Is YouTube a Reliable Source of Health-Related Information? A Systematic Review

Wael Osman (✉ wael.osman@ku.ac.ae)

Khalifa University

Fatma Mohamed

Khalifa University

Mohamed Elhassan

Saint Agnes Medical Center

Abdulhadi Shoufan

Khalifa University

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Abstract

Background: YouTube is a valuable source of health-related educational material which can have a profound impact on people's health-related behaviors and decisions. However, YouTube contains a wide variety of unverified content that may promote unhealthy behaviors and activities. We aim in this systematic review to provide insight into the published literature concerning the quality of health information and educational videos found on YouTube.

Methods: A search of peer-reviewed original articles was conducted regarding the educational value of YouTube medical videos which were published in English. We searched Google Scholar, Medline (through PubMed), EMBASE, Scopus, Direct Science, Web of Science, and ProQuest databases. A literature search was conducted between April 1 and April 31 of 2021. Based on the eligibility criteria, 202 articles covering 30 medical categories were included in the qualitative synthesis.

Results: We reviewed approximately 22,300 videos in all of the studies we reviewed, with a mean of 115 videos per paper, which were assessed by 2.6 assessors. The quality of the videos was rated based on either scores or categories. Researchers commonly employed scoring systems that were either standardized (e.g., GQS, DISCERN, and JAMA) or based upon the guidelines and recommendations of professional associations. The results using different scores indicated an average to below-average quality. According to our aggregate quality assessment data, most of the videos were of poor quality. In terms of bias, only 32% of the videos appear neutral toward the health content, indicating that bias occurs frequently in these videos. Furthermore, the majority of the studies found a negative correlation between the quality and popularity of the videos.

Conclusions: YouTube is currently a poor to average source of health information. Furthermore, YouTube metrics are indeed tricky and can be misleading when determining the quality of videos. The future solution should be to implement ranking filtering algorithms that consider experts' endorsements, peer-review, and other metrics that can push up endorsed videos in the search results.

1. Background

YouTube is currently the second most popular search engine and social media platform. YouTube, which was founded in 2005, had over 2.1 billion users in 2020, resulting in over one billion hours of video being viewed each day and over 500 hours of video being uploaded each minute¹. According to estimates, over 95% of the Internet population from 88 countries and 76 languages engages in some form of social interaction on YouTube every week (e.g., liking, sharing, and commenting)^{2,3}. The United States alone is estimated to have 74% of the adult population using YouTube by September 2020⁴.

The instant popularity of YouTube is due to multiple factors, including its accessibility to almost any type of content in a simple and highly efficient mobile application, its popularity among young people^{3,5} including young trainees and residents⁶, as well as its sharing of its enormous advertising revenue with

the content creators (also known as YouTubers). Moreover, since 70% of users access YouTube using their mobile devices ⁷, YouTube can be accessed at any time of the day.

Nowadays, YouTube has emerged as a valuable educational resource as a result of its innovative digitalization. Specifically, the YouTube model is based on a visual model that can include both theory and practice for teaching purposes. YouTube's popularity, ease of access, and relatively uncontrolled nature also make it a powerful tool for influencing people's decisions and promoting their well-being. For example, Mamlin and colleagues (2016) predicted that social media platforms such as YouTube would be widely used to exchange healthcare information between healthcare providers and consumers, to provide peer-to-peer patient support, and as a tool for public health surveillance ⁸. The health information videos on YouTube are derived from various sources, such as those uploaded by doctors and health institutions, universities and medical schools, patients, advertisers, and user-generated content. However, and regardless of the source of the content, YouTube's terms of service stipulate that "the content is the responsibility of the person or entity that provides it to the Service" ⁹. YouTube's search results are typically based on metrics such as views, likes, and dislikes, rather than quality-based metrics, which leads to the wide availability of misleading videos that promote unhealthy habits and activities or provide inaccurate information ¹⁰. For example, a recent study found that more than 25% of the most viewed YouTube videos regarding COVID-19 contained misleading information that reached millions of people around the world ¹¹. Furthermore, Nour and colleagues (2016) reported that inaccurate and accurate YouTube videos both received similar views for receiving information about a particular subject such as psoriasis ¹².

