8	11.9	16.2	0.0
Injury comparison	9.0	4.5	0.0	11.9	5.4	0.0
Evaluation of surgery	1.5	4.5	14.7	5.2	8.1	0.0
Longevity	6.0	0.0	2.9	0.7	2.7	0.0
Total %	100.0	100.0	100.0	100.0	100.0	100.0

formal education by the physician prior.²² The authors highlight that information on the internet may have influenced preoperative expectations of patients undergoing rTSA and anatomic TSA.²² Patients aged <65 years and those who demonstrate higher activity level can expect to return to maximum allowed activity by 8 months following rTSA.²³ Importantly, most patients can expect to return to low-impact upper extremity sports within 6 months such as running/jogging, biking, and hiking.^{12,23} Providing patients with a thorough timeline of postoperative milestones and when they can expect to perform activities of daily living and exercise will help set expectations and motivation.

Long-term stability concerns exist for rTSA relative to hemiarthroplasty and anatomic TSA, resulting in both short-term and long-term limitations. Due to the restrictions placed on postoperative utilization of the upper extremity, it is unsurprising that Restrictions was the third most common question topic (11.3% of all topics). Early postoperative restrictions include limited external rotation to avoid subscapularis compromise, while long-term restrictions avoid internal rotation to avoid dislocation. Although some of the questions pertained to short-term activity restrictions during the postoperative period (eg, “What will I not be able to do after a reverse shoulder replacement?” “What should I avoid after reverse shoulder replacement”), most questions specified lifetime restrictions and limitations (eg, “What are the permanent restrictions after reverse shoulder replacement?” “What are the lifetime restrictions after reverse shoulder replacement?”). This is supported by a recent study demonstrating 37.5% of patients are concerned about the postoperative course following rTSA despite being asymptomatic.²⁰ Patients must be cognizant about activities with moderate upper extremity utilization or fall potential (eg, ice skating, swimming, golf).²³ High-impact activities (eg, American football, martial arts, snowboarding, tennis, weight lifting) are generally restricted indefinitely.²³ These questions may also reflect concerns of younger, more active patients undergoing rTSA given the increasing utilization in patients aged <65 years.

Subsequent advancements in surgical techniques and implant designs have demonstrated favorable long-term clinical and radiographic outcomes, leading to an expansion of clinical indications warranting rTSA. Considering the increasing utilization of rTSA in patients who would not have been historical candidates, including active patients and those aged <65 years, the authors hypothesized that Indications would be one of the most asked question topics. However, Indications only constituted 6.0% of

question topics (eighth of 16 topics). Taken together, patients may be less concerned about why they need an rTSA and are more interested in what the postoperative implications are. This suggests that patients are experiencing a low quality of life preoperatively and have accepted rTSA as a means of alleviating their symptoms, making them less concerned about Indications warranting rTSA.^{22,31}

Despite the legitimacy that many academic organizations are viewed with for disseminating credible information, much of on-line information may be of questionable accuracy. Academic websites constituted the second highest prevalence of websites categories (22.3%) but had the fourth lowest JAMA score (1.36) in the present study. The high prevalence of academic websites and low quality of information is consistent across other orthopedic studies spanning different conditions and subspecialties.^{25,28,34,36} However, many readers are likely unaware of the potential for underlying biases or misinformation given the aforementioned trust and confidence in online orthopedic information.^{6,14} Houck et al analyzed all available online resources on reverse total shoulders and found that academic websites constituted most websites (43%).¹⁵ Going forward, academic websites may benefit from listing the physicians who author the published information with corresponding references to high-quality studies, date of publication/updates, and disclosing whether or not conflicts of interest exist.

