

Can youtube be trusted as a source of quality and reliable information on COVID-19 vaccination in Italy?

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Abstract. *Background and aim:* Social media platforms are common sources of information, even more so during the COVID-19 pandemic. YouTube is the second most popular social media platform both in Italy and globally. Following criticisms regarding quality control during the pandemic, banners that would direct viewers to official health information sources were incorporated into Youtube videos related to COVID-19. The aim of this study is to assess the reliability and information quality of YouTube videos related to COVID-19 vaccination in Italy. *Methods:* On March 2022, six different search queries were used to retrieve COVID-19 vaccination-related videos, resulting in the identification of 329 videos, and their characteristics were described. Two validated instruments, namely HoNCode and DISCERN, were used to assess the reliability and quality of the videos' content. *Results:* Of the total number of videos, 72.0% were from non-medical or generalist channels. The most represented category was internet media (32.5%) while the less frequent was educational medical channel (7.0%). Videos from medical channels had higher reliability ($p=0.002$) and quality ($p<0.001$) than not medical channels, despite receiving fewer visualizations ($p=0.004$), likes ($p=0.018$) and comments ($p<0.001$). Media and news agencies sources consistently delivered lower quality content. *Conclusions:* These findings suggest that public health professionals and institutions should consider investing in social media representation to fill the gap with non-medical sources in terms of popularity, to provide reliable and interesting videos, and ultimately deliver health education to the general public. (www.actabiomedica.it)

Key words: YouTube, COVID-19, vaccination, internet, social media, information, health literacy

Introduction

COVID-19 is not the only pandemic to have spread in recent centuries. In the past, information reached the population slowly and was limited in its reach (1). However, in 2020, the internet and social media transformed the way people communicate, sometimes promoting the dangerous spread of false information (2). The emergence of the COVID-19 pandemic has given rise to a phenomenon known as the “infodemic,” which is characterized by the rapid

and excessive circulation of information that is often not properly screened for accuracy, making it difficult to obtain reliable news (3). The internet has become a popular source of health-related information (4,5), especially among people with chronic diseases (6,7). Google Trends data demonstrate a significant surge in searches related to COVID-19 vaccination (8,9) following the launch of vaccination campaigns. Unfortunately, this increase in searches has also led to an influx of false information on the topic (fake news), making it difficult for people to discern the truth (10). This

poses a threat to public health and undermine efforts to prevent disease through vaccines because people exposed to social media information are more likely to be misinformed and have vaccine hesitancy (11).

Social networks and video-sharing websites are among the main sources of information, including health-related content. YouTube is the most frequently visited video-sharing and social media platform and the second most commonly used source of information on the internet, after Google, in Italy and around the world (12,13). YouTube's significant influence has led to the implementation of policies that prevent the publication of false content (14). For COVID-19-related videos, for example, YouTube has added a banner beneath the video linking to the Italian Department of Health website (15). Similarly, YouTube provides different links for each country that direct users to official regional sources of information. This policy applies not only to videos related to the pandemic but to all news that may misinform users (14).

In recent years, many authors have questioned the accuracy of YouTube content regarding COVID-19, particularly concerning its impact on vaccination adherence. Several studies have evaluated the quality and reliability of these videos using different tools (16). The most frequently used are DISCERN, which assesses the quality of consumer health information videos (17), and the Health on the Net Foundation Code of Conduct (HonCode) (18), which assesses their reliability. These studies have reported conflicting results regarding the accuracy of the content. Some studies found that the videos were of good quality and reliability, indicating that the platform could be a useful source of public health information (19-21), while others reported contradictory results (10,22).

The aim of this study is to assess the quality and the reliability of COVID-19 vaccination-related videos that have been published on the Italian version of YouTube, approximately one year after the introduction of a mass immunization program. This evaluation is particularly important given the surge in availability of vaccine-related content on social media in Italy, and the potential impact of such content on public health outcomes.

