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Evaluating the Quality and Reliability of YouTube as a Source of Information on Extracorporeal Membrane Oxygenation: A Call to Publish More Quality Videos by Professionals

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ABSTRACT

Background: Extracorporeal membrane oxygenation (ECMO) is a medical intervention employed to provide life-sustaining support for patients. YouTube is a dynamic and widely utilized platform for distributing health-related information. The aim of this study was to evaluate ECMO-related videos on YouTube and assess the frequency of misleading information in the accumulation of ECMO videos.
Methods: On September 17, 2024, an in-depth examination on YouTube was conducted using search phrases "Extracorporeal Membrane Oxygenation" and "ECMO treatment." The study included 55 selected videos. Video parameters and sources were analyzed. Content assessments were conducted utilizing the Global Quality Scale (GQS), the modified DISCERN instrument, the *Journal of the American Medical Association* (JAMA) Benchmark Criteria, and the Patient Education Materials Assessment Tool for Audio/Visual Materials (PEMAT-A/V). The authors conducted comparisons among quality groups.
Results: Among the 55 videos analyzed, 30.9% (n = 17) were categorized as low quality, 21.8% (n = 12) as intermediate quality, and 47.3% (n = 26) as high quality. Physicians (75%) provided the most high-quality videos. News outlets (83.3%) provided the most low-quality videos. No statistically significant difference was observed between quality groups in daily views, likes, and comments ($P > 0.05$). Significant correlations were identified between video duration and GQS ($r = 0.585$), modified DISCERN questionnaire ($r = 0.557$), JAMA Benchmark Criteria ($r = 0.511$), PEMAT-A/V Understandability ($r = 0.530$), and PEMAT-A/V Actionability scores ($r = 0.433$) ($P < 0.001$ for all correlation analyses).

Data Sharing Statement
Raw data can be provided to readers on reasonable requests.

Author Contributions
Conceptualization: Permenov BA, Zimba O, Yessirkepov M, Qumar AB, Suigenbayev D, Kocyigit BF. Data curation: Permenov BA, Zimba O, Suigenbayev D. Formal analysis: Kocyigit BF. Investigation: Permenov BA, Zimba O, Yessirkepov M, Qumar AB, Suigenbayev D, Kocyigit BF. Methodology: Permenov BA, Zimba O, Yessirkepov M, Qumar AB, Suigenbayev D, Kocyigit BF. Software: Kocyigit BF. Visualization: Kocyigit BF. Writing - original draft: Permenov BA, Zimba O, Yessirkepov M, Qumar AB, Suigenbayev D, Kocyigit BF. Writing - review & editing: Permenov BA, Zimba O, Yessirkepov M, Qumar AB, Suigenbayev D, Kocyigit BF.

Conclusion: There is a wide variety in the quality of YouTube ECMO videos. Although YouTube content created by physicians is more likely to provide accurate and beneficial information, substandard videos present a significant public health threat by disseminating misinformation. The critical role of quality control methods on social media platforms in ensuring the accurate and high-quality transmission of health-related information is readily evident.

Keywords: Extracorporeal Membrane Oxygenation; ECMO Treatment; Social Media; Internet; Information Science

INTRODUCTION

Extracorporeal membrane oxygenation (ECMO) is a temporary medical approach to sustain life-saving assistance for individuals suffering from cardiovascular diseases, lung disorders, and respiratory distress. This assistance is provided until the patient's organ systems begin to recover or other treatment strategies are attempted.[1,2] ECMO redirects blood through an extracorporeal system, facilitating oxygenation and carbon dioxide elimination from the individual's tissues before reintegration into circulation. This technology is an instrument for enabling recuperation, donating or transplanting an organ, or determining terminal medical needs.[3] The number of healthcare institutions providing ECMO support has risen over the past years, and the use of ECMO for organ failure has expanded.[4]

Veno-venous ECMO is a viable alternative for primary respiratory failure that is unresponsive to conventional medical treatment and where mechanical ventilation fails to facilitate sufficient recovery.[5] Veno-arterial ECMO supplies carbon dioxide-oxygen and electromechanical circulatory assistance, particularly helpful in isolated cardiac dysfunction or concurrent cardiac-pulmonary failure.[6]

The coronavirus disease 2019 (COVID-19) pandemic has raised global awareness of ECMO, making it a key option for patients with severe respiratory failure who are unresponsive to traditional approaches.[7] With an emergence of COVID-19-related conditions resulting in acute respiratory distress syndrome (ARDS), ECMO has been increasingly utilized to offer life-saving assistance.[8] The increased use of ECMO during the pandemic has raised concerns regarding its potential benefits and challenges and a growing interest in understanding its indications.

