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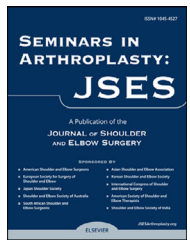

YouTube is a poor-quality source for patient information on the rehabilitation following total shoulder arthroplasty

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ABSTRACT

Background: Despite the ubiquity of health information on YouTube, the quality of the information as it pertains to total shoulder arthroplasty (TSA) rehabilitation is unknown. The purpose of this study is to investigate the quality of information available on YouTube as it pertains to rehabilitation following TSA, including anatomic and reverse TSA.

Methods: Utilizing predefined search terms, 480 videos regarding rehabilitation following TSA were screened for study inclusion. A total of 143 videos were included in the final analysis. Of these, 99 (69.2%) videos were on rehabilitation of anatomical TSA and 44 (30.8%) videos reported on rehabilitation after reverse TSA. Each video was reviewed using 3 scoring systems: (1) Journal of the American Medical Association (JAMA) benchmark criteria, (2) Global Quality Score (GQS), and (3) DISCERN instrument.

Results: YouTube videos regarding TSA are of suboptimal educational quality with a mean JAMA score of 2.5 ± 0.7, mean GQS of 2.7 ± 0.9, and mean DISCERN score of 33.2 ± 5.5 overall. Upon evaluation of video metrics based on classification it was found that educational nonphysician videos had significantly more likes than all other categories ($P = .01$). Educational physician videos were found to be significantly longer than all other categories (educational physician: 10.0 ± 14.8 minutes, educational nonphysician: 6.2 ± 3.2 minutes, personal testimony: 3.5 ± 2.6 minutes, commercial: 5.8 ± 5.4 minutes; $P < .01$) and had significantly higher JAMA ($P < .01$), GQS ($P < .01$), and DISCERN ($P < .01$).

Conclusion: YouTube videos are a poor source of educational information for patients regarding TSA rehabilitation. Educational videos prepared by nonphysicians accrued more likes than other video categories. Although educational videos by physicians provided

This study did not require review by the institutional review board.

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statistically higher quality educational content as noted by JAMA, GQS, and DISCREN scores, the average scores across all author categories were classified as low (JAMA), moderate to poor (GQS), or poor (DISCERN) quality educational content. Additionally, our findings suggest that physician educational videos that are shorter in duration are more likely to be well received and watched to completion by viewers compared to longer videos. Patients should be provided trusted resources to learn more about TSAs.

Level of evidence: Level IV, Case Series.

Shoulder arthroplasty volume has been increasing steadily in the last 2 decades, driven by an aging population and improvements in surgical technique.[13,20] As operative volume increases, the educational material available to patients has also experienced a concomitant increase. Studies have shown that patients frequently turn to the internet as a source of medical information.[10,26] Over 50% of North American patients have reported using the internet to search for health information and patients undergoing elective orthopedic surgery are much more likely to turn to social media than those undergoing urgent or emergent procedures.[8,15,26,27]

One of the most widely available resources on the internet is YouTube (Alphabet, Mountain View, CA, USA). YouTube is available in over 100 countries and 80 different languages, the Web site hosts over a billion visitors each month. Despite the widespread availability and accessibility of information on YouTube, multiple studies have demonstrated that the quality of patient-directed information is quite low.[7,10,27,30] In the hip and knee arthroplasty literature, preoperative access to high-quality educational materials has been shown to decrease perioperative anxiety, length of stay, readmission, and overall costs while also increasing rates of home discharge.[11] More recently, effective preoperative education has been shown to decrease opioid dependence after arthroscopic rotator cuff repair.[6]

Given the high number of patients who utilize YouTube for educational content, the current state of resources on YouTube for patients undergoing total shoulder arthroplasty (TSA) merits investigation. The purpose of this study is to investigate the quality of information available on YouTube as it pertains to rehabilitation following TSA, including anatomic and reverse TSA. We hypothesized that the average information quality, reliability, and accuracy would be poor when measured using the Journal of the American Medical Association (JAMA), Global Quality Score (GQS), and DISCERN scores, and that physician-distributed content is of higher quality on YouTube.