Methods

Search protocol

On the 3rd of March of 2022, six keyword combinations regarding the SARS-CoV-2 vaccination were entered into the YouTube search platform using a cleared-cache web browser. In detail, these search queries were "Covid vaccine", "Covid vaccination", "Coronavirus vaccine", "Coronavirus vaccination", "Sars Cov 2 vaccine" and "Sars Cov 2 vaccination" (in Italian: "Vaccino Covid", "Vaccinazione Covid", "Vaccino Coronavirus", "Vaccinazione Coronavirus", "Vaccino Sars Cov 2" and "Vaccinazione Sars Cov 2"). For each search query, we considered the first 100 elements in the result list, which were sorted by "relevance" based on the YouTube algorithm. No filters were applied, except for the criterion that the content was in Italian language/origin, which however did not lead to any exclusions.

In the first screening of the results based on their URLs, a total of 263 elements were removed from the initial 600 results due to duplicates. The video analysis phase was conducted on a refined list of 337 elements. In this phase, seven additional duplicate videos were identified as re-uploads of the same content, and one video clip was excluded from the analysis due to its unavailability, due to removal by the owner (Figure 1).

For each available video, two reviewers collected the following information: search queries used to retrieve the video, URL, title of the video clip, upload date, view count, comment count and like count. These data were merged to create the final database.

The reviewers categorized each video based on the type of YouTube channel it came from. Six main categories were identified: educational channels produced by medical professionals, educational channels produced by non-medical individuals (e.g., science education or explanatory media), independent non-medical users (e.g., users with no obvious affiliations), internet media (e.g., newsmagazine shows or talk shows), news agencies (e.g., clips uploaded from network news), and non-profit or medical organizations (e.g., hospitals, government organizations, or universities). Each category was then classified as either medical (educational medical channel and medical organizations) or non-medical (educational non-medical channels,