This study has limitations attributed to the methodology. The JAMA Benchmark Criteria were used to assess the quality of online health information based on the criteria of authorship, date of publication, financial disclosures, and scientific references. The JAMA score does not evaluate the quality of the information provided. However, these criteria act as a proxy of transparency and may not be indicative of content accuracy. Regardless, incorporating these criteria reduces the risk of implicit bias and misinformation conveyed to the public. Second, this methodology assumes that these online questions are asked by patients despite the possibility that other individuals (ie, friends, family members, health-care providers) may be inquiring. Nonetheless, these results will allow providers to guide patient and family expectations. Additionally, the anonymity of online searches minimizes the risk of bias associated with in-person surveys. Fourth, the anonymity of who performs the searches limits information regarding patient demographics, education, health status, or physical activities. Thus, the authors are unable to make patient-specific analyses based on various factors such as age, activity level, and comorbidities. Finally,

the search terms used in this study (“reverse total shoulder arthroplasty,” “reverse total shoulder replacement,” and “reverse total shoulder surgery”) and the decision to incorporate the first 100 questions for each query do not encompass all the potential queries. However, using multiple search terms with different keywords and strict exclusion criteria provide the most reliable sample from all queries.

Conclusion

These results reflect that patients are interested in the timeline of recovery, their ability to perform specific activities after surgery, and short-term and long-term restrictions following rTSA. Although all patients will benefit from education on alternative ways to perform activities of daily living based on postoperative restrictions, physicians should set preoperative expectations regarding return-to-activity following rTSA, particularly in younger, more active patients. Finally, surgeons should provide patients with physical booklets and online information available on their websites to avoid reliance on low-quality online sources.

Disclaimers:

Funding: No funding was disclosed by the authors.

Conflicts of interest: William N. Levine, MD discloses Zimmer Biomet Holdings, Inc: Royalties or licenses, consulting fees; American Shoulder and Elbow Surgeons: Past president; Journal of American Academy of Orthopaedic Surgeons: Editorial board; and Journal of Shoulder and Elbow Surgery: Editorial board. The other authors, their immediate families, and any research foundation with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