In recent years, the Internet has emerged as the primary source for health-related information, with the public actively searching for medical advice, treatment alternatives, and insights into intricate medical technologies online.[9] Platforms like YouTube have become essential tools for patients and healthcare professionals. YouTube is now an indispensable platform for analyzung health professionals' online activities and interactions with the society.[10] YouTube's free accessibility and global use make it critically important for disseminating health information, particularly treatment approaches.[11] Nonetheless, the videos' quality, accuracy, and reliability vary widely, raising concerns about misleading information or poor educational content.[12] As an increasing number of healthcare providers and patients utilize YouTube to elucidate treatment strategies, evaluating the reliability and usefulness of these materials is essential.

This study aimed to assess the quality of YouTube videos regarding ECMO therapy. It seeks to examine the characteristics of the videos and discover the sources that deliver high-quality

content. The study examines the link between video presentation techniques and their quality. The results provide insights into the use of YouTube videos on ECMO and perspectives of publishing quality materials by skilled professionals with interest in ECMO therapy.

METHODS

Screening of YouTube videos was conducted on September 17, 2024, utilizing the search phrases "Extracorporeal Membrane Oxygenation" and "ECMO treatment." Search phrases were selected from MeSH terms. All cookies and browsing history were deleted since YouTube prioritizes personalized results. This aimed to mitigate the influence of previous internet usage. The Google Chrome web browser was configured to incognito mode to guarantee anonymity before the search procedure. Results were presented via "relevance-based sorting" as the standard option, emulating the conventional habits of an average customer seeking on the page.[13,14] Based on the findings of studies revealing that most individuals tend to restrict their exploration of internet search outcomes to the first few pages, the primary focus of our investigation was to examine the 50 videos for each search phrase.[15] The criteria for exclusion were established as follows: 1) videos in languages besides English, 2) recurred videos, 3) unrelated videos, 4) videos shorter than 1 minute and longer than 60 minutes, and 5) videos with audio or visual issues. Videos shorter than 1 minute were omitted due to insufficient depth and comprehensiveness for delivering beneficial educational content, particularly regarding the intricate medical procedure of ECMO. These brief videos may emphasize rapid summaries, promotional content, or partial explanations that fail to fulfill the objective of comprehensive information distribution. Conversely, videos beyond 60 minutes were omitted to preserve the emphasis on content corresponding to standard user engagement patterns on YouTube.

The video examination procedure involved two researchers making independent assessments of the videos. The independent judgments were juxtaposed at the conclusion of the procedure, and inconsistencies were observed. A third researcher made the final decision on these videos. Cohen's kappa coefficient was utilized to evaluate the concordance in their ratings.[16]

Video parameters

The metrics for each video's views, likes, and comments were obtained from YouTube. The length of the video was tracked and documented in seconds. The duration from the first upload date of the video to the search procedure was calculated and recorded. Using this data, the daily numbers for views, likes, and comments were calculated. The objective was to minimize the influence of the video upload date on video parameters by computing daily values.

Videos were categorized into four categories based on the presentation technique: 1) videos using only narrators, 2) videos emphasizing patient experiences, 3) videos incorporating animations, and 4) videos using slide presentations. The image quality of the videos was recorded as a low definition (≤ 360p), standard definition (480p), or high definition (≥ 720p).

Video sources

We focused on video sources on YouTube and recorded whichever of the following categories they fit: 1) university-hospital, 2) government organization, 3) physician, 4) non-profit organization and association, 5) health-related website, 6) academic, 7) internet user, 8) patient, 9) non-physician health worker, and 10) news outlets.