Methods

A search was performed of YouTube videos containing patient-directed educational material pertaining to TSA rehabilitation using predetermined search terms. The following 8 terms were used: (1) total shoulder replacement rehab exercises, (2) total shoulder replacement testimonials, (3) total shoulder replacement rehab, (4) total shoulder replacement physical therapy protocol, (5) TSA exercises, (6) TSA X-ray, (7) TSA subscapularis, and (8) TSA therapy protocol. An initial search was performed on December 1, 2020. To account for the dynamic nature of content on YouTube a second search using the same search terms was performed on December 13, 2020. No discrepancies were noted between both searches. The review of videos for eligibility and quality assessment was performed by 2 individual observers (2 orthopedic surgery residents) and any discrepancies between the 2 observers were clarified by mutual agreement.

In conformity with previously published methodology, search terms were initially derived using the autofill tool in the YouTube video search bar.[9,14,19,26,28] The autofill uses an algorithm to stratify terms based on popularity. In order to minimize the impact of previous browsing history and avoid biased search results, the incognito browsing function of Google Chrome (Alphabet) was used for this study. Google Chrome is a free software that enables anonymous web browsing through the incognito function. The incognito function conceals user's information and browsing habits and browsing location, inhibiting YouTube algorithms from introducing bias and influencing results.

In the default configuration, YouTube sorts search results in descending order of relevance to the search term used. Due to users of the platform rarely accessing videos beyond the third page, the first 60 videos under each search term were evaluated for study inclusion.[18,26] Duplicate videos, videos that were non-English language, lacked sound support, did not explicitly discuss TSA rehabilitation even though it was mentioned in the title, and non–human videos were excluded from the study.

The following metrics were collected for each video: (1) Universal Resource Locator, (2) video title, (3) number of total views, (4) video category, (5) duration of video in minutes, (6) date of publication, (7) days since upload, (8) number of likes, (9) number of dislikes, (10) like ratio, (11) video power index (VPI), and (12) view ratio (views/day). The like ratio was calculated by the number of likes divided by the number of dislikes. The VPI is an index that is used to quantify the popularity of a video based on the views and likes, and has been utilized in previous literature.[12,21,22,26] The VPI is calculated as follows: (like ratio × view ratio)/100. Video duration was evaluated due to previous literature indicating that viewer engagement diminishes in videos longer than 9 minutes.[2,17,25] Videos were then sorted into 4 separate categories based on author type. Educational-physician videos were videos in which the publisher disclosed their

identity as a physician. Educational nonphysician videos consisting of content publishers who identified as health professionals other than licensed medical doctors. Personal testimony videos made up videos produced by patients describing their experiences. Commercial videos represented videos uploaded by companies in the medical industry.

Three scoring methods were used to examine the quality of included videos: JAMA benchmark criteria, the GQS, and the DISCERN instrument (Supplementary Appendix S1). These scoring methods were selected due to their use in pervious literature; additionally, they have been demonstrated to be both valid and reliable.[2,5,25] The JAMA benchmark criteria is an objective assessment aid that consists of 4 independent guidelines. These guidelines include authorship, attribution, disclosure, and currency. One point is given for the presence of each guideline. A maximum of 4 points can be achieved and a higher score designates a better accuracy and reliability for the source. In accordance with previously published definitions utilizing the JAMA criteria scores $\geq$3 represented high-quality sources while scores <3 represented low quality.[24] The caliber of educational content was evaluated by the use of the GQS. The GQS contains several criteria that gauge the educational value of online resources. This includes quality, flow, and relevant information for patients. One point was assigned for the presence of each criterion. The higher the score, the higher the educational quality. A score of 1 represented very poor quality, 2 poor quality, 3 moderate quality, 4 good quality, and the highest attainable score is a score of 5, which indicates excellent quality and flow of information. The DISCERN instrument consists of a series of questions developed for the critical appraisal of written consumer health information about treatment choices. The instrument uses a Likert scale to elicit a reviewer's rating of source quality on a scale of 16-26 (very poor), 27-38 (poor), 39-50 (fair), 51-62 (good), and 63-75 (excellent).

Statistical analysis

Descriptive analysis was used to report categorical data as absolute and relative frequencies, while continuous data were reported as mean and standard deviation. Variables with a non-normal distribution were evaluated using Mann-Whitney *U*-tests. The relationship between video characteristics and category was evaluated using one-way analysis of variance for continuous variables and chi-squared test for categorical variables. If assumptions for analysis of variance were not met nonparametric Kruskal-Wallis tests were utilized. If an overall difference among the video categories was detected, then pairwise comparisons of the groups were performed. For those variables where Kruskal-Wallis tests were used, the pairwise *P*-values were computed using the Dwass, Steel, Critchlow-Fligner method. All calculations were performed by SPSS software version 21 (IBM, Armonk, NY, USA). Results with *P* value <.05 were considered statistically significant.

