

ARTICLE



YouTube is inadequate as an information source on delayed ejaculation

Tuncay Toprak¹✉, Mehmet Yilmaz², Mehmet Akif Ramazanoglu³, Ayhan Verit¹, Daniel Schlager² and Arkadiusz Miernik²

© The Author(s), under exclusive licence to Springer Nature Limited 2022

The prevalence of delayed ejaculation in sexually active men is reportedly 3%. Due to its rarity and uncertain definitions, people seek information about delayed ejaculation on the internet. YouTube is one of the largest video platforms preferred global for gathering medical information. We aimed to determine the quality of YouTube videos on delayed ejaculation. YouTube search was performed with the keywords “delayed and retarded ejaculation”, and we recorded the first 400 videos according to relevance. The search results were saved in the playlist, and the first 400 videos were evaluated by two independent urologists. DISCERN and Global Quality Scale (GQS) were used to assess the reliability and quality of videos. Repeated ($n = 17$), off-topic ($n = 279$), non-English videos ($n = 37$), and videos with no audio ($n = 16$) were excluded from the study. The remaining 51 videos were evaluated. DISCERN and GQS scores were statistically significantly associated with video durations ($r = 0.329$, $P = 0.018$ and $r = 0.349$, $P = 0.012$; respectively). A statistically significant association was also observed between and DISCERN and GQS scores with video power index values ($r = 0.466$, $P = 0.001$ and $r = 0.422$, $P = 0.002$; respectively). 62.7% ($n = 32$) videos were low quality, 23.5% ($n = 12$) were intermediate quality, and 13.7% ($n = 7$) were high quality according to the GQS. Most of the YouTube content on delayed ejaculation was of poor quality. Physicians should be aware of this situation, and take the lead in bringing high-quality videos about delayed ejaculation to the community.

IJIR: Your Sexual Medicine Journal; <https://doi.org/10.1038/s41443-022-00559-3>

INTRODUCTION

Delayed ejaculation (DE) is a psychological and/or medical condition not associated with other types of psychiatric diagnoses. DE is defined as requiring one of two symptoms: significantly DE, failure to ejaculate, or its infrequency during intercourse at a rate of 75–100% persisting for at least 6 months and causing personal distress [1]. The prevalence of DE in sexually active men is reported to be 3% [2, 3].

Causes of DE can be organic (e.g., penile nerve damage or a spinal cord lesion), psychological, or pharmacological (e.g., antipsychotics, antihypertensive drugs, or selective serotonin reuptake inhibitors) [4, 5]. Pharmacologic agents used to treat DE have various success. However, due to the lack of randomized, blinded, placebo-controlled studies, no drug has been proven to be superior or effective regarding DE treatment [6]. Furthermore, there is no European Medicines Agency- or Food and Drug Administration-approved drug for treating DE. There is very little literature on the psychological aspects of DE and also little empirical evidence on psychological treatment efficacy. People thus may tend to seek information on the internet.

As access to online health information becomes easier, the internet is increasingly used as a health information resource [7–9]. YouTube, the media and video sharing website with over 1 billion users worldwide, is an important information source that

people can gather information about various illnesses and even surgical procedures [10, 11]. Recently, several studies have evaluated the quality of YouTube videos on topics such as bladder pain syndrome [12], bladder cancer [13], erectile dysfunction [14], penile prosthesis [15], male infertility [16], Peyronie's disease [17], and even COVID-19 pandemic [18] hoping to illuminate YouTube's effectiveness for patient education. However, there is no study evaluating the quality of YouTube videos regarding DE. We aimed to evaluate the quality of YouTube videos related to DE and to define the characteristics of the videos from the users' point of view. Thus, we tried to determine whether accurate and reliable information about DE could be reached on Youtube.

MATERIALS AND METHODS

Ethics committee approval was not necessary because the videos were open to the public and there were no animal or human study participants. Similar studies in the literature were not ethics-approved either [19, 20]. The studies evaluating video quality on YouTube generally evaluated the top 100 or 200 videos [14, 21]. In addition, it is known that the vast majority of internet users tend to review videos on the first three pages of their search results [22]. Therefore, we decided to evaluate the first 400 videos on DE according to relevance that would cover most of the YouTube videos most likely to be viewed by internet users.