Assessment of video content

The quality was examined using the Global Quality Scale (GQS), a well-recognized tool for assessing internet-based materials' instructional worth and practicality. There are five parts to the GQS. Scores range from 1 (the lowest possible) to 5 (the highest possible). If the score is 1, it shows no consistency and significant gaps in the presented data. Alternatively, a score of 5 shows considerable consistency, which is very helpful. Videos are ranked as high quality if they have a total score of 4 or 5 and intermediate quality if they receive a score of 3. The low-quality category is reserved for videos with a score of 1 or 2.[17,18]

The reliability evaluation was conducted with the modified DISCERN instrument. This tool evaluates many dimensions, including clarity, intelligibility, bias, objectiveness, and the incorporation of references and supplementary materials. The approach employs dichotomous queries, assigning a value of one for favorable responses and zero for unsuccessful responses. The maximum score attainable with this method is 5.[19]

The *Journal of the American Medical Association* (JAMA) Benchmark Criteria are guidance to assess the trustworthiness and quality of online health information. These criteria evaluate essential components that guarantee the reliability of online materials, encompassing authorship, attribution (accurate referencing of sources and data), disclosure, and currency (indicating the publication date and ensuring information is up-to-date).[20]

The Patient Education Materials Assessment Tool for Audio/Visual Materials (PEMAT-A/V) is a systematic tool intended to assess the understandability and actionability of visual and auditory health information materials. Understandability assesses the ease with which patients may grasp information, emphasizing clarity, organization, vocabulary, and visual aids. Actionability evaluates whether the materials explicitly delineate steps that patients may take to manage their condition. PEMAT-A/V is frequently employed to evaluate the quality of online medical materials to ensure their accessibility and usefulness for patients. Scores are expressed as a percentage.[15,21]

Statistical analysis

The authors employed Statistical Package for Social Sciences version 29.0 software (IBM Corp., Armonk, NY, USA) for statistical analyses. Before executing any analysis, adherence to normal distribution was assessed using the Shapiro-Wilk test. Data were provided as median (minimum-maximum) and number with percentage. Three distinct quality groups were established, and intergroup comparisons were conducted utilizing the Kruskal-Wallis test. The Spearman rho test was utilized for correlation analyses. The Kappa coefficient was computed to evaluate consistency. Interpretations of statistical significance of *P* values are based on a threshold of 0.05.

RESULTS

The top 50 videos for each search term were listed to highlight the most relevant and fitting videos. A total of 100 videos were evaluated; 45 were excluded based on the criteria, resulting in 55 videos being included in the analysis. **Fig. 1** illustrates further details regarding the sampling method. The median duration of the videos was 219 (71–2,797) seconds. The median number of views, likes, and dislikes were 4,615 (208–1,547,318), 34 (0–20,000), and 1 (0–896), respectively. Of all videos, 38.2% (n = 21) were presented with narrators only, 21.8%