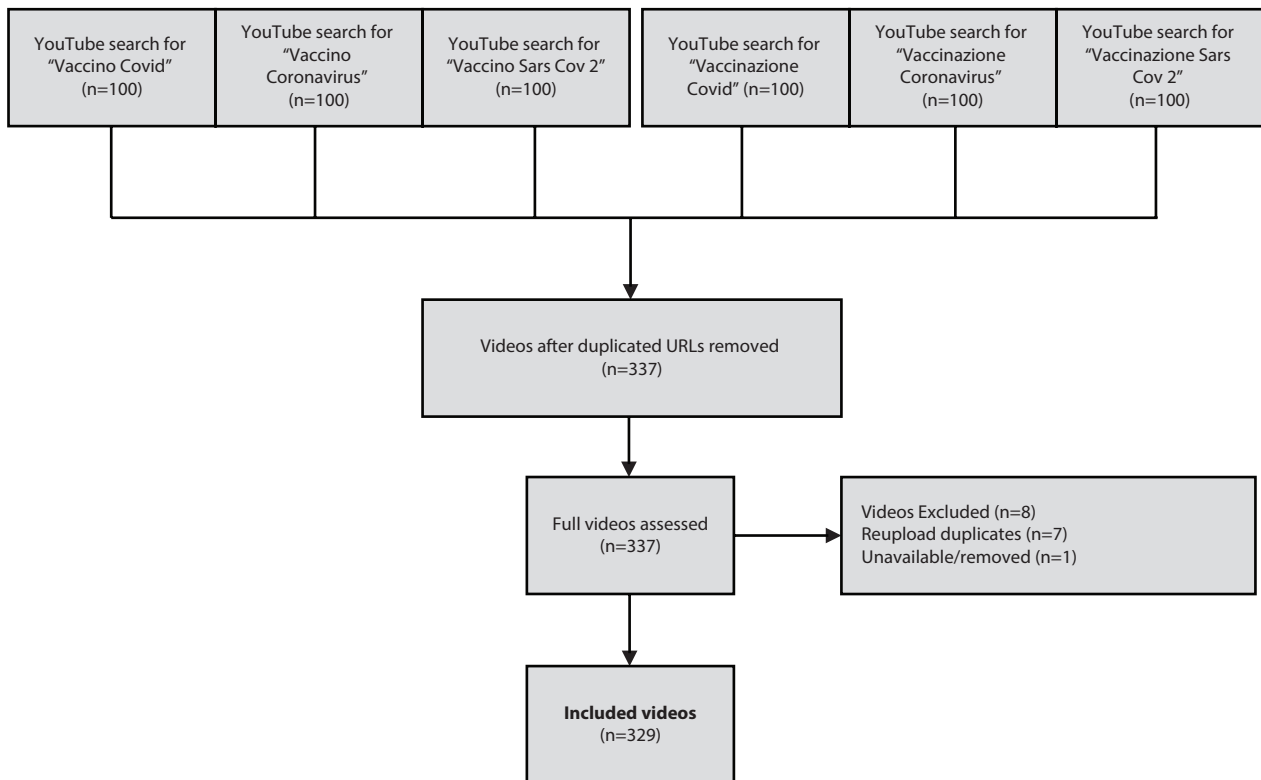


Figure 1. Flowchart revealing the selection of YouTube videos

independent non-medical users, internet media, news agencies and non-profit organizations). All this information was finally recorded in the database.

The reliability and quality assessments

The reliability and quality assessments were carried out for each video using the HoNcode (18) and the DISCERN (17) instruments, respectively.

The HoNcode consists of 8 binary items, with a total score ranging from 0 to 8. As reported in Table 1, the 8 items are as follows: (a) “Authoritative” (a score of 1 indicates that the medical information provided in the video was given by qualified professionals, while a score of 0 indicates that it was not); (b) “Complementary” (a score of 1 is assigned when the provided information was meant to complement the relationship between a patient and their physician, rather than replace it); (c) “Privacy” (a score of 1 is given if the video content respected the privacy of patients and

guarantees their right to confidentiality); (d) “Attribution” (a score of 1 indicates that the sources of medical information or advice was clearly given, where possible, with links to the data); (e) “Justifiability” (a score of 1 indicates that the health information presented in the video was complete, objective, balanced, and transparent); (f) “Transparency” (a score of 1 indicates that the content creator provided contact addresses for viewers seeking support or more detailed information); (g) “Financial disclosure” (a score of 1 indicates that sources of funding of the content was clearly identified); (h) “Advertising policy” (a score of 1 indicates that advertising and other promotional material were presented to viewers in a manner and context that facilitate differentiation between it and the original content). We then classified videos according to two categories: videos with a HoNcode score of 3 or more were classified as having satisfactory reliability, while those with a score lower than 3 were classified as having unsatisfactory reliability.

The DISCERN score consists of a set of 16 questions, which are listed in Table 2. Each question is assigned a value ranging from 1 (worst) to 5 (best), with a possible total range of 16 to 80. The first eight

questions evaluate the technical aspects of the content's reliability, such as the clarity of the objectives, whether the content achieves those objectives, the relevance of the content, and the clarity regarding the sources of information used to compile the video. The remaining eight questions evaluate the overall quality of the content.

Each video was independently watched and evaluated by two authors (AA and MG). Any discrepancies in HoNcode scoring were discussed, and the video was re-watched if necessary. A third author (LG) was consulted to resolve any remaining disagreements. For DISCERN scoring, discrepancies of +/-1 and +/-2 per item were considered acceptable, but larger discrepancies were discussed and resolved through re-screening of the video, in order to ensure objective evaluation while also considering personal opinions.

Table 1. Description of principles of the Health on the Net Foundation Code of Conduct.