¹Department of Urology, University of Health Sciences Fatih Sultan Mehmet Training and Research Hospital, Istanbul, Turkey. ²Department of Urology, Faculty of Medicine, University of Freiburg-Medical Centre, Freiburg, Germany. ³Department of Urology, University of Health Sciences Trabzon Kanuni Training and Research Hospital, Trabzon, Turkey. ✉email: drtuncay55@hotmail.com

Received: 25 December 2021 Revised: 28 February 2022 Accepted: 8 March 2022

Published online: 23 March 2022

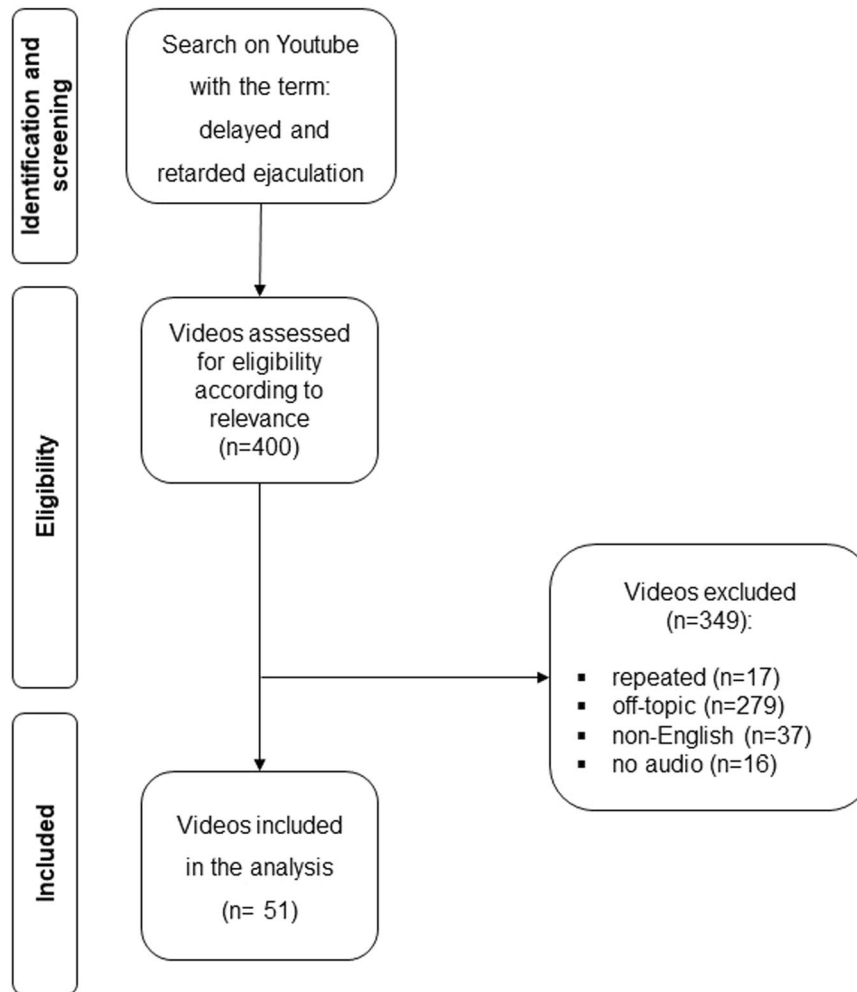


Fig. 1 The flowchart of the video selection process. After search on Youtube, 400 videos were assessed for eligibility and 349 videos were excluded. 51 videos included in the study.

Table 1. DISCERN reliability tool.

1. Is the video clear, concise, and understandable?
2. Are valid sources cited?
3. Is the information provided balanced and unbiased?
4. Are additional sources of information listed for patient reference?
5. Does the video address areas of controversy/uncertainty?