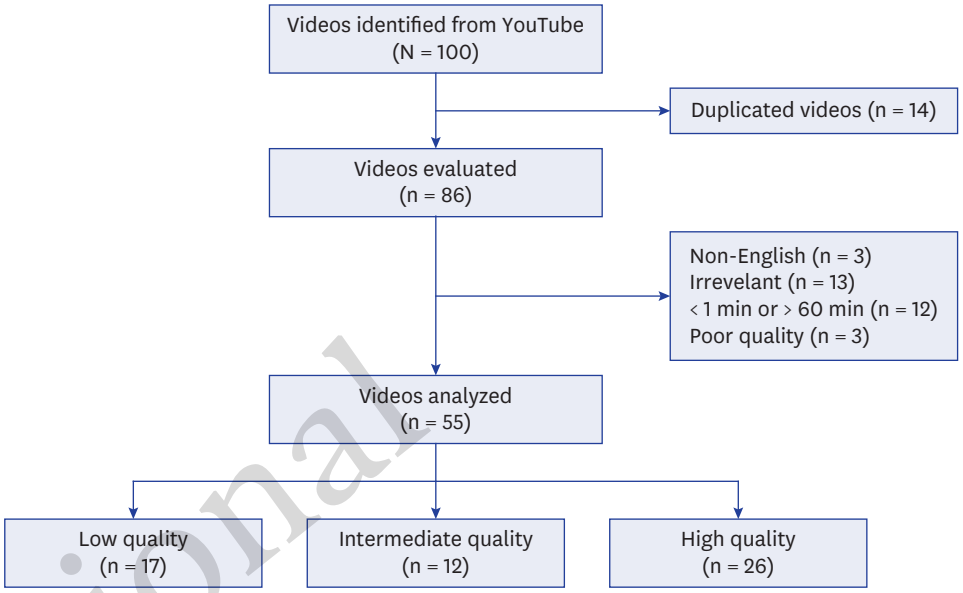

Fig. 1. The flowchart delineates the procedure for selecting YouTube videos.

Table 1. General features of the videos

Variables	Values
Video features	
Duration, sec	219 (71–2,797)
Number of views	4,615 (208–1,547,318)
Number of likes	34 (0–20,000)
Number of comments	1 (0–896)
Days since upload	1,443 (463–4,498)
Views per day	4,615 (208–1,547,318)
Likes per day	0.03 (0–13.17)
Comments per day	0 (0–0.58)
Presentation method	
Video containing only narrator(s)	21 (38.2)
Video containing patient experiences	12 (21.8)
Animation	8 (14.5)
Narrating with a slide presentation	14 (25.5)
Image quality	
Low definition (≤ 360p)	42 (76.4)
Standard definition (480p)	13 (23.6)
High definition (≥ 720p)	0 (0.0)

Data are expressed as median (minimum–maximum) or numbers (percentage).

(n = 12) with patient experiences, 14.5% (n = 8) with animations and 25.5% (n = 14) with slide presentations. The main characteristics of the videos are summarized in **Table 1**.

The videos were divided into three groups: low, intermediate, and high quality, according to GQS scores, and 30.9% (n = 17) of the videos were in the low, 21.8% (n = 12) in the intermediate, and 47.3% (n = 26) in the high-quality group. Video sources were analyzed according to quality groups. The source provides high-quality videos, with the highest percentage being physicians (75%). On the other hand, the source providing low-quality videos with the highest percentage was news outlets (83.3%) (**Table 2**, **Fig. 2**).

No statistically significant difference was detected when quality groups were compared based on views, likes, and comments per day (**Table 3**).

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Table 2. Categorization of the videos according to sources

Source	Low quality	Intermediate quality	High quality	Total
University-Hospital	7 (25.0)	7 (25.0)	14 (50.0)	28 (100.0)
Physician	0 (0.0)	1 (25.0)	3 (75.0)	4 (100.0)
Non-profit organization	1 (12.5)	3 (37.5)	4 (50.0)	8 (100.0)
Health-related website	4 (44.4)	1 (11.2)	4 (44.4)	9 (100.0)
News outlets	5 (83.3)	0 (0.0)	1 (16.7)	6 (100.0)

Data are expressed as numbers (percentage).

