

SHORT REPORT



Information in Spanish on YouTube about Covid-19 vaccines

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ABSTRACT

Our objective was to analyze the sources, characteristics, tone, and content of the most viewed YouTube videos in Spanish about Covid-19 vaccines. In February 2021, a search was carried out on YouTube using the terms “Vacuna Covid,” “Vacuna coronavirus,” and “Vacuna Covid19.” Associations between tone, source, and others variables (e.g. number of views or dislikes) were studied with a Mann–Whitney U-test and a chi-square test. A total of 118 videos were analyzed; 63.6% were originated from Mexico and the USA; media created 57.6% of the videos. Positive tone was observed in 53.4%. The most discussed topics were target groups for vaccination (38.9%) and safety (43.2%). The 68 videos produced by media accumulated 31,565,295 views (55.0% of views), and the 19 videos created by health professionals obtained 10,742,825 views (18.7% of views). A significantly smaller number of likes was obtained in videos of media compared to those created by health professionals ($p = .004$). Videos made by health professionals, compared to those of media, showed a greater positive tone (OR = 3.09). Hoaxes/conspiracy theories were identified in 1.7% of the videos. Monitoring that the information on YouTube about Covid-19 vaccines is reliable should be a central part of Covid-19 vaccination campaigns.

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Introduction

Coronavirus disease 2019 (Covid-19) pandemic represents a public health problem due to its high mortality, morbidity, and huge economic loss.¹ Covid-19 vaccines are considered the best option to prevent and control the pandemic.² On 10 November 2020, the first results of clinical trials on the first Covid-19 vaccine were released.³ Subsequently, several clinical trials of various vaccines have been published,^{4–6} showing their safety and vaccine efficacy ranges from 81.3%⁵ to 94.6%.⁶ On December 2020, several Spanish-speaking countries, such as Chile, Argentina, or Mexico, started their mass vaccination programs.⁷

In this context, it is as important to have safe and effective vaccines as it is to achieve high vaccination coverage. A proposed strategy for achieving high vaccination coverages is to use social media to raise awareness of the importance of the vaccines.⁸ Video-sharing sites are among the most popular websites; in particular, YouTube with about 2 billion views every day⁹ is used extensively to search health information and can influence its users (e.g. regarding their vaccination habits).¹⁰

YouTube can represent a fundamental communication channel for improving awareness about health issues; however, several studies have showed that YouTube videos also contain incorrect or misleading information.^{11,12} This fact represents a problem, as the dissemination of disinformation is related with decline in vaccination coverage.^{13,14}

Studying information available in YouTube about vaccines is useful in planning and carrying out effective information

campaigns.¹⁴ For this reason, several authors have evaluated the characteristics of YouTube videos providing information about vaccines,^{15–20} including those of Covid-19.² However, information in Spanish about Covid-19 vaccines has not been studied.

Moreover, given that an infodemic (overabundance of information, some accurate and some not) is occurring in parallel to the pandemic, and given that combating against the Covid-19 pandemic is also the fight against the infodemic,²¹ monitoring that the information available on YouTube about Covid-19 vaccines is necessary. Thus, the objective of this study is to describe the tone, sources, characteristics, and content of the most viewed YouTube videos in Spanish about the Covid-19 vaccines.

Materials and methods

The keywords “Vacuna Covid,” “Vacuna coronavirus,” and “Vacuna Covid19” were searched on YouTube on 9 February 2021 using a cleared browser. The results were sorted by the number of views since this is a common and accepted procedure when investigating YouTube videos.^{2,17,18,22,23} After applying the exclusion criteria (not available for viewing, language other than Spanish, videos that were duplicated, and videos that did not provide information on Covid-19 vaccines), the 118 most widely viewed videos were selected. This sample size was estimated considering an accuracy level of 6%, an alpha error of 5%, and an expected proportion of pro-vaccination videos of 88%.¹⁹

Two authors (HG-I and GG-I) independently viewed the videos. The following information was recorded: date of upload, country of publication, type of source (media, health professionals, user-generated content, and others), type of publication, video duration (seconds), message tone (message's attitude toward the vaccination), and number of views, likes, dislikes and comments.