Principle	Description
Authoritative	Any medical or health advice provided in this video will only be given by medically trained and qualified professionals unless a clear statement is made that the advice offered is from a nonmedically qualified individual or organization.
Complementary	The information provided is designed to support, not replace, the relationship that exists between a patient and his/her existing physician.
Privacy	The information in the video maintains the right to confidentiality and respect of the individual patient featured.
Attribution	Where appropriate, information contained in the video will be supported by clear references to source data and, where possible, have specific links to those data.
Justifiability	Any claims relating to the benefits or performance of a specific treatment, commercial product, or service will be supported by appropriate, balanced evidence in the manner outlined in attribution principle.
Transparency	The designers of the video will seek to provide information in the clearest possible manner and provide contact addresses for viewers who seek further information or support.
Financial disclosure	Support for this video will be clearly identified, including the identities of commercial and noncommercial organizations that have contributed funding, services, or material for the video.
Advertising policy	If advertising is a source of funding, it will be clearly stated. Advertising and other promotional material will be presented to viewers in a manner and context that facilitate differentiation between it and the original content.

Table 2. The DISCERN quality criteria for assessing the quality of content. Each question is assigned a value ranging from 1 (worst) to 5 (best).

1. Are the aims clear?
2. Does it achieve its aims?
3. Is it relevant?
4. Is it clear what sources of information were used to compile the video?
5. Is it clear when the information used or reported in the video was produced?
6. Is it balanced and unbiased?
7. Does it provide details of additional sources of support and information?
8. Does it refer to areas of uncertainty?
9. Does it describe how each treatment works?
10. Does it describe the benefits of each treatment?
11. Does it describe the risks of each treatment?
12. Does it describe what would happen if no treatment is used?
13. Does it describe how the treatment choices affect overall quality of life?
14. Is it clear that there may be more than one possible treatment choice?
15. Does it provide support for shared decision-making?
16. Based on the answers to all of the above questions, rate the overall quality of the video as a source of information about treatment choices

Statistical analysis

The distribution of the HoNcode score as binary (<3: low reliability; ≥3: high reliability) according to the channel category was expressed as numbers and percentages, and differences between groups were evaluated using the Chi-square test. The distribution of the DISCERN score was expressed as median and interquartile range due to its skewed distribution, and a boxplot was also displayed according to the channel category. Differences between median values of the DISCERN score for each channel category were assessed using Dwass-Steel-Critchlow-Fligner (DSCF) test for multiple comparisons, based on pairwise two-sample Wilcoxon statistic. Finally, differences between medical and not medical channels according to median values of the DISCERN score, likes, visualizations, and comments were evaluated using the non-parametric Wilcoxon test. Percentages and statistical tests for the comparison between groups were based on non-missing values. All statistical tests were performed at a significance level of alpha=0.05.

Results

Out of the 329 videos included in the study, the most represented category was internet media with 107 videos (32.5%), followed by 69 videos (21.0%) belonging to medical organizations, and 40 videos (12.2%) to news agencies. The less frequent categories (each one representing less than 10% of the videos) were educational channels (medical) with 23 videos, independent channels (not medical) with 28 videos, and educational channels (not medical) with 30 videos. Overall, most of the videos (n=237, 72.0%) were from not medical or generalist channels, while the remaining videos were from medical ones.

Reliability assessment

Table 3 shows the distribution of the HoNcode score categorized into two groups (<3 and ≥3) for each channel category, for the total of 329 videos. Overall, 185 videos (56.2%) scored a HoNcode value below 3, while 144 videos (43.8%) scored 3 or greater. Notably,

Table 3. Distribution of HoNcode score (<3 vs ≥3) by channel category (N=329).

	Total	HoNcode score		p-value*
		<3	≥3	
	N (%)	N (%)	N (%)	
<i>Overall</i>	329	185 (56.2)	144 (43.8)	
Channel category				0.001
Educational channel (medical)	23 (7.0)	12 (6.5)	11 (7.6)	
Educational channel (not medical)	30 (9.1)	15 (8.1)	15 (10.4)	
Independent nonmedical users	28 (8.25)	13 (7.0)	15 (10.4)	
Internet media	107 (32.5)	71 (38.4)	36 (25.0)	
News Agencies	40 (12.2)	31 (16.8)	9 (6.3)	
Medical Organizations	69 (21.0)	27 (14.6)	42 (29.2)	
Non-profit Organizations	32 (9.7)	16 (8.7)	16 (11.1)	
Medical channel				0.002
No	237 (72.0)	146 (78.9)	91 (63.2)	
Yes	92 (28.0)	39 (21.1)	53 (36.8)	

*P-value for the Chi-square test.

medical channels more frequently scored HoNcode values of 3 or more as compared to the not medical ones ($p=0.002$).