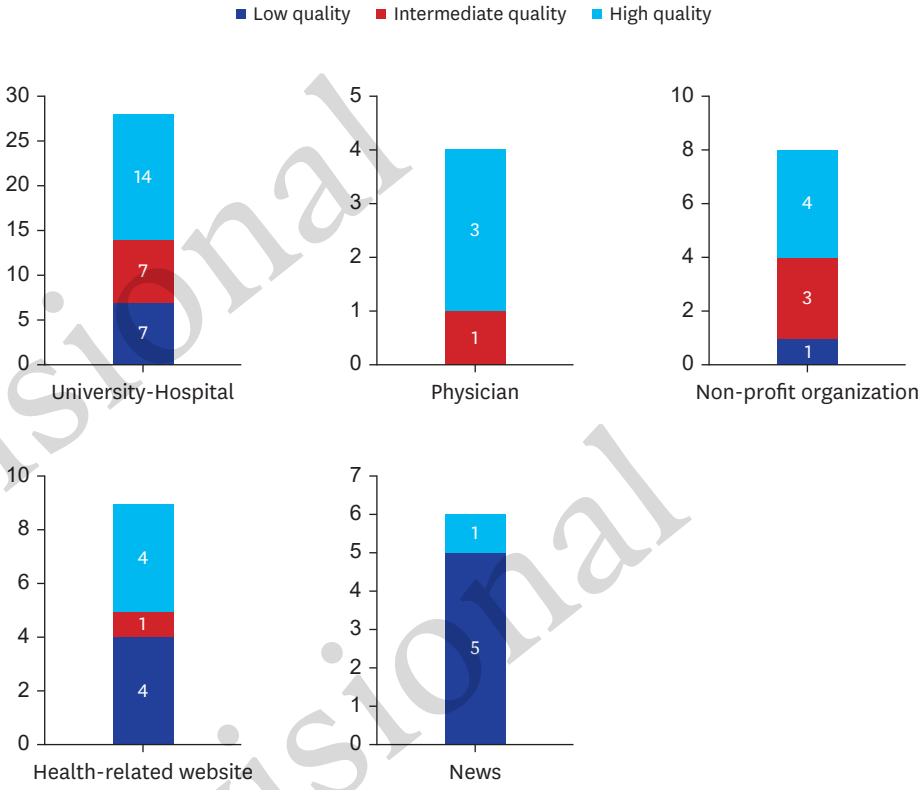

Fig. 2. Low, intermediate, and high-quality video distributions according to video sources.

Table 3. Comparison of the video parameters between the low-quality, intermediate, and high-quality groups

Parameters	Low quality	Intermediate quality	High quality	*P* value
Views per day	3.45 (0.25–118.13)	1.66 (0.17–26.16)	9.63 (0.22–587.46)	0.216
Likes per day	0.03 (0–0.68)	0.01 (0–0.22)	0.05 (0–13.17)	0.234
Comments per day	0 (0–0.16)	0 (0–0.01)	0.01 (0–0.58)	0.075

Data are expressed as median (minimum–maximum).

Analyses demonstrated that the scores of the video assessment instruments were significantly and positively correlated with each other ($P < 0.001$; **Fig. 3**). Furthermore, correlation analyses were conducted between the video assessment instrument scores and video parameters. Significant and positive correlations were identified between video duration and GQS, modified DISCERN questionnaire, JAMA Benchmark Criteria, PEMAT-A/V Understandability, and PEMAT-A/V Actionability scores ($P < 0.001$). A significant and positive correlation existed between the days since upload and JAMA Benchmark Criteria scores ($P < 0.05$). In addition, daily comments possessed a significant positive correlation with modified DISCERN questionnaire scores ($P < 0.05$; **Table 4**).

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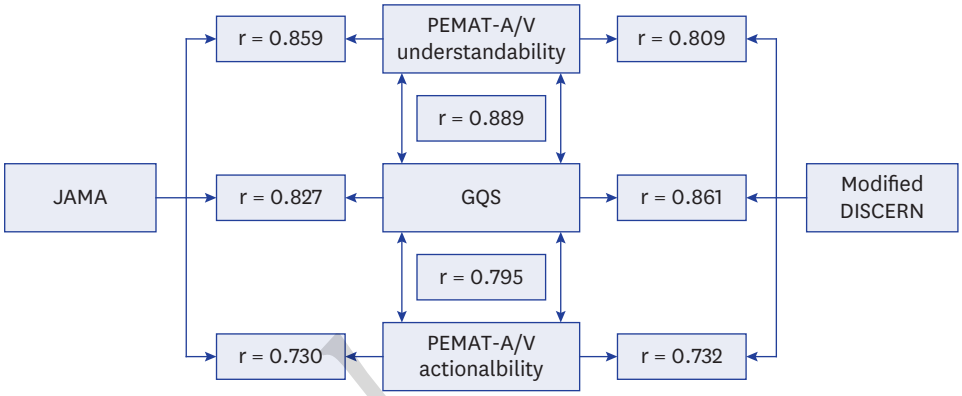

Fig. 3. Correlation analyses between video content assessment instruments.
The rho value between JAMA Benchmark Criteria and modified DISCERN questionnaire is 0.900.
$P < 0.001$ in all correlation analyses.
JAMA = *Journal of the American Medical Association*, GQS = Global Quality Scale, PEMAT-A/V = Patient Education Materials Assessment Tool for Audio/Visual Materials.