Videos were classified according to message tone, adopting a classification previously used: a) "positive," if vaccination was clearly recommended; b) "negative," if arguments were put forward against vaccination; c) "ambiguous," if they contained both positive and negative information about the vaccines; and d) "neutral," if there weren't statements neither for or against vaccines.^{10,20} The agreement between the two authors (HG-I and GG-I) regarding the message tone was total, except for 2 videos (kappa coefficient for inter-rater reliability = 0.971); such disagreements were resolved by consensus. Benefits, efficacy, costs, safety, adverse effects, contraindications and precautions, dosage, target groups for vaccination, and myths and conspiracy theories were also recorded.

A descriptive analysis of the variables was performed; in particular, for quantitative variables (video length, number of views, number of likes, number of dislikes, and number of comments), after checking with the Kolmogorov-Smirnov test that none followed a normal distribution, the median was used as measure of central tendency, and the range as measure of dispersion. Associations between message tone (positive, neutral, and ambiguous) and quantitative variables were studied; moreover, associations between type of source (media, health professionals, user-generated content, and others) and quantitative variables were studied. For it, the median values were compared with a Mann-Whitney U-test and a Kruskal-Wallis test. Finally, association between type of source and message tone (classified in positive and others), as well as association between date of upload (classified in before and after 10 November 2020) and message tone (classified in positive and others), were studied using a chi-square test or Fisher's exact test; the magnitude of the associations were quantified with the odds ratio (OR) and its 95% confidence interval (CI) obtained from univariate logistic regression analysis. The level of statistical significance was established at $p < .05$. All the statistical analyses were done using SPSS v25.

Videos publicly available on YouTube were assessed, and no human participants/animals were included. Therefore, Institutional Review Board approval was not required for this study.

Results

The oldest video was upload on 18 March 2020, and the newest was upload on 5 February 2021. Between November 2020 and February 2021, 66.1% of the videos were published. The majority of the videos ($n = 75$, 63.6%) was created from Mexico (35.6%), the United States of America (15.3%), and Colombia (12.7%). By type of source, media produced 57.6% of the videos. News pieces and material created by a user accumulated 83.1% of the videos (Table 1).

The total amount of views for all videos summed up to 57,390,500 (median [range]: 318,311.5 [150,015–3,975,728]).

The total amount of seconds, likes, dislikes, and comments summed up to 150,068, 1,632,065, 82,783, and 212,637, respectively. The median length (range) was 476.5 (15–10,360) seconds, and the median (range) of likes, dislikes and comments were 6,710 (0–155,928), 414.5 (0–5,325), and 1,401 (0–11,005), respectively.

Positive messages regarding the use of the Covid-19 vaccines were detected in 53.4% of the videos, while neutral or ambiguous messages were observed in 32.2%, and 13.6% of the videos, respectively. Negative tone was detected in 1 video (0.8%). The 63 positive videos accumulated 30,497,303 views (53.1% of all views) (Table 2), and they were significantly longer than tone-neutral videos ($p = .005$) and tone-ambiguous videos ($p = .012$). Moreover, tone-ambiguous videos obtained more dislikes than videos with a neutral tone ($p = .029$).

According to the type of source, the 68 videos produced by the media accumulated 31,565,295 views (55.0% of all views), and the 19 videos produced by health professionals accumulated 10,742,825 views (18.7% of all views) (Table 3). In particular, when comparing the videos of the media with those of health professionals, significant differences were observed in their length ($p = .002$), number of likes ($p = .004$), and number of dislikes ($p = .035$). Likewise, when comparing the videos of the media with the user-generated content, significant differences were observed in their length ($p = .000$), number of views ($p = .015$), number of likes ($p = .000$), number of dislikes (0.000) and number of comments (0.000). Finally, when comparing the videos of the healthcare professionals with the user-generated content, significant differences were detected in their length ($p = .032$) and number of likes ($p = .007$).

Table 1. Country of publication, month, and type of source and publication of the videos.