YouTube search

On October 10, 2021, a video search was performed with the term “delayed and retarded ejaculation” in the internet address <https://www.youtube.com/>. The video search was performed by two independent urologists (TT and MY) using two separate YouTube accounts. In terms of ranking the same video list by two independent urologists and so that the previous search history does not affect the new search, we deleted the search history, when the YouTube search was performed from different computers. In addition, we have also canceled the memberships of previously subscribed medical YouTube channels so that they do not affect the search process. Since we aimed to evaluate the videos on delayed and retarded ejaculation, it was essential for the results of the study to find the videos most related to delayed and retarded ejaculation. Therefore, it was listed the first 400 videos by relevance (YouTube’s default option). The search results were saved in the playlist, and the first 400 videos were evaluated by two independent urologists (TT and MY). Repeated, off-topic, non-English videos and videos with no audio were

excluded from the study. Figure 1 shows the flowchart of the video selection process.

Video features and quality analysis

Video length, number of comments, comments rate (comments per day), number of ratings (views/day), the total number of “likes” and “dislikes”, time since the upload date and the video source were recorded. The videos containing animation was also recorded. Video sources were categorized as physician, health-related websites, independent user, non-physician health personnel, and sex therapist. The video power index (VPI) to evaluate the popularity of videos was calculated using the formula as follow: $[(\text{total likes}/\text{total likes} + \text{total dislikes}) \times 100]$. Global Quality Scale (GQS) (Table 1) and modified DISCERN tool (Table 2) were used for quality and reliability analyses.

GQS is a five-point scale with the lowest 1 point and the highest 5 points. It is a scale for rating of internet videos that measures the videos’

Table 2. Global quality scale (GQS).

1. Poor quality, poor flow, most information missing, not helpful for patients
2. Generally poor, some information given but of limited use to patients
3. Moderate quality, some important information is adequately discussed
4. Good quality good flow, most relevant information is covered, useful for patients
5. Excellent quality and excellent flow, very useful for patients

Table 3. Characteristics and quality assessments of YouTube videos.

| Video content | Low quality, <i>n</i> (%) | Intermediate quality, <i>n</i> (%) | High quality, <i>n</i> (%) | Total (<i>n</i>) |
|-------------------------------------|---------------------------|------------------------------------|----------------------------|--------------------|
| Symptoms | 12 (63.2) | 4 (21.1) | 3 (15.8) | 19 |
| Symptoms, treatment and suggestions | 4 (26.7) | 7 (46.7) | 4 (26.7) | 15 |
| Treatment and suggestions | 14 (100) | 0 | 0 | 14 |
| Personal experience | 3 (100) | 0 | 0 | 2 |
| Total | 32 (62.7) | 12 (23.5) | 7 (13.7) | 51 |
| Source of upload | <i>n</i> (%) | <i>n</i> (%) | <i>n</i> (%) | (<i>n</i>) |
| Independent user | 15 (78.9) | 3 (15.8) | 1 (5.3) | 19 |
| Physician | 7 (50) | 3 (21.4) | 4 (28.6) | 14 |
| Non-physician health personnel | 4 (57.1) | 2 (28.6) | 1 (14.3) | 7 |
| Sex Therapist | 3 (50) | 3 (50) | 0 | 6 |
| Health-related websites | 3 (60) | 1 (20) | 1 (20) | 5 |
| Total | 32 (62.7) | 12 (23.5) | 7 (13.7) | 51 |
| Video features | Median (min–max) | Median (min–max) | Median (min–max) | Median (min–max) |
| GQS | 2 (1–2) | 3 (3–3) | 4 (4–5) | 2 (1–5) |
| DISCERN | 1 (1–3) | 2 (1–4) | 3 (1–4) | 1 (1–4) |
| Number of likes | 19 (0–3100) | 12 (0–3300) | 141 (1–4000) | 13 (0–4000) |
| Number of dislikes | 1.5 (0–167) | 1 (0–237) | 8 (0–63) | 1 (0–237) |
| Number of comments | 2 (0–437) | 3 (0–751) | 44 (0–339) | 3 (0–751) |
| Number of comments per day | 0.001 (0–0.34) | 0.007 (0–0.97) | 0.02 (0–0.69) | 0.001 (0–0.97) |
| Number of views | 9368.5 (72–333,255) | 2120 (116–232,187) | 27,716 (195–191,127) | 9361 (72–333,255) |
| Number of view per day | 4.58 (0–259.74) | 3.9 (0.22–302.7) | 14.91 (0.39–394) | 4.48 (0–394) |
| Duration (seconds) | 193 (49–2403) | 458.5 (100–3747) | 389 (156–838) | 272 (49–3747) |
| Time since upload (days) | 1129.5 (48–3860) | 853 (99–3027) | 1616 (346–3064) | 1026 (48–3860) |
| VPI | 87.7 (0–100) | 94.1 (0–100) | 99 (84.3–100) | 92.8 (0–100) |
| | <i>n</i> (%) | <i>n</i> (%) | <i>n</i> (%) | (<i>n</i>) |
| Real Image, <i>n</i> (%) | 27 (69.2) | 7 (17.9) | 5 (12.8) | 39 |
| Animation, <i>n</i> (%) | 5 (41.7) | 5 (41.7) | 2 (16.7) | 12 |