Table 4. Correlation analysis between content scores and video parameters

Parameters	GQS	Modified DISCERN questionnaire	JAMA Benchmark Criteria	PEMAT-A/V Understandability	PEMAT-A/V Actionability
Video duration	0.585**	0.557**	0.511**	0.530**	0.433**
Days since upload	0.063	0.246	0.269*	0.089	0.158
Views per day	0.186	0.185	0.182	0.143	0.154
Likes per day	0.139	0.135	0.120	0.094	0.147
Comments per day	0.230	0.268*	0.234	0.183	0.266

GQS = Global Quality Scale, JAMA = *Journal of the American Medical Association*, PEMAT-A/V = Patient Education Materials Assessment Tool for Audio/Visual Materials.
*$P < 0.05$, **$P < 0.01$.

Table 5. Comparison of the presentation methods in terms of video quality

Video quality	Video containing only narrator(s)	Video containing patient experiences	Animation	Narrating with a slide presentation	*P* value
Low-quality	4 (19.0)	9 (75.0)	3 (37.5)	1 (7.1)	0.009**
Intermediate-quality	5 (23.8)	2 (16.7)	1 (12.5)	4 (28.6)	
High-quality	12 (57.1)	1 (8.3)	4 (50.0)	9 (64.3)	
Total	21 (100.0)	12 (100.0)	8 (100.0)	14 (100.0)	

Data are expressed as numbers (percentage).
**$P < 0.01$.

Video presentation methods were compared in terms of quality groups. The presentation that provided the highest percentage of high-quality video was 'narrating with a slide presentation' (64.3%). On the other hand, the presentation that provided the highest percentage of low-quality video was 'video containing patient experiences' (75%) ($P = 0.009$; **Table 5**).

A Kappa coefficient of 0.84 was determined.

DISCUSSION

The current study examined YouTube videos as an important tool for spreading information regarding ECMO. In the current landscape, where the Internet is a pervasive source of information, it is essential to assess the reliability and quality of materials distributed on online platforms, including YouTube.[22] The key points of this study are as follows:

- Less than half of the ECMO videos are classified as high quality, while nearly one-third are deemed low quality.

- Physicians are the leading providers of high-quality videos, while news outlets are the source of low-quality videos.
- The quality groups do not differ in the daily values of the video parameters.
- The scores of the video assessment instruments exhibit significant positive correlations with each other.

Despite the favorable outcomes of nearly 50% of videos being deemed as high quality and a relatively limited proportion of low-quality videos, it is critical to consider the issue. Low-quality videos are associated with dissemination of erroneous, insufficient, and biased information.[23] The presence of low-quality videos poses a threat to public health. Misinformation about critical medical procedures such as ECMO may seriously impact patient decisions and healthcare provider opinions. For patients and caregivers seeking life-saving medical information, such as ECMO therapy, erroneous or negatively presented content may lead to misconceptions regarding the treatment's hazards, advantages, or appropriate use. The emergence of these issues motivate professional associations, particularly Extracorporeal Life Support Organization (ELSO; https://www.elso.org), to document and disseminate credible videos regarding ECMO mechanisms, indications, advantages, and efficacy. ECMO videos should be understandable for non-expert audiences, especially relatives of patients who may benefit from ECMO. The variation in ECMO use and availability across countries necessitates the creation of multi-language videos or English videos supplemented with subtitles in multiple languages. Focusing on topics of the personnel involved in ECMO administration, timelines for efficiency assurance, and awareness campaigns would be helpful.