Quality assessment

Table 4 shows the median and interquartile range of the DISCERN score for each channel category, along with the results of the multiple comparison analysis. The corresponding boxplots are displayed in Figure 2. The educational channel (medical) category had the highest median score (46.0), followed by medical organizations (43.5) and educational channel (not medical) (41.3); In contrast, news agencies (24.3) and internet media (26.5) had the lowest quality score.

Videos from internet media had a significantly lower median DISCERN score than videos from most other categories ($p<0.001$ vs. educational channel (medical); $p<0.001$ vs. educational channel (not medical); $p<0.001$ vs. medical organizations; $p=0.045$ vs. non-profit organizations). Similarly, news agency videos had a significantly lower median DISCERN score compared to medical organizations videos ($p<0.001$) and educational channels, both medical ($p<0.001$) and not medical ($p=0.002$).

Table 5 shows a comparison between medical and not medical channels in terms of median values of the DISCERN score, as well as number of likes,

visualizations and comments. The median quality score of medical channels was significantly higher as compared to not medical ones (44.3 vs. 31.0, respectively, $p<0.001$). However, videos from medical channels received fewer likes than those from not medical ones (median 41 vs. 69.5, respectively, $p=0.018$), fewer visualizations (3,348 vs. 8,368, $p=0.004$), and fewer comments (7 vs. 102, $p=0.001$).

Discussion

To the best of our knowledge, this is the first study in Italy to investigate the reliability and quality of videos related to COVID-19 vaccination after the implementation of the mass vaccination program. Based on the findings of the study, YouTube content on COVID-19 vaccination was highly diverse, encompassing both simple videos for general audiences and educational content intended for healthcare professionals. Interestingly, the most popular videos did not necessarily demonstrate the highest reliability and quality, highlighting the importance of critically evaluating online health information.

Previous studies conducted on English language videos have shown that information from reputable sources, such as healthcare workers, may be perceived as less favorable by the public (16). In our analysis, the

Table 4. Median values and interquartile range (IQR) of the DISCERN score by channel category and results of multiple comparisons analysis.

Channel category		DISCERN score		B	C	D	E	F	G
		N=329	Median (IQR)						
Educational channel (medical)	A	23	46.0 (39.5-59.0)	0.291	0.108	<0.001	<0.001	0.625	0.076
Educational channel (not medical)	B	30	41.3 (38.0-47.0)		0.789	<0.001	0.002	0.940	0.937
Independent nonmedical users	C	28	35.5 (25.0-47.0)			0.093	0.070	0.415	1.000
Internet media	D	107	26.5 (20.5-36.5)				0.967	<0.001	0.045
News Agencies	E	40	24.3 (18.5-36.8)					<0.001	0.057
Medical Organizations	F	69	43.5 (35.5-51.0)						0.457
Non-profit Organizations	G	32	34.3 (24.8-49.8)						

*P-values for the Dwass-Steel-Critchlow-Fligner (DSCF) test for multiple comparisons analysis of the differences between the median values of the DISCERN score (based on pairwise two-sample Wilcoxon statistic); $p<0.05$ values are considered as statistically different and are highlighted in bold.