	Frequency, n (%)
Country of publication	
Mexico	42 (35.6)
The United States of America	18 (15.3)
Colombia	15 (12.7)
Spain	13 (11.0)
Argentina	12 (10.2)
Chile	5 (4.2)
Germany	4 (3.4)
United Kingdom	4 (3.4)
Peru	3 (2.5)
Venezuela	1 (0.8)
Dominican Republic	1 (0.8)
Type of source	
Media	68 (57.6)
User-generated content	28 (23.7)
Health professionals	19 (16.1)
Others	3 (2.5)
Type of publication	
News	50 (42.4)
Material created by the user	48 (40.7)
Interviews	14 (11.9)
Advertisements	3 (2.5)
Documentaries	3 (2.5)
Month of publication	
March-April 2020	7 (5.9)
May-June 2020	6 (5.1)
July-August 2020	19 (16.1)
September-October 2020	8 (6.8)
November-December 2020	47 (39.8)
January-February 2021	31 (26.3)

Table 2. Quantitative characteristics of the videos and message tone.

	Positive videos (n = 63)	Neutral videos (n = 38)	Ambiguous videos (n = 16)	Negative (n = 1)	p-Value
N° views					0.201
Total	30,497,303	16,355,625	10,172,318	365,254	
Median (range)	327,588 (150,015–3,975,728)	251,129.5 (150,032–2,935,282)	461,911 (191,075–2,852,666)	-	
Video length					0.017
Total (seconds)	118,248	19,208	12,369	243	
Median (range)	513 (15–10,360)	261 (20–5,017)	650.5 (127–2,551)	-	
N° likes					0.379
Total	968,771	473,915	170,953	18,426	
Median (range)	7,693 (0–73,241)	4,059 (398–155,928)	7,557 (2,301–44,021)	-	
N° dislikes					0.043
Total	41,262	21,752	17,910	1,859	
Median (range)	455 (0–3,489)	318 (67–5,325)	644 (153–4,024)	-	
N° comments					0.170
Total	111,327	60,451	34,441	6,418	
Median (range)	1,547.5 (0–11,005)	1,287 (101–8,281)	1,601 (531–6,919)	-	

The most common topics discussed in the videos were safety of the Covid-19 vaccines (43.2%) and target groups for vaccination (38.9%) (Table 4). In particular, the target group for vaccination referred most frequently was that of healthcare workers (32.2%) (Table 4). The information under study was most frequently detected in the videos created in November–December 2020 (Figure 1). Moreover, 14 videos (11.9%) mentioned the importance of all people, both vaccinated and unvaccinated, continuing to maintain basic prevention measures (hand hygiene, use of masks, and social distance). Hoaxes and conspiracy theories were detected in 2 videos; such videos were produced by media and users, on May and August 2020, from the USA and Spain; by type of publication, they were news and material created by the user, their median (range) duration was 524 seconds (243–805), and garnered 616,191 views, 23,477 likes, 2,458 dislikes and 7,790 comments. The information disseminated in these videos was as follows: a) “If they want to vaccinate all of us compulsorily, I suspect that there is something behind it, I am beginning to think that there is something dictatorial behind it [. . .]”; b) “There is a theory that says that the Coronavirus was created in a laboratory by the WHO, and I believe in that theory that it was created that way [. . .]. The vaccine cannot be the mark of the Beast, 666, because the World President, who is the antichrist, has not yet manifested himself.”

On the other hand, 15 videos (12.7%) debunked Covid-19 vaccines hoaxes and conspiracy theories (6 corresponded to user-generated content, 5 were created by health professionals, and 4 was made by media). On December 2020 and January 2021 were created 3 and 6 of such videos, mainly from Colombia (5), Spain (4), and Mexico (2); by type of publication, they were material created by the user (11), interviews (3), and news (1). These videos had a median (range) duration of 845 seconds (243–5,017), and a total of 5,172,057 views (9.0% of all views), 267,260 likes (16.4% of likes), 13,739 dislikes (16.6% of dislikes), and 37,052 comments. In particular, 5 videos debunked that Covid-19 vaccines contain mind-controlling and surveillance chips, 4 videos debunked that such vaccines can produce sterility, and 3 videos debunked that Covid-19 vaccines produce genetic changes in humans. Another video debunked that Covid-19 vaccines cause the disease. In addition, the following theories or myths were debunked in other 7 videos: a) Covid-19 pandemic does not exist, b) the needle remains inside the vaccinated person’s body, c) Covid-19 vaccines cause mental deficiency and poison our cells, d) Covid-19 and its vaccines are part of a conspiracy by the pharmaceutical industries to increase their revenues, and e) the masks have a 5 G antenna for monitoring people.