VPI Video Power Index, GQS Global quality scale.

quality, ease of use and flow. A video score of 1 or 2 points is considered low quality, 3 points medium quality, and 4 or 5 points high quality [23].

Modified DISCERN tool is a five-point evaluation tool [24, 25]. We relied on it to assess the reliability of YouTube videos. There are 5 yes and no questions in this scale, and each yes answer counts as 1 point.

Characteristics and quality assessments of videos and quality scale correlations according to source and content of the video were reviewed. Inter-observer agreement between the DISCERN and GQS scores was also evaluated.

The procedures were conducted in accordance with the Helsinki Declarations of 2004.

Statistical analysis

The Statistical Package for Social Sciences 22.0 (SPSS 22.0) software was used for statistical analysis. To understand the distribution of data, Shapiro–Wilk test was used. Median, minimum, maximum, mean, standard deviation, and frequency were used as descriptive methods. Kruskal–Wallis

test was used to determine differences between more than two groups of the independent variable. Dunn–Bonferroni post hoc method was used for paired comparison after a significant Kruskal–Wallis test. For correlations Spearman test was used. Mann–Whitney *U* was used to compare independent groups without normal distribution. For inter-rater agreement, Kappa coefficient was used. $p < 0.05$ was considered as statistically significant. Bonferroni adjustment was performed by multiplying Dunn's *p* value by the number of comparisons.

RESULTS

A total of 349 videos were excluded from the study. Repeated ($n = 17$), off-topic ($n = 279$), non-English videos ($n = 37$) and videos with no audio ($n = 16$) were excluded from the study. The remaining 51 videos were evaluated. Table 3 summarizes the videos' features. Video contents were mostly about symptoms (37.2%). Most of the videos (37.2%) were uploaded by

Table 4. The correlations between quality scales and video features.

| | VPI values (r, p) | Video lengths (r, p) | View rate (r, p) | Comment per day (r, p) | Likes (r, p) | Dislikes (r, p) | Number of Comments (r, p) | Number of view (r, p) |
|---------|-------------------|----------------------|------------------|------------------------|--------------|-----------------|---------------------------|-----------------------|
| DISCERN | 0.466, 0.001* | 0.329, 0.018* | -0.149, 0.29 | 0.060, 0.67 | 0.074, 0.608 | -0.094, 0.513 | 0.014, 0.92 | -0.165, 0.24 |
| GQS | 0.422, 0.002* | 0.349, 0.012* | 0.128, 0.37 | 0.238, 0.09 | 0.176, 0.217 | -0.025, 0.86 | 0.253, 0.073 | 0.043, 0.76 |

VPI Video Power Index, GQS Global quality scale.

Spearman correlations, * $P < 0.05$

independent users. The median DISCERN and GQS scores were 1 and 2, respectively. 23.5% of the videos contained animation, 76.5% of the videos contained real images. According to the GQS, 62.7% of the videos were low quality, 23.5% were intermediate and 13.7% were high quality. DISCERN and GQS scores by the two urologists were highly consistent with each other (0.86 and 0.85, respectively). DISCERN and GQS scores were statistically significantly associated with video durations ($r = 0.329$, $P = 0.018$ and $r = 0.349$, $P = 0.012$; respectively). A statistically significant association was also observed between and DISCERN and GQS scores with VPI values ($r = 0.466$, $P = 0.001$ and $r = 0.422$, $P = 0.002$; respectively). No significant relationship between DISCERN and GQS scales and other video features was detected (Table 4). Although the DISCERN and GQS scores of animated videos were higher than those containing real images, there was no statistically significant difference between whether or not the videos contained animation.