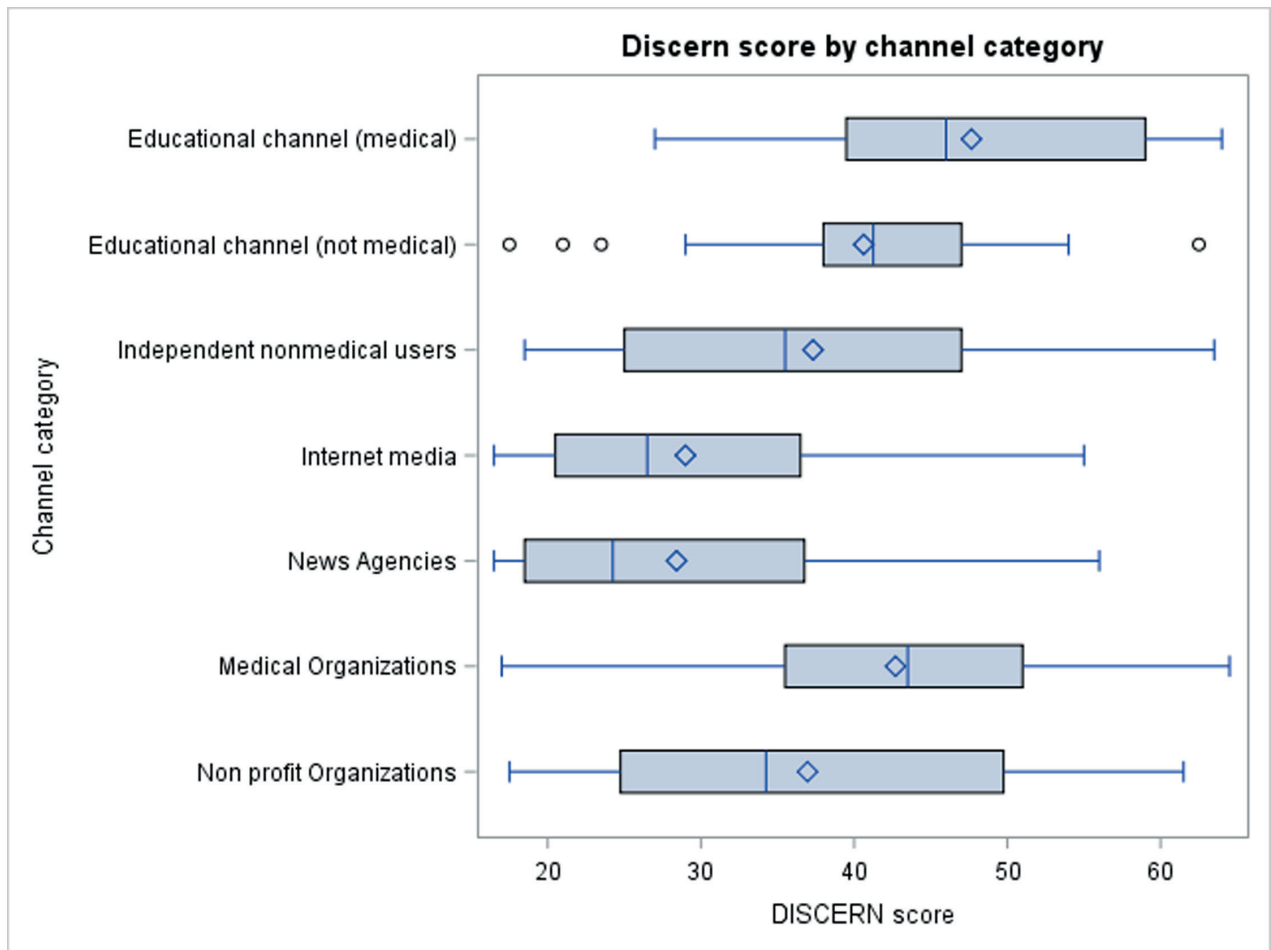


Figure 2. Box-plot displaying the distribution of the DISCERN score according to the channel's category.

Table 5. Comparison between median values of the DISCERN score, number of likes, visualizations, and comments, among medical and not medical channels.