One of the main outcomes of the current study is that physicians generated the highest percentage of high-quality videos, implying that healthcare professionals provide accurate and relevant information regarding ECMO. In contrast, news outlets yielded the highest percentage of low-quality videos, raising concerns regarding the credibility of news outlets-related information for healthcare. This result is consistent with prior research that identified healthcare professionals as the most reliable source of online medical information.[24,25] Given the significance of ECMO as a sophisticated and critical intervention, consumers who obtain information via online platforms must acknowledge content from verified sources such as physicians or institutions.

No statistically significant differences were found when comparing the quality categories' daily views, likes, and comments. This result suggests that engagement measures like views, likes, and comments may not always be an adequate means to gauge the quality of health-related videos.[26,27] Instead, video reliability and quality were more closely correlated with duration, with longer videos scoring better on all assessment instruments, including GQS, modified DISCERN questionnaire, JAMA Benchmark Criteria, and PEMAT-A/V. This might imply that longer videos present more extensive explanations and are more appropriate for instructional purposes.[28,29]

The analysis of video presentation methodologies indicated that the most efficacious approach for conveying high-quality content was the integration of narration with slide presentations. This research indicates that organized presentations, including clear graphics and narratives, deliver comprehensive, high-quality content more effectively.[30] On the other hand, videos showcasing patients' experiences had a higher percentage of low-quality content, showing that, while personal narratives can be appealing, they may lack the educational rigor necessary

to transmit correct health-related information. This result emphasizes the need to balance engaging storytelling with reliable, high-quality YouTube content.

The instruments used to evaluate video reliability and quality (GQS, modified DISCERN questionnaire, JAMA Benchmark Criteria, and PEMAT-A/V) are compatible with each other and work well together, as shown by the significant correlations identified among them. This result proves that these tools are reliable for evaluating the quality of health-related videos on YouTube.

This research has several limitations. The omission of non-English videos may restrict the generalizability of the findings to non-English-speaking audiences. The study was planned as cross-sectional due to the dynamic nature of YouTube content, rendering longitudinal research impractical. The video screening was performed anonymously to prevent consumer biases. Therefore, anyone looking for the phrases "Extracorporeal Membrane Oxygenation" and "ECMO treatment" may come across videos that differ from the ones used in the current study, thereby affecting the generalisability of these results. The quality and reliability of videos were examined at a particular time point. It is essential to acknowledge that search results may fluctuate over time. We limited the number of videos examined for each search phrase. A greater number of video assessments would have yielded more complete results.

In conclusion, this study emphasizes that while YouTube can be a powerful tool to disseminate information regarding ECMO treatment, considerable variability exists in the content's quality. Videos created by physicians and healthcare organizations were often of high quality, but those from news outlets or showcasing patient experiences generally had lower quality. Efficient presentation techniques, such as narrating with slide presentations, are crucial for delivering reliable instructional content. The critical function of quality control methods on social media platforms in guaranteeing an accurate and high-quality dissemination of health-related information becomes evident. Internet users must take caution, emphasizing proper citation and thoroughly scrutinizing content for any advertising, misleading, or substandard information on YouTube within the evolving digital landscape.

Involving specialist editors in editing, publishing, and aggregating ECMO would be an effective strategy.[31] Endorsing quality videos by ELSO and other associations with interest in ECMO and then pooling these videos on respective resource platforms may improve professional understanding of numerous aspects of ECMO.

Healthcare professionals may face various challenges that affect the quality of ECMO-related educational videos. Balancing the complexity of ECMO with the necessity of making the information accessible to a broad audience presents a considerable challenge. ECMO is a specialized and complex procedure, necessitating precise communication of its technical aspects to patients, carers, and non-medical audiences while maintaining accuracy. Healthcare professionals must ensure their explanations are scientifically accurate while avoiding jargon that may confuse the public. Healthcare professionals should develop innovative methods to convey information engagingly, utilizing animations, visuals, and patient narratives while maintaining the educational integrity of the content. Addressing these challenges necessitates that healthcare professionals function as educators, proficient communicators, and content creators.

Further initiatives are required to enhance awareness regarding health-detrimental videos on YouTube that advocate ECMO technology by commercial entities while obscuring their intrinsic limitations and to evaluate YouTube's strengths and weaknesses.[32]

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