A limited number of reviews have evaluated the quality of health information available on YouTube, either in general ^{13,14} or concentrating on specific topics like surgical education ¹⁵. According to these reviews, there was a lack of standardization and unclear information regarding patient education on YouTube. There were a limited number of articles included in the reviews, ranging from seven to 18, which did not provide an elaborate description of the problem or provide detailed recommendations.

The current study examined 202 articles from 30 general health fields providing health information on YouTube. We provide detailed information regarding the scores used to evaluate each article's YouTube video content and the bias sources. Furthermore, we provide recommendations from the articles which we believe will help provide practical solutions to improve YouTube's educational value for health information.

2. Methods

2.1 Literature search:

A flowchart of the search strategy and papers selection can be seen in Fig. 1. The search was conducted using Google Scholar, Medline (through PubMed), EMBASE, Scopus, Direct Science, and Web of Science databases from April 1st through April 31st, 2021. We also searched the ProQuest database for

dissertations and theses in order to avoid publication bias. As we observed a noticeable shift towards papers on the COVID-19 pandemic after that, which may affect our conclusions, we limited the search to papers published by August 2020 to ensure unbiased coverage of health information topics. The search terms used included "YouTube" and "medical, medical education, health, healthcare, health information," and "quality." Two researchers (FA, WO) conducted the search independently. Any disagreements were resolved by a third reviewer (AS).

2.2 Eligibility and papers selection:

First, we read the abstracts or scanned the full texts and supplementary materials if the abstracts were not sufficiently informative. Based on this, we classified the eligibility as yes, no, or unclear and included the unclear abstracts until we reviewed the full-text articles. The inclusion criteria for the papers were: peer-reviewed original articles about the quality of educational value of YouTube medical videos published by the end of August 2020 in English. The exclusion criteria included papers that did not meet the inclusion criteria, duplicate publications, technical reports, organization websites, case reports, and organizational reports. In reviewing the full-texts, we reviewed the five theses^{16–20}; but we excluded three of them from this study since they presented descriptive analyses of health topics without assessing the quality of the research as an eligibility criterion. Ultimately, we selected 202 articles to be reviewed, the titles and topics of which are summarized in the **Supplementary Table 1**.

2.3 Data extraction:

From the included papers, we collected the following data: title, abstract, topic, quality assessment score and results, number of assessors, number of videos, the resulting categories and classifications, type and source of bias, and conclusion and recommendations. Data extraction and analysis were conducted using the PRISMA recommendations for systematic reviews (Fig. 1).

2.4 Statistical analysis:

We used simple descriptive statistics like means, standard deviations, ranges, and frequency to describe the data.

3. Results

3.1 Methodological aspects:

In our review, we selected 202 papers to be reviewed (Fig. 1, Methods), the titles and topics of which are summarized in the **Supplementary Table 1**. We found that researchers adopted different approaches to evaluate the quality of health information on YouTube, but they generally followed these steps:

1. Focus on a single topic, such as a particular disease or treatment
2. A cross-sectional analysis of related videos and the application of some inclusion criteria, such as being in English or having a minimum number of views

3. Videos are evaluated by one or more experts, usually among the authors themselves. Researchers in some studies evaluated the scoring reliability using an inter-rater agreement analysis, resolved discrepancies by consensus, or invited an additional assessor to settle disagreements.
4. Assessors used a scoring system either developed by the authors or standardized by the assessors
5. According to the scores, videos were assigned to different quality categories
6. According to the results of the scoring or classification process, authors generally evaluate the suitability of YouTube for providing reliable health-related information
7. Based on this judgment, some general remarks and recommendations were made.

We summarize the results of our review in the following sections in light of this general approach. We first highlight some methodological aspects and then summarize the findings of reviewed papers.

In Table 1, we summarize some statistics related to the number of videos, assessors, and quality categories included in the reviewed studies. Across all the studies we reviewed, the total number of videos was approximately 22,300, with an average of 115 videos per paper, assessed by an average of 2.6 assessors. The large number of quality categories makes it difficult to aggregate the data. As an example, some studies categorize the videos into three classes, for example "excellent", "moderate", and "poor" ²¹, whereas other studies use four categories, for example "very useful", "useful", "slightly useful", or "misleading" ²².