Results

A total of 480 YouTube videos were screened for inclusion. A total of 337 videos were excluded, of which 268 videos were duplicates and 69 videos failed to mention rehabilitation following TSA. One hundred forty-three unique videos were included in the final analysis (Fig. 1). Of these, 99 (69.2%) videos were on rehabilitation of anatomical TSA and 44 (30.8%) videos reported on rehabilitation after reverse TSA. Of the 143 videos present in the analysis, the total number of views was 3,765,881, total likes were 21,003 across all videos, and total dislikes was 1135. The distribution of JAMA, GQS, and DISCERN scores are shown in Figures 2–4 respectively. The mean duration for all videos was 6.7 ± 9.69 minutes and the mean number of likes per video was 146.9 (range, 0-2709). The average time since upload was 1445.1 ± 1018.3 days and the mean VPI was 4.1 ± 10.3 (Table I). The mean JAMA score was 2.5 ± 0.7, mean GQS was 2.7 ± 0.9, and mean DISCERN score was 33.2 ± 5.5 overall and 2.1 ± 0.3 for each individual question.

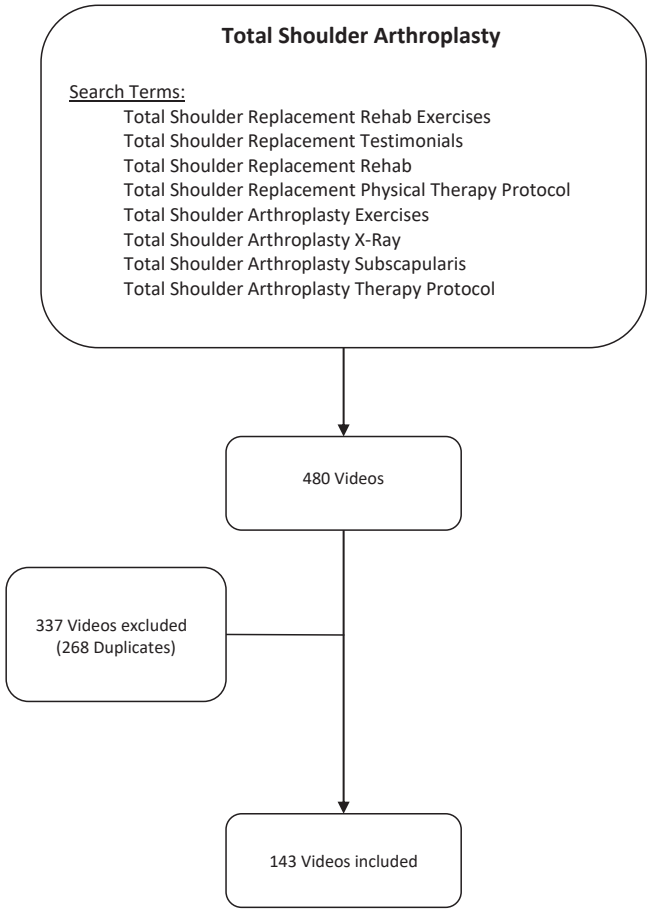

Figure 1 – Flow diagram of search criteria used for inclusion of YouTube videos regarding a total shoulder arthroplasty.

When evaluating the distribution of videos based on their classification 57 videos were educational-physician videos, 27 videos as educational-nonphysician, 40 videos as commercial, and 19 videos as personal testimony. Upon evaluation of video metrics based on classification it was found that educational-nonphysician videos had significantly more likes than all other categories ($P = .01$). Educational-physician videos were found to be significantly longer than all other categories (educational-physician: 10.0 ± 14.8 minutes, education-

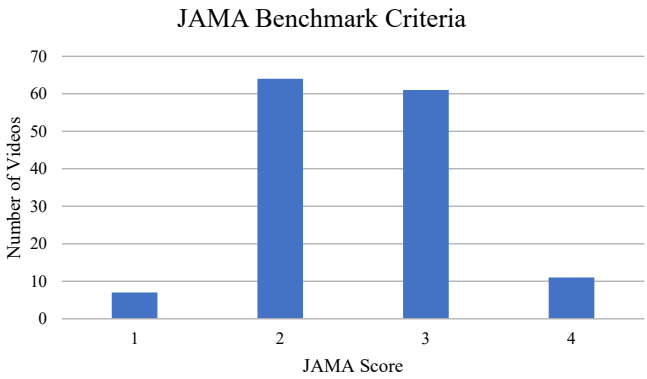

Figure 2 – Distribution of video scores using the Journal of the American Medical Association benchmark criteria. A score of ≥3 represents high quality content, while a score <3 represents lower quality content. *JAMA*, Journal of the American Medical Association.