In the univariate analysis between type of source and message tone, videos created by health professionals, compared to

Table 3. Quantitative characteristics of the videos and type of source.

	Media (n = 68)	User-generated content (n = 28)	Health professionals (n = 19)	Others (n = 3)	p-Value
N° views					0.143
Total	31,565,295	14,089,956	10,742,825	992,424	
Median (range)	259,891.5 (150,015–3,975,728)	471,109 (191,075–958,917)	316,177 (192,873–2,935,282)	320,446 (178,027–493,951)	
Video length					0.000
Total (seconds)	28,684	102,951	17,910	523	
Median (range)	268.5 (20–2,551)	1,138 (239–10,360)	636 (15–2,847)	84 (58–381)	
N° likes					0.000
Total	401,343	823,152	404,901	2,669	
Median (range)	3,154.5 (398–36,490)	32,617 (2,617–73,241)	9,492 (0–155,928)	104 (22–2,543)	
N° dislikes					0.000
Total	35,640	25,805	20,997	341	
Median (range)	323.5 (31–3,782)	669 (191–4,024)	539 (0–5,325)	37 (6–298)	
N° comments					0.002
Total	100,876	71,480	39,483	798	
Median (range)	1,263 (101–6,919)	2,174 (531–11,005)	1,538 (0–8,281)	0 (0–798)	

Table 4. Topics related to the Covid-19 vaccines discussed in the videos.

Topic	Discussed, n (%)	Not discussed, n (%)
Covid-19 vaccines are safe	51 (43.2)	67 (56.8)
Target groups for vaccination	46 (38.9)	72 (61.1)
Recommendation for healthcare workers	38 (32.2)	80 (67.8)
Recommendation for all persons over 18 years of age	15 (12.7)	103 (87.3)
Recommendation for persons 60/65 years of age or older	12 (10.2)	106 (89.8)
Recommendation for seniors	13 (11.0)	105 (89.0)
Recommendation for persons with chronic diseases	11 (9.3)	107 (90.7)
Recommendation for all persons over 80 years of age	6 (5.1)	112 (94.9)
Recommendation for teachers	6 (5.1)	112 (94.9)
Recommendation for all persons over 70 years of age	3 (2.5)	115 (97.5)
Recommendations for institutionalized persons in nursing homes	3 (2.5)	115 (97.5)
Recommendation for the armed and security forces	2 (1.7)	116 (98.3)
Recommendation for pregnant women	1 (0.9)	117 (99.1)
Adverse effects of the Covid-19 vaccines	45 (38.1)	73 (61.9)
Benefits of the Covid-19 vaccines	41 (34.8)	77 (65.2)
Efficacy of the Covid-19 vaccines	37 (31.4)	81 (68.6)
Description of the dosage	35 (29.7)	83 (70.3)
Costs of the vaccine	26 (22.0)	92 (78.0)
Vaccination free of charge	20 (16.9)	98 (83.1)
Vaccination is optional	17 (14.4)	101 (85.6)
Cautions and contraindications of the Covid-19 vaccines	12 (10.2)	106 (89.8)
If you have passed the Covid-19, you can be vaccinated	3 (2.5)	115 (97.5)

the videos produced by media, presented significant differences in positive tone (OR = 3.09; 95% CI = 1.05–9.13; $p = .037$). Also, significant differences in positive tone were detected when comparing user-generated content with videos created by the media (OR = 3.02; 95% CI = 1.19–7.63; $p = .018$). There were no differences in the message tone (positive *versus* others) according to the date of publication (before or after 10 November 2020) ($p = .424$).