Table 1
The basic metrics for quality assessment of health-related content in studies

Feature	Mean	SD	Median	Max	Min
<i>Number of videos</i>	115	116	96	1000	2
<i>Number of assessors</i>	2.6	1.2	2	8	1
<i>Number of quality classes</i>	3.2	0.9	3	6	2

In general, each paper addressed a series of videos related to a single topic. In a few instances, the same subject was addressed in more than one study. Therefore, the reviewed papers cover a wide range of topics. To provide a concise overview of these topics, we classified them into 30 different medical categories and determined the number of studies under each category, as shown in Fig. 2.

The majority of authors frequently used their scoring systems based on some reference in the respective medical field in order to assess the quality of the content (Fig. 3). For instance, Brooks and colleagues (2014) based their evaluation of videos about patient information for lumbar discectomy on the recommendations of the British Association of Spine Surgeons ²³. Aside from these, general quality standards were used by many authors. These include the Global Quality Standard (GQS), the DISCERN

instrument, and the Journal of the American Medical Association (JAMA) benchmark criteria. These three scores are described elsewhere ^{24,25}.

3.2 Quality assessment results

The reviewed studies assessed content quality by scoring, categorizing, or both. In addition, many authors correlated quality metrics with video popularity metrics such as views and likes. Nearly all reviewed papers conclude with recommendations. In the following, we present the findings of the reviewed studies according to these aspects.

The quality assessment by scores presents the average quality score of videos according to the three most widely used standards GQS, DISCERN, and JAMA (Fig. 4). As an example, 25 papers used the GQS standard and provided a mean score for each video. The value of 2.68 in Fig. 4 is the average of the 25 mean values presented in related papers. As can be seen in the figure, the mean score is the same for all three standards, noting the 4-point scoring system of JAMA as opposed to the 5-point scoring systems used for the other two standards.

The majority of papers assessing content quality by classification use category labels to describe quality, usefulness, or reliability of the quality assessment. In order to facilitate data aggregation, we have mapped the used category names to one of five labels, as shown in Table 2. The percentage of videos which are assigned to the categories "excellent," "very useful," "very accurate," or "high quality" in the reviewed studies is grouped under the category "excellent quality" in our study.

Table 2

Assigning quality categories in reviewed papers to five categories for the purposes of data aggregation

Excellent quality	Good quality	Average quality	Not useful	Poor quality
- Excellent	- Educationally useful	- Fair	- Not educationally useful	- Dangerously misleading
- Very useful	- Useful	- Satisfactory	- Irrelevant	- Misleading
- Very accurate	- Good	- Slightly useful	- Offering little value	- Very poor
- High quality	- Accurate	- Somewhat useful		- Poor
	- Reliable	- Moderately useful		- Inadequate
		- Intermediate quality		- Low quality
				- Not reliable
				- Inaccurate

Figure 5 illustrates the results of data aggregation. The upper dark bars represent the average percentage of videos classified into each category. For example, the value of 40% in the figure represents the average

percentage of videos assigned to the category "poor" within the reviewed papers. Lower light bars indicate the relative frequency of using the categories in the related studies. As a result, "not useful" was the most frequently used category, followed closely by "poor quality" and "good quality," with "excellent quality" being the least frequently used.

In some papers, controversial topics were discussed, such as vaccination²⁶ or unauthorized treatments²⁷. In such cases, the authors categorized the videos based on the producers' perceived bias towards or against the topic, as determined by the authors, and the results are summarized in Fig. 6. According to the figure, the average proportion of videos is 58% in favor of the discussed treatment. A majority of the videos imply commercial interest (51%), while only 32% are neutral by highlighting the advantages and disadvantages of presented topics without supporting or devaluing them.

Almost a third of the papers correlate the quality of analyzed videos with their popularity metrics, such as views, likes, dislikes, shares, and comments. Fig. 7 summarized the results of these analyses. For example, 3 of the studies found no correlation and 13 found a negative correlation between number of views and quality of the videos^{28,29}, meaning that lower-quality videos were viewed more frequently than higher-quality videos^{30,31}. In only seven papers, a positive correlation was observed between the quality and popularity of both views and likes^{32,33}.

Furthermore, some papers classified videos according to their comprehensiveness, i.e., the amount of coverage that was considered essential for each topic^{34–36}. As an example, Pant and colleagues (2012) assessed the credibility of YouTube content on acute myocardial infarction and discovered that only 6 percent of the reviewed videos addressed all relevant aspects according to the authors' criteria³⁷. The average percentage of total videos in all reviewed articles is 13.2%.