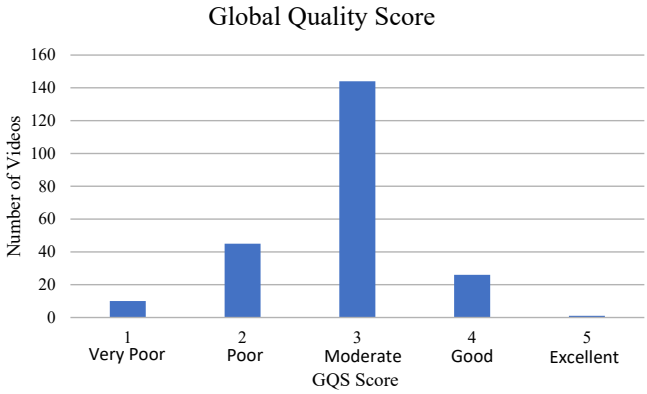

Figure 3 – Distribution of video scores using the Global Quality Score. *GQS*, Global Quality Score.

nonphysician: 6.2 ± 3.2 minutes, personal testimony: 3.5 ± 2.6 minutes, commercial: 5.8 ± 5.4 minutes; $P < .01$) and had significantly higher JAMA ($P < .01$), GQS ($P < .01$), and DISCERN ($P < .01$) (Table II). However, it should be noted that all videos indeterminate of video classification had low quality JAMA scores (<3), moderate to poor quality GQS (2 or 3), and poor DISCERN scores (27-38).

Discussion

The present study demonstrated that YouTube videos are a poor source of educational information for patients regarding TSA rehabilitation. Educational videos prepared by nonphysicians accrued more likes than other video categories. Although educational videos by physicians provided statistically higher quality educational content as noted by JAMA, GQS, and DISCREN scores, the average scores across all author categories were classified as low (JAMA), moderate to poor (GQS), or poor (DISCERN) quality educational content. Given the fact that the majority of patients report using the internet for information regarding their health, and YouTube videos do not undergo a rigorous peer-review process, patients should

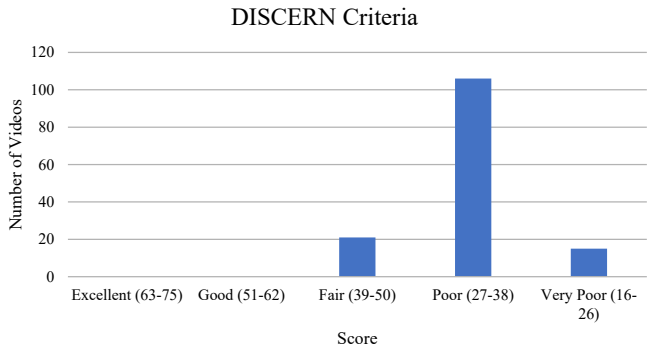

Figure 4 – Distribution of video scores using the DISCERN criteria.

Table I – Characteristics of all included videos.

Variable	Mean (N = 143)
Views	26,334.8 ± 49,539.3
Duration (min)	6.7 ± 9.69
Time since upload (d)	1445.1 ± 1018.3
Likes	146.9 ± 332.4
Dislikes	7.9 ± 16.2
Like ratio	15.4 ± 16.7
View ratio	18.3 ± 34.9
VPI	4.1 ± 10.3
JAMA	2.5 ± 0.7
GQS	2.7 ± 0.9
DISCERN	33.2 ± 5.5

VPI, video power index; *JAMA*, Journal of the American Medical Association benchmark criteria; *GQS*, Global Quality Score; *SD*, standard deviation.
Continuous variables are presented as mean ± SD.

be cautioned about using YouTube resource to learn more about TSA and rehabilitation and surgeons should instead provide patients with trusted resources to learn more about their procedures.