References

- Burrus MT, Werner BC, Starman JS, Kurkis GM, Pierre JM, Diduch DR, et al. Patient Perceptions and current trends in internet use by orthopedic outpatients. *HSS J* 2017;13:271-5. <https://doi.org/10.1007/s11420-017-9568-2>.
- Cassidy JT, Baker JF. Orthopaedic patient information on the world wide web: an essential review. *J Bone Joint Surg Am* 2016;98:325-38. <https://doi.org/10.2106/JBJS.N.01189>.
- Cheung E, Willis M, Walker M, Clark R, Frankle MA. Complications in reverse total shoulder arthroplasty. *J Am Acad Orthop Surg* 2011;19:439-49.
- D'Ambrosi R, Annibaldi A, Carrozzo A, Vieira TD, An J-S, Freychet B, et al. Evaluating the reliability of YouTube as a source of information for meniscal ramp lesions. *Orthop J Sports Med* 2024;12:23259671231219815. <https://doi.org/10.1177/23259671231219815>.
- D'Ambrosi R, Milinkovic DD, Abermann E, Herbolt M, Fink C. Quality of YouTube videos regarding anterior cruciate ligament reconstruction using quadriceps tendon autograft is unsatisfactory. *Arthroscopy* 2024;40:2236-43. <https://doi.org/10.1016/j.arthro.2024.01.002>.
- Dekkers T, Melles M, Groeneveld BS, de Ridder H. Web-based patient education in orthopedics: systematic review. *J Med Internet Res* 2018;20:e143. <https://doi.org/10.2196/jmir.9013>.
- Elrod JK, Fortenberry JL. Advertising in health and medicine: using mass media to communicate with patients. *BMC Health Serv Res* 2020;20(Suppl 1):818. <https://doi.org/10.1186/s12913-020-05599-3>.
- Favard L, Levigne C, Nerot C, Gerber C, De Wilde L, Mole D. Reverse prostheses in arthropathies with cuff tear: are survivorship and function maintained over time? *Clin Orthop* 2011;469:2469-75. <https://doi.org/10.1007/s11999-011-1833-y>.
- Flatow EL, Harrison AK. A history of reverse total shoulder arthroplasty. *Clin Orthop* 2011;469:2432-9. <https://doi.org/10.1007/s11999-010-1733-6>.
- Frankle M, Levy JC, Pupello D, Siegal S, Saleem A, Mighell M, et al. The reverse shoulder prosthesis for glenohumeral arthritis associated with severe rotator cuff deficiency. a minimum two-year follow-up study of sixty patients surgical technique. *J Bone Joint Surg Am* 2006;88(Suppl 1 Pt 2):178-90. <https://doi.org/10.2106/JBJS.F.00123>.
- Fraval A, Ming Chong Y, Holcdorf D, Plunkett V, Tran P. Internet use by orthopaedic outpatients - current trends and practices. *Australas Med J* 2012;5: 633-8. <https://doi.org/10.4066/AMJ.2012.1530>.
- Garcia GH, Taylor SA, DePalma BJ, Mahony GT, Grawe BM, Nguyen J, et al. Patient activity levels after reverse total shoulder arthroplasty: what are patients doing? *Am J Sports Med* 2015;43:2816-21. <https://doi.org/10.1177/0363546515597673>.
- Guery J, Favard L, Sirveaux F, Oudet D, Mole D, Walch G. Reverse total shoulder arthroplasty. Survivorship analysis of eighty replacements followed for five to ten years. *J Bone Joint Surg Am* 2006;88:1742-7. <https://doi.org/10.2106/JBJS.E.00851>.
- Hertling S, Matziolis G, Graul I. [The role of the Internet as a source of medical information for orthopedic patients]. *Orthopädie (Heidelb)* 2022;51:521-30. <https://doi.org/10.1007/s00132-022-04238-5>.
- Houck DA, Kraeutler MJ, Belk JW, McCarty EC, Bravman JT. Evaluation of information available on the internet regarding reverse total shoulder arthroplasty. *Shoulder Elbow* 2019;11(2 Suppl):29-34. <https://doi.org/10.1177/1758573217713720>.
- How does Google determine ranking results - Google search. <https://www.google.com/search/howsearchworks/how-search-works/ranking-results/>. Accessed September 7, 2024.
- In-Depth guide to how Google search works, google search central, documentation [internet]. Google Dev. <https://developers.google.com/search/docs/fundamentals/how-search-works>. Accessed September 1, 2024.
- Kanthawala S, Vermeesch A, Given B, Huh J. Answers to health questions: internet search results versus online health community responses. *J Med Internet Res* 2016;18:e95. <https://doi.org/10.2196/jmir.5369>.
- Khalil LS, Castle JP, Akiyamen NO, Corsi MP, Cominos ND, Dubé M, et al. What are patients asking and reading online? An analysis of online patient searches for rotator cuff repair. *J Shoulder Elbow Surg* 2023;32:2245-55. <https://doi.org/10.1016/j.jse.2023.04.021>.
- Kim HG, Kim S-H, Kim SC, Park JH, Kim JS, Kim BT, et al. Return to sports activity after reverse total shoulder arthroplasty. *Orthop J Sports Med* 2023;11: 23259671231208959. <https://doi.org/10.1177/23259671231208959>.
- Kunze KN, Krivicich LM, Verma NN, Chahla J. Quality of online video resources concerning patient education for the meniscus: a YouTube-based quality-control study. *Arthroscopy* 2020;36:233-8. <https://doi.org/10.1016/j.arthro.2019.07.033>.
- Lawrence C, Lazarus M, Abboud J, Williams G, Namdari S. Prospective comparative study of preoperative expectations and postoperative outcomes in anatomic and reverse shoulder arthroplasty. *Joints* 2021;7:159-64. <https://doi.org/10.1055/s-0041-1730982>.
- Magnussen RA, Mallon WJ, Willems WJ, Moorman CT. Long-term activity restrictions after shoulder arthroplasty: an international survey of experienced shoulder surgeons. *J Shoulder Elbow Surg* 2011;20:281-9. <https://doi.org/10.1016/j.jse.2010.07.021>.
- Mayfield CK, Korber SS, Hwang NM, Bolia IK, Gamradt SC, Weber AE, et al. Volume, indications, and number of surgeons performing reverse total shoulder arthroplasty continue to expand: a nationwide cohort analysis from 2016-2020. *JSES Int* 2023;7:827-34. <https://doi.org/10.1016/j.jseint.2023.05.002>.
- McCormick JR, Kerzner B, Tuthill TA, Khan ZA, Hodakowski AJ, Damodar D, et al. Patients with femoroacetabular impingement obtain information from low-quality sources online and are most interested in conservative treatment and expected recovery. *Arthrosc Sports Med Rehabil* 2023;5:e21-7. <https://doi.org/10.1016/j.asmr.2022.09.011>.
- Monroe EJ, Selley RS, Gombera MM, Nair R, Martusiewicz A, Christian RA, et al. The quality and accuracy of online resources for total and reverse shoulder replacement. *J Surg Orthop Adv* 2019;28:290-4.
- Nassiri M, Bruce-Brand RA, O'Neill F, Chenouri S, Curtin PT. Surfing for hip replacements: has the “internet tidal wave” led to better quality information. *J Arthroplasty* 2014;29:1339-1344.e1. <https://doi.org/10.1016/j.arth.2014.01.009>.
- Obana KK, Law C, Mastroianni MA, Abdelaziz A, Alexander FJ, Ahmad CS, et al. Patients with posterior cruciate ligament injuries obtain information regarding diagnosis, management, and recovery from low-quality online resources. *Phys Sportsmed* 2024;26:1-7. <https://doi.org/10.1080/00913847.2024.2346462>.
- Obana KK, Lind DRG, Mastroianni MA, Rondon AJ, Alexander FJ, Levine WN, et al. What are our patients asking Google about acromioclavicular joint injuries?—frequently asked online questions and the quality of online resources. *JSES Rev Rep Tech* 2024;4:175-81. <https://doi.org/10.1016/j.xrrt.2024.02.001>.
- Rabinowitz J, Kothandaraman V, Lin J, Li X, Friedman RJ, Eichinger JK. Utilization of shoulder arthroplasty in the United States — An analysis of current trends and future predictions. *Semin Arthroplasty* 2020;30:200-9. <https://doi.org/10.1053/j.sart.2020.08.004>.
- Rauzy RC, Ruzbarsky JJ, Swarup I, Gruskay J, Dines JS, Warren RF, et al. Predictors of patient satisfaction after reverse shoulder arthroplasty. *J Shoulder Elbow Surg* 2020;29:e67-74. <https://doi.org/10.1016/j.jse.2019.07.043>.
- Rothwell JD. In mixed company: communicating in small groups. 8th edition. Boston, MA: Wadsworth Publishing; 2012.
- Sechrest RC. The internet and the physician-patient relationship. *Clin Orthop* 2010;468:2566-71. <https://doi.org/10.1007/s11999-010-1440-3>.
- Shen TS, Driscoll DA, Islam W, Bovonratwet P, Haas SB, Su EP. Modern internet search analytics and total joint arthroplasty: what are patients asking and reading online? *J Arthroplasty* 2021;36:1224-31. <https://doi.org/10.1016/j.arth.2020.10.024>.