DISCUSSION

People are increasingly using the internet to learn about their illnesses and often choose YouTube as it contains visual material to get information about illnesses thanks its low cost and easy 24 h access. Since the knowledge on DE is limited, people use the internet, especially Youtube, to get information on DE and its treatment as well as a myriad of others.

Although YouTube videos are easy and free to access, there is no mechanism by which to check their quality and accuracy. Anyone who is a member of YouTube can upload videos. These uploaded videos may be of poor quality and full of misleading information. On the other hand, 75 percent of internet users worry about whether such internet information is reliable [26, 27]. Many studies in the literature have assessed the quality of YouTube videos presenting information on a wide range of diseases [10, 21, 28]. However, no study to date has evaluated the quality of YouTube videos related to DE. In the present study, we evaluated DE videos on Youtube and our study showed that DE videos currently on YouTube are of low quality.

The DISCERN and GQS tools have been applied in the studies evaluating video reliability and quality [29, 30]. In the present study, according to the GQS, 13.7% of the videos were of high quality. Similar to our study, Rittberg et al. [22] reported rates of high-quality videos as 19.6% and 18.4%, respectively. However, on the contrary, Singh et al. [24] and Tolu et al. [31] reported that close to 50% of the videos were of high quality. Differences in the numbers of videos evaluated, the researchers' evaluation of YouTube videos about various conditions and diseases, and the subjectivity of assessing YouTube videos may be reasons for the diverging results in these investigations.

When evaluating video quality in terms of their sources, we noted that the higher quality videos had been uploaded by physicians, while the primary source of low-quality videos was usually independent users (Table 1). Other studies have found that high-quality videos are predominantly uploaded by physicians, academic sources, and universities [32, 33]. Our results show that it is important to consider video sources when using YouTube as a source of health information. Furthermore, it was shown that video content may be inadequate or inconsistent despite having been uploaded by healthcare professionals [34]. Physicians were also an important source of low-quality videos in our study (Table 1). Table 5 shows the quality ratings of YouTube videos according to upload sources.

In the present study, we found that video lengths correlated positively with both the DISCERN and GQS scores. The longer the video is, the more information it can convey and be understood. In line with our study, other researchers have found that high-quality videos last longer than low-quality videos [35]. On the other hand, despite the longer-lasting video content in these studies, there is

Table 5. Quality assessments of YouTube videos on delayed ejaculation according to sources of upload.

| Source of upload | GQS median (min–max) | DISCERN median (min–max) |
|--------------------------------|----------------------|--------------------------|
| Sex therapist | 2.5 (1–3) | 2.5 (1–3) |
| Physician | 2.5 (1–5) | 2 (1–3) |
| Health-related websites | 2 (1–4) | 1 (1–4) |
| Independent user | 2 (1–4) | 1 (1–3) |
| Non-physician health personnel | 2 (1–4) | 2 (1–4) |

GQS Global quality scale.

evidence that users gradually lose interest over time [35]. Videos should therefore provide high-quality information within a reasonable period of time. VPI values correlated positively with GQS and DISCERN scores in our study. This is an indication that the higher a video's quality is, the more "likes" it attracts. We identified no correlation between DISCERN, GQS and the number of likes, dislikes, comments or views. These parameters did not prove to be indicators of high-quality videos in our study.

Whether the video is animated or not seems immaterial in terms of quality. The study by Gokcen and Gumussuyu [36] showed that the presence of animation does not affect video quality. Independent users uploaded 37.2% of the videos in our study, which may be one reason why many videos were low quality. The inclusion and exclusion criteria in the present study resemble those of other investigations in the literature [37, 38]. Instead of evaluating all the information about DE, we aimed to analyse the information by creating an instant search model from the patients' perspective. The effect of knowledge on the physician's thinking is a controversial issue that requires a different perspective.

Study limitations

One of the major limitations of our study was that we interpreted videos in English only, which can create a bias, because the number of excluded non-English videos approximated that of English videos (37 and 51, respectively). However, if we had examined those non-English videos, we might have obtained similar rating—a factor that should not be ignored. A second limitation is that when entering a search keyword on YouTube, an instant data is obtained. The dynamic nature of YouTube caused by ongoing video uploads may make results vary.