Several studies sought to evaluate the quality of medical information available to patients on YouTube. Ward et al[29] performed a review of the educational quality of 87 YouTube videos regarding attention deficit/hyperactivity disorder. Their analysis found that YouTube provided poor educational content with a mean DISCERN score per question of 2.03. Goobie et al[16] examined the educational quality of 102 YouTube videos regarding idiopathic pulmonary fibrosis. They found that the average overall DISCERN score was 34 with a range of 28-45 and concluded that YouTube provides incomplete and inaccurate information regarding idiopathic pulmonary fibrosis. Springer et al[26] examined the educational quality of 140 YouTube videos regarding the return to sport and rehabilitations following an anterior cruciate ligament reconstruction. Their analysis also demonstrated the poor quality of videos with a GQS of 1.95 ± 0.64 and 1.62 ± 0.82 and JAMA score of 1.32 ± 0.64 and 1.26 ± 0.7 for rehabilitation and return to sport, respectively. The poor quality of educational content regarding medical education on YouTube is further redemonstrated in the present study. The present study found that YouTube is a poor source of educational information

Table II – Characteristics of videos by category.

Variable	Education-physician	Education-nonphysician	Personal testimony	Commercial	*P* value
Views	23,310.1 ± 33,137.8	44,268.3 ± 72,337.9	13,562.5 ± 33,187.2	36,813.9 ± 70,777.8	.06
Duration (min)	10.0 ± 14.8	6.2 ± 3.2	3.5 ± 2.6	5.8 ± 5.4	**<.01**
Time since upload (d)	1386.9 ± 1024.8	1420.1 ± 929.9	1523.8 ± 1094.4	1489.5 ± 1020.3	.93
Likes	108.1 ± 164.2	324.4 ± 587.4	66.1 ± 168.2	181.0 ± 400.6	**.01**
Dislikes	6.9 ± 11.8	14.3 ± 24.6	3.7 ± 9.2	10.9 ± 21.8	**.04**
Like ratio	15.1 ± 14.1	19.7 ± 15.6	14.6 ± 22.6	12.2 ± 9.2	.47
View ratio	15.9 ± 20.5	29.6 ± 56.7	11.9 ± 23.9	23.1 ± 45.1	.19
VPI	2.9 ± 5.5	7.2 ± 14.2	3.9 ± 13.2	3.7 ± 7.8	.35
JAMA	2.8 ± 0.7	2.3 ± 0.5	2.3 ± 0.8	2.6 ± 0.5	**<.01**
GQS	3.1 ± 0.7	3.0 ± 0.6	2.1 ± 0.7	2.6 ± 0.9	**<.01**
DISCERN	35.7 ± 5.8	32.9 ± 2.9	30.5 ± 4.4	32.2 ± 6.3	**<.01**

VPI, video power index; *JAMA*, Journal of the American Medical Association benchmark criteria; *GQS*, Global Quality Score; *SD*, standard deviation.
Continuous variables are presented as mean ± SD. Significant values are noted in **bold**, $P < .05$.

regarding TSA rehabilitation with a mean JAMA score of 2.5 ± 0.7, mean GQS of 2.7 ± 0.9, and mean DISCERN score of 33.2 ± 5.5 overall. These findings suggest that patients should be made aware that YouTube may not be the ideal source for information regarding TSA rehabilitation and is fraught with inaccurate information due to the fact that the information on the platform is not subject to a rigorous peer-review process. It is advisable that clinicians provide patients with educational resources that have been reviewed for accuracy regarding TSA rehabilitation. Additionally, physicians who invest the resources in developing concise and accurate videos regarding the rehabilitation process can aid in improving the quality of available information on the platform.

When accessing the educational quality of content on YouTube, several studies have sought to examine if the source of the content influenced the overall quality of the video. Celik et al[4] examined the educational content of 67 YouTube videos regarding rotator cuff repairs based on the authorship of the video. Their study demonstrated that the videos created by physicians had significantly higher DISCERN and JAMA scores ($P < .01$) when compared to all other author types. Kunze et al[22] examined the educational quality of 50 YouTube videos regarding menisci. They also demonstrated that videos created by physicians had significantly higher JAMA and GQS scores compared to nonphysician, testimonial, and commercial videos ($P < .01$). In accordance with previous literature, the present study demonstrated that the educational quality of YouTube videos pertaining to TSA was higher in videos produced by physicians. Physician educational videos had statistically higher JAMA, GQS, and DISCREN scores when compared to all other author types; however, this difference was not meaningfully different between author types as the average scores across all author categories were no better than moderate quality. Again, patients should be directed to known higher quality resources.