	N	Medical N=92	Not medical N=237	<i>p</i> -value*
		Median (IQR)	Median (IQR)	
DISCERN score	329	44.3 (37-52)	31.0 (21.5-40.5)	<0.001
Likes	297	41 (9-99)	69.5 (13.0-432.5)	0.018
Visualizations	329	3,348 (1,063-16,048)	8,368 (1,678-56,126)	0.004
Comments	277	7 (0-42.5)	102 (6-612)	<0.001

IQR: interquartile range.

**P*-value for the non-parametric Wilcoxon test.

source category of the YouTube channel was found to be an important determinant. The three major uploading sources were internet media, news agencies and medical organizations. However, videos uploaded by

internet media and news agencies often received lower scores in terms of expected quality and reliability. On the other hand, contents validated and presented by medical professionals (such as educational channel or

medical organizations channel) scored higher in quality and reliability. However, it is noteworthy that medical channels received fewer likes, visualizations, and comments compared to non-medical channels.

One possible criticism of healthcare professionals who use YouTube to promote health literacy is their use of technical language, which may make their videos less appealing to the general population. This is particularly relevant, given the importance of public health information during the pandemic.

There is no doubt that YouTube has become a crucial platform for sharing COVID-19-related information in recent years, and it is widely recognized as a source of health information on various topics, including emerging infectious diseases. As other authors have noted, effective communication about public health issues, particularly vaccination, is critical (23). Therefore, it is recommended that public health professionals and health institutions should consider investing in this social media platform, and possibly co-operate with reputable social media influencers or popular channel to promote health campaigns and improve health literacy (24-26). In addition, given the recent legislative history surrounding mandatory vaccination and related debates in Italy, the issue of vaccination hesitancy is of strategic importance (27-31).

Our analysis revealed a limited presence of misinformation or negative information on COVID-19 vaccines, which can be attributed to the YouTube COVID-19 medical misinformation policy (14) that prohibits the dissemination of false content since April 2020, despite the absence of actions against inaccurate information.

Our study has three important public health implications that remain to be explored. Firstly, it raises questions about the actual impact of misinformation on vaccination, despite the measures taken by YouTube to limit its spread. Secondly, it highlights the potential influence of high-quality and reliable information on vaccination intentions. Finally, it underscores the strategic role of social media in combating vaccine hesitancy, which should be further investigated through additional studies.

This study has both strengths and limitations. One limitation is that the tools used to evaluate the quality and reliability of the videos were originally designed for written content and may not be fully applicable to

video clips. This is especially noticeable in the reliability assessment using the HoNcode instrument, where some items are rarely met by YouTube webpages. However, given the lack of specific evaluation tools for videos, it is important to adapt scoring instruments to adequately assess the quality, reliability, and accuracy across a variety of media channels.

In addition, a possible selection bias could result from the sample construction methodology: in fact, we combined the results of six searches by evaluating the first 100 videos presented in order of relevance according to the YouTube algorithm. Therefore, it is possible that some less popular videos were excluded from our analysis. Furthermore, since we only captured a snapshot of a specific moment, and considering the constantly changing and expanding nature of YouTube's content and its dynamic structure, our findings may not fully reflect the current state of COVID-19 vaccine-related contents on the platform.

Despite these limitations, our study employed two validated scoring systems and two independent reviewers, rendering the results comparable to those of other similar studies conducted in other European countries.

Conclusions

In the digital era we live in, YouTube has implemented policies to combat misinformation related to COVID-19 vaccination. However, our study reveals that there is a significant variation in the quality and reliability of the videos available on the platform. Viewers should handle with caution the content produced by non-medical users, particularly those belonging to internet media and news agencies, as their quality may not be suitable for such an important topic. In addition, public health professionals and institutions should seize the opportunity to use social media platforms such as YouTube to promote accurate and reliable information about vaccination.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Contribution of Authors: The authors provided substantial contributions to the conception and design of the study, acquisition of the data, or analysis and interpretation of the data; 2) drafted the article or revised it critically for important intellectual content; and 3) gave the final approval of the version to be published.

Ethic Committee: not applicable

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