Finally, based on their research findings, almost all reviewed papers provide one or more recommendations to improve the quality of health-related content on YouTube, as summarized in Fig. 8. Accordingly, most frequent recommendations (in ~ 65% of the papers) highlight the role of reputable sources such as professional societies, health organizations, academic institutions, medical institutions in providing qualified content on YouTube^{38–41}. 13% the reviewed papers explicitly or implicitly regard the situation irredeemable and entirely discouraged using YouTube as a source for health-related information^{42–46}. Only a very few authors took the opposite position and recommended YouTube without concerns^{47,48}.

4. Discussion

A reliable and up-to-date source of health information is essential, as it can significantly influence the health of users and their ability to make informed decisions about their treatment and medication. YouTube was originally introduced as a platform for entertainment and not education. Since then, it has become an indispensable educational resource for both the general public and specialists alike. As an example, different studies suggest that surgical videos on YouTube are currently the preferred source of

education among trainees as they are free, portable, reusable, and accessible via mobile phones ^{6,49}. Accordingly, researchers expressed early concerns about the quality of health-related content on YouTube and began investigating the issue as early as 2007 ⁵⁰. Since then, the number of publications that evaluate the quality of health-related content has steadily increased.

As shown in Fig. 2, our study included papers that evaluated YouTube's health-related information in almost all specialties. It is important to keep in mind that within each of the topics in Fig. 2, the videos covered a wide range of pathological conditions and health information (e.g., the orthopedics category may contain information on inflammatory conditions, cancer, or surgical procedures). Some specialties were covered more than others potentially because of their frequency, the difficulty of understanding the disease's nature, or because researchers in those specialties are more engaged in research on the subject. In general, searches for health information about chronic diseases tend to be higher ²⁵.

Different scores were applied to the assessment of video quality (Fig. 3). The scores ranged from standardized scores, such as JAMA and GQS, to customized scores based on specialty guidelines and recommendations of boards, societies, and organizations. Because it was difficult to consider specific scores as they are specialty-dependent and are not unified or standardized, we focused on general scores. Even so, it has been reported that the use of both general and specific scores together to assess video quality led to consistent results ⁵¹. All of the scores indicated that YouTube's health information videos were of average quality (Fig. 4). However, the use of the word "average" implies a serious problem, since it means obtaining information that is likely to have a substantial impact on health even if it is equally correct or incorrect.

We developed a quality clustering for the video based on the terms used in various papers to describe the quality categories. According to our analysis, YouTube has poor to average quality as a source of health information. In approximately 19% of papers searching for "excellent" quality videos, only 16% found videos of excellent quality. In Generally, vidoes relating to complementary and alternative medicine (CAM) were of poor quality ^{52,53}, while papers addressing specific or specialized audiences, such as trainees and residents, were of higher quality ^{54,55}.

The authors of several papers also assessed whether any bias existed in the making of the content (Fig. 6). Over half of them found a commercial bias in the content, mainly in information related to plastic surgery or unapproved therapies. As an example, Adeeb and colleagues (2019) study of 13 YouTube videos on "Facelift" found that 12 were created by individuals having a private practice, which is mentioned in video ⁴⁹. In our analysis, more than a quarter of the videos appeared to be against a particular treatment, health procedure, or health information. Only 32% of the videos were neutral, showing that YouTube videos are significantly influenced by maker bias.

Most of the studies that assessed the relationship between quality and YouTube metrics (e.g., views, likes, dislikes, shares) found no or negative correlations, indicating that YouTube metrics can be misleading indicators when it comes to healthcare video quality. Furthermore, this also demonstrates that adding

more videos produced by professionals and health institutions will not have a significant effect without taking other measures.

As a result of our analysis, we discovered that the most frequent recommendations to improve the quality included encouraging experts and professional institutions to guide users or upload videos to YouTube. Nevertheless, YouTube is an informal educational resource which is based on different factors, such as self-motivation and general learning. In this sense, making video content will not be easy for institutions because of the limited time available to physicians and professionals. Furthermore, studies have revealed that videos uploaded by professional institutions are not necessarily more popular. According to Desai and colleague (2013), the public does not engage with videos uploaded by credible health organizations because they tend to have extensive educational content, making them overly appropriate for the public

Only 13% of papers recommended that YouTube not be used for health-related purposes. As an impractical recommendation, this recommendation ignores the present and potential benefits of YouTube in health education^{6,57,58} as well as the economic implications of this recommendation. A recommendation of this kind also ignores the fact that > 3.02 billion people are expected to use social media platforms such as YouTube to seek health information by 2021⁵⁹, making it nearly impossible to ignore the educational importance of these platforms.