Previous investigations have sought to evaluate medical video content on YouTube based on VPI and viewership. In a study examining the first 50 videos specific to posterior cruciate ligament of the knee on YouTube, Kunze et al[21] reported a mean number of views of 50,477.9 and a mean VPI of 1240.4. Their study found that there was no statistically significant difference in VPI between video content classification or corresponding JAMA or GQS ($P > .05$). In an evaluation of YouTube videos related to rotator cuff tears, Kuru and Erken[23] found an average VPI of 90.6 and total viewership of 401,329.0. They also found no statistically significant difference in VPI between physician and nonphysician videos. The present study found a mean viewership of 3,765,881 and a mean VPI of 4.1 indicating that more people are viewing content related to TSA in comparison to aforementioned orthopedic injuries; however, VPI is lower in this domain. In accordance with previous literature this study found no statistically significant difference in VPI between video groups.

There are a paucity of studies that sought to evaluate differences in educational video characteristics between physician-produced content and content produced by nonphysician health professionals. Celik et al[4] examined differences in educational videos regarding a rotator cuff repair between physicians and allied professionals. Their study found that videos produced by allied professionals had a significantly higher view ratio (number of views/time since upload) than physician videos (50.7 (9.6-148.9) vs. 30 (4-426; 36.4), $P < .01$, respectively). The present investigation found that videos produced by nonphysician healthcare professionals had significantly more likes (324.4 ± 587.4 vs. 108.1 ± 164.2, $P = .01$) and were significantly shorter (6.2 ± 3.2 vs. 10.0 ± 14.8, $P < .01$) than videos produced by physicians. Nonphysician videos also had a high number of average views compared to physician videos (44,268.3 ± 72,337.9 vs. 23,310.1 ± 33,137.8), although this relationship was not statistically significant. The shorter duration of nonphysician videos likely contributes to these findings, as YouTube does not count a "view" unless the video is watched to completion. Additionally, in an empiric analysis of educational videos and student engagement, Guo et al demonstrated that video engagement as measured by video playback time was significantly higher for videos under 6 minutes. Additionally, they demonstrated that viewers typically make it less than halfway through videos longer than 9 minutes.[17] In the present investigation the physician videos may have not been fully watched by patients given the average length of 10 minutes. Additionally, a review article by Brame[3] has found that producing educational videos shorter than 6 minutes aids in improving a viewer's understanding by minimizing content

overload. These findings suggest that physicians should focus their attention on developing shorter videos, more targeted videos, as they are more likely to be well received and watched to completion by viewers compared to longer videos.

Limitations

This study is not without limitations. One limitation of this study pertains to the nature of YouTube as a video hosting platform—contents available on the platform are constantly in-flux with new content always being uploaded on the Web site. Video content was screened at 2 separate time points, although these dates are close together potential for biased can be introduced due to new content potential being uploaded between these dates and videos been organized differently based on viewership on the platform. No such discrepancy between search dates was noted in our analysis. Although JAMA, GQS, and DISCERN scores are all validated assessment tools used in the evaluation of video content on YouTube and other web-based quality studies, the video scoring is performed against a scoring criteria checklist which can produce variation between observers. Any discrepancies between the 2 observers were clarified by mutual agreement. Additionally, it is important to recognize that in the realm of social media platforms, entities colloquially referred to as "bots" exist as software programs that perform automated, repetitive, and predefined task that can be utilized to inaccurately and artificially inflate the like and viewership count of videos.[1] Although the researchers did not have a mechanism to counter the possible effect of bots, social platforms are constantly working on minimizing their presence on platforms.

Conclusion

YouTube videos are a poor source of educational information for patients regarding TSA rehabilitation. Educational videos prepared by nonphysicians accrued more likes than other video categories. Although educational videos by physicians provided statistically higher quality educational content as noted by JAMA, GQS, and DISCREN scores, the average scores across all author categories were classified as low (JAMA), moderate to poor (GQS), or poor (DISCERN) quality educational content. Additionally, our findings suggest that physician educational videos that are shorter in duration are more likely to be well received and watched to completion by viewers compared to longer videos. Patients should be cautioned about using this resource to learn more about TSAs.

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Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.1053/j.sart.2022.05.009.

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