35. Silberg WM, Lundberg GD, Musacchio RA. Assessing, controlling, and assuring the quality of medical information on the internet: caveant lector et viewer—let the reader and viewer beware. *JAMA* 1997;277:1244-5.
36. Starman JS, Gettys FK, Capo JA, Fleischli JE, Norton HJ, Karunakar MA. Quality and content of Internet-based information for ten common orthopaedic sports medicine diagnoses. *J Bone Joint Surg Am* 2010;92:1612-8. <https://doi.org/10.2106/JBJS.I.00821>.
37. Wagner ER, Farley KX, Higgins I, Wilson JM, Daly CA, Gottschalk MB. The incidence of shoulder arthroplasty: rise and future projections compared with hip and knee arthroplasty. *J Shoulder Elbow Surg* 2020;29:2601-9. <https://doi.org/10.1016/j.jse.2020.03.049>.
38. Werner CML, Steinmann PA, Gilbert M, Gerber C. Treatment of painful pseudoparesis due to irreparable rotator cuff dysfunction with the Delta III reverse-ball-and-socket total shoulder prosthesis. *J Bone Joint Surg Am* 2005;87:1476-86. <https://doi.org/10.2106/JBJS.D.02342>.
39. Zhou HS, Chung JS, Yi PH, Li X, Price MD. Management of complications after reverse shoulder arthroplasty. *Curr Rev Musculoskelet Med* 2015;8:92-7. <https://doi.org/10.1007/s12178-014-9252-9>.