Nearly 85% recommended improving the content – through peer review for example - but did not advise caution when using YouTube as a source of information. However, these recommendations are not specific enough, as the authors did not provide any specific steps to perform this. Moreover, this will be a complex task due to the large number of videos and the financial and technical requirements. On the other hand, about 15% of papers urged users to use caution when seeking information on YouTube. Similarly, this was unclear because no specific criteria were described for selecting and obtaining the correct information.

Collectively, we believe that the most practical step would be to create a ranking and filtering algorithm for YouTube health education videos that takes into consideration all recommendations, such as peer review and expert endorsement. The filter system should include additional parameters associated with quality. Aside from the uploading source, these criteria may also include the video duration⁶⁰, presence of medical terminology (e.g., arthrocentesis versus aspiration)⁵⁴, and presence of links to specialized resources in the title.. Using this filtering system, endorsed videos will be brought up and most of the recommendations made by reviewers (Fig. 8) will be taken into consideration. While a system of this type may take some time to develop, other measures can be taken, such as:

- Watching videos from more than one resource on the same topic;
- Keep in mind the bias of the author when viewing their videos;
- The presence or absence of the resources on which the videos are based;

- To encourage healthcare institutions to periodically review YouTube for the most popular videos on health-related topics and make public announcements that specifically address misinformation.

5. Limitations

This study had some limitations. Firstly, we categorized the videos based on their quality. Although we believe this classification represents the data in the papers, some minor variations may occur as a result of changes made to the categories. Furthermore, we did not conduct subanalyses for each of the disease classes depicted in Fig. 2. Because of this, we were unable to determine whether YouTube content about a particular disease or category was superior to other content. Three, we limited the search to a certain time period in order to avoid bias towards COVID-19 videos, but this may result in a selection bias. Separate studies are necessary for COVID-19 disease and vaccines against it. In addition, all the papers included in the analysis were in English. In spite of this, four papers that examined videos in languages other than English found that the results were consistent^{6,52,61,62}. Furthermore, the protocol of this review was not pre-registered for this purpose (e.g., in PROSPERO), which may introduce potential bias in accordance with Cochrane guidelines. Finally, although we included 202 articles in our review, we may have missed some articles that we do not believe will have a significant impact on the study's findings.

6. Conclusions And Future Work

In this review, we presented quality analyses from 202 studies that analyzed health information from over 22,300 videos on YouTube that related to 30 medical topics. According to our study, YouTube is currently a poor or average source of health information for the general public, but videos directed at specialized audiences like residents and trainees are of higher quality. YouTube metrics are indeed tricky and can be misleading when determining the quality of videos. In the future, we recommend that a filtering system be implemented that considers expert endorsement and includes peer review.

7. Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and material

All data is included in the manuscript. Any request about the study design, search strategy, or any other inquiries will be addressed upon contacting the corresponding author.

Competing interests

Authors declare that they have no competing interests.

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Authors' contributions

AS designed the study protocol with the support of WO; FA and WO separately performed the search, performed the analysis, and summarized the search data; WO, FA, ME, and AS interpreted the results; WO, FA, ME wrote the manuscript and ME has critically revised the manuscript. All authors have approved the submitted version of the manuscript.

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Conflict of interest

The authors declare no conflict of interest.

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Figures

Figure 1

PRISMA Flow chart of literature screening and selection for reviewed articles

Figure 2

Fields addressed by reviewed studies and number of papers in the respective field

Figure 3

Common scoring systems for assessing the content's quality

Figure 4

The average quality measures from three general standard scores: GQS, JAMA, and DISCERN

Figure 5

The most common quality categories for the content as used in the reviewed papers

Figure 6

The classification of the reviewed papers according to bias classes

Figure 7

The correlation between video quality and popularity as described in the reviewed papers

Figure 8

Recommendations derived from the reviewed papers and their frequency

Supplementary Files

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