CONCLUSIONS

Our study demonstrates that DE videos currently on YouTube are of low quality, and that many of those videos were uploaded by independent users. We consider our study important as it is the first to analyse the quality of YouTube videos regarding DE. We hope that our study will serve as a stimulus for the academic community interested in this subject/problem to ensure that more accurate and higher quality information be provided to society. For example, a channel on YouTube licensed by experts interested in this subject could be created: if YouTube videos fulfilled the evaluation criteria we applied in this investigation, the quality of health videos on the website would improve. We thus maintain that health-related videos on YouTube should meet certain quality criteria as a guideline for viewers. Such a solution would help solve the low-quality health video problem on social media.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

- Salonia A, Bettocchi C, Boeri L, Capogrosso P, Carvalho J, Cilesiz NC, et al. European Association of Urology Guidelines on sexual and reproductive health—2021 update: male sexual dysfunction. *Eur Urol.* 2021;803:333–57.
- Laumann EO, Paik A, Rosen RC. Sexual dysfunction in the United States: prevalence and predictors. *Jama.* 1999;281:537–44.
- Simons JS, Carey MP. Prevalence of sexual dysfunctions: results from a decade of research. *Arch Sex Behav.* 2001;302:177–219.
- Abdel-Hamid IA, Ali OI. Delayed ejaculation: pathophysiology, diagnosis, and treatment. *World J Mens Health.* 2018;361:22–40.
- Rowland DL, Keeney C, Slob AK. Sexual response in men with inhibited or retarded ejaculation. *Int J Impot Res.* 2004;163:270–4.
- Butcher MJ, Serefoglu EC. Treatment of delayed ejaculation. In: *The textbook of clinical sexual medicine.* Springer: New York, NY, USA 2017. pp 255–69.
- Amante DJ, Hogan TP, Pagoto SL, English TM, Lapane KL. Access to care and use of the Internet to search for health information: results from the US National Health Interview Survey. *J Med Internet Res.* 2015;174:e106.
- Hanna K, Arthur M, Welliver C. Erectile dysfunction and prostate diseases are the predominant Google search terms amongst men's health topics. *Int J Impot Res.* 2021. Online ahead of print.
- Gul M, Huynh LM, El-Khatib FM, Yafi FA, Serefoglu EC. A qualitative analysis of Internet forum discussions on hard flaccid syndrome. *Int J Impot Res.* 2020;325:503–9.
- Drozd B, Couvillon E, Suarez A. Medical YouTube videos and methods of evaluation: literature review. *JMIR Med Educ.* 2018;41:e3.
- Tonyali S. YouTube: a good source for retrograde intrarenal surgery? *Investig Clin Urol.* 2021;622:180–5.
- Morra S, Collà Ruvolo C, Napolitano L, La Rocca R, Celentano G, Califano G, et al. YouTube(TM) as a source of information on bladder pain syndrome: a contemporary analysis. *NeuroUrol Urodyn.* 2022;411:237–45.
- Loeb S, Reines K, Abu-Salha Y, French W, Butaney M, Macaluso JN Jr, et al. Quality of bladder cancer information on YouTube. *Eur Urol.* 2021;791:56–9.
- Fode M, Nolsøe AB, Jacobsen FM, Russo GI, Østergren PB, Jensen CFS, et al. Quality of information in YouTube videos on erectile dysfunction. *Sex Med.* 2020;83:408–13.
- Capece M, Di Giovanni A, Cirigliano L, Napolitano L, La Rocca R, Creta M, et al. YouTube as a source of information on penile prosthesis. *Andrologia.* 2022;541:e14246.
- Ku S, Balasubramanian A, Yu J, Srivatsav A, Gondokusumo J, Tatem AJ, et al. A systematic evaluation of youtube as an information source for male infertility. *Int J Impot Res.* 2021;336:611–5.
- Baydilli N, Selvi I. Is social media reliable as a source of information on Peyronie's disease treatment? *Int J Impot Res.* 2021. Online ahead of print
- Gerundo G, Collà Ruvolo C, Puzone B, Califano G, La Rocca R, Parisi V, et al. Personal protective equipment in Covid-19: Evidence-based quality and analysis of YouTube videos after one year of pandemic. *Am J Infect Control.* 2022;50:300–5.
- Leong AY, Sanghera R, Jhaji J, Desai N, Jammu BS, Makowsky MJ. Is YouTube useful as a source of health information for adults with Type 2 diabetes? A South Asian perspective. *Can J Diabetes.* 2018;424:395–403.e4.
- Nason GJ, Kelly P, Kelly ME, Burke MJ, Aslam A, Giri SK, et al. YouTube as an educational tool regarding male urethral catheterization. *Scand J Urol.* 2015;492:189–92.
- Toprak T, Tokat E. A quality analysis of nocturnal enuresis videos on YouTube. *J Pediatr Urol.* 2021;174:449.e441–e6.
- Rittberg R, Dissanayake T, Katz SJ. A qualitative analysis of methotrexate self-injection education videos on YouTube. *Clin Rheumatol.* 2016;355:1329–33.
- Bernard A, Langille M, Hughes S, Rose C, Leddin D, Veldhuyzen, et al. A systematic review of patient inflammatory bowel disease information resources on the World Wide Web. *Am J Gastroenterol.* 2007;1029:2070–7.
- Singh AG, Singh S, Singh PP. YouTube for information on rheumatoid arthritis—a wakeup call? *J Rheumatol.* 2012;395:899–903.
- Esen E, Aslan M, Sonbahar B, Kerimoğlu RS. YouTube English videos as a source of information on breast self-examination. *Breast Cancer Res Treat.* 2019;1733:629–35.
- 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. *JBSJ.* 2010;927:1612–8.
- Fox S, Rainie L. E-patients and the online health care revolution. *Physician Exec.* 2002;286:14–7.
- Khatri P, Singh SR, Belani NK, Yeong YL, Lohan R, Lim YW, et al. YouTube as source of information on 2019 novel coronavirus outbreak: a cross sectional study of English and Mandarin content. *Travel Med Infect Dis.* 2020;35:101636.
- Gul M, Diri MA. YouTube as a Source of Information About Premature Ejaculation Treatment. *J Sex Med.* 2019;1611:1734–40.

30. Kocyigit BF, Nacitarhan V, Koca TT, Berk E. YouTube as a source of patient information for ankylosing spondylitis exercises. *Clin Rheumatol.* 2019;386:1747–51.
31. Tolu S, Yurdakul OV, Basaran B, Rezvani A. English-language videos on YouTube as a source of information on self-administer subcutaneous anti-tumour necrosis factor agent injections. *Rheumatol Int.* 2018;387:1285–92.
32. Kocyigit BF, Akaltun MS, Sahin AR. YouTube as a source of information on COVID-19 and rheumatic disease link. *Clin Rheumatol.* 2020;397:2049–54.
33. Delli K, Livas C, Vissink A, Spijkervet FK. Is YouTube useful as a source of information for Sjögren's syndrome? *Oral Dis.* 2016;223:196–201.
34. Fischer J, Geurts J, Valderrabano V, Hügler T. Educational quality of YouTube videos on knee arthrocentesis. *J Clin Rheumatol.* 2013;197:373–6.
35. Lena Y, Dindaroğlu F. Lingual orthodontic treatment: a YouTube™ video analysis. *Angle Orthod.* 2018;882:208–14.
36. Gokcen HB, Gumussuyu G. A quality analysis of disc herniation videos on YouTube. *World Neurosurg.* 2019;S1878–8750:30246–3.
37. Erdem MN, Karaca S. Evaluating the accuracy and quality of the information in kyphosis videos shared on YouTube. *Spine.* 2018;4322:E1334–9.
38. Staunton PF, Baker JF, Green J, Devitt A, Online. Curves: a quality analysis of scoliosis videos on YouTube. *Spine.* 2015;4023:1857–61.

AUTHOR CONTRIBUTIONS

Conceptualization, statistical analysis, writing—original draft, writing—review and editing: TT. Conceptualization, investigation, data curation, resources: MY, MAR. Conceptualization, formal analysis, review: AV. Paper editing, review: DS, AM. Supervision: AM. All authors read and approved the final paper.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

Correspondence and requests for materials should be addressed to Tuncay Toprak.

Reprints and permission information is available at <http://www.nature.com/reprints>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.