Discussion

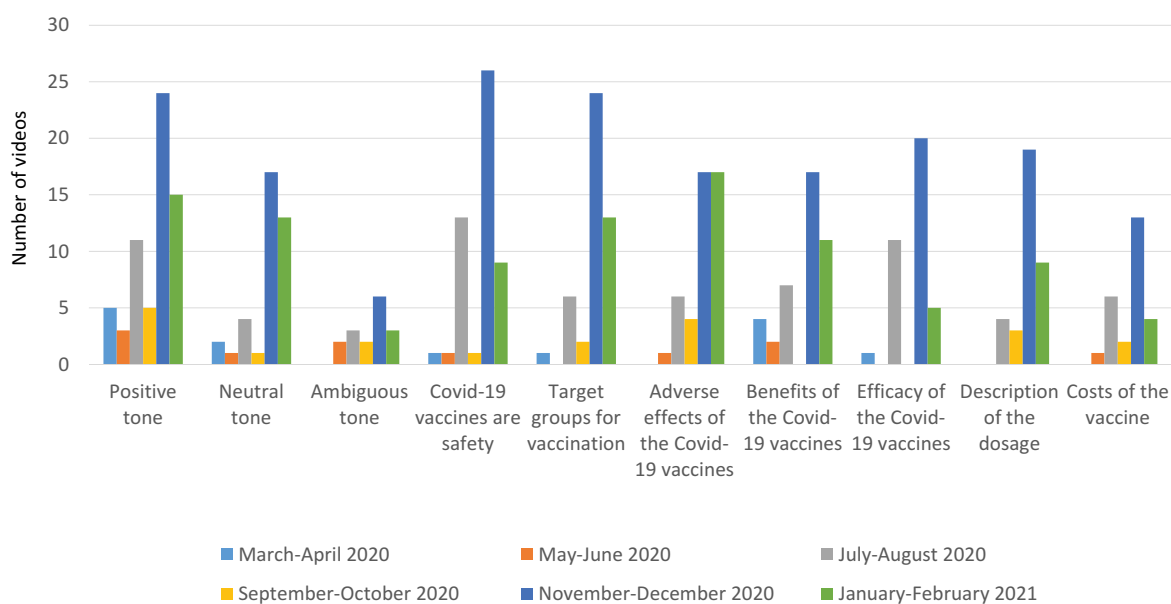
To our knowledge, this is the first study that assesses the characteristics of YouTube videos in Spanish on Covid-19 vaccines. For it, the most frequently terms in Spanish to refer to this virus/disease were used.²⁴

More than 60% of the videos were upload since November 2020; in addition, the information under study was most frequently detected in such videos. It is congruent with the date when the first results of clinical trials on the Covid-19 vaccines began to be disseminated (10 November 2020).³

Just over half of the videos show a favorable view regarding the use of the Covid-19 vaccines. This represents a novel finding because in the only study conducted to evaluate English-language information on YouTube about such vaccines, the message tone was not determined² (perhaps because it was made on 6 April 2020, when the development of Covid-19 vaccines had not yet been finalized). With regard to videos available in Spanish on YouTube about other vaccines, such as influenza,²⁵ meningococcal B,²⁶ or human papillomavirus,¹⁹ the percentage of positive videos is lower (58.1%²⁶–87.6%¹⁹). This could be evidence of a certain reluctance toward Covid-19 vaccines.

Like the study by Basch,² the median number of views (318,311.5) was much greater than those showed in similar research that analyzed the most viewed YouTube videos on the flu vaccine (10,553.5),²⁵ or on vaccines in children (62,075).²⁷ Similarly, the median number of likes, dislikes, and comments was much higher than in such studies, where the values ranged between 69.5²⁵ and 480,²⁷ 11.5²⁵ and 54,²⁷ or 16.5,²⁵ respectively. All of which is evidence of the great interest on Covid-19 vaccines among YouTube users.

According to the tone of the message, positive videos accounted for 53.1% of the views, which is proportional to the number of positive videos (53.4%). However, by type of source, videos produced by the media accumulated 55.0% of the views, while those of healthcare professionals accounted for

**Figure 1.** Number of videos according to the message tone and topics discussed over time.

18.7% of all views, which would be not so proportional to the number of videos (57.6% and 16.1% of the videos, respectively). This could be explained because healthcare professionals would have learned ways to communicate through videos that attract more views.² Another possible explanation would be that people prefer to watch these videos given that health professionals are considered trusted sources of health information.²⁸ Future research should be carried out to verify these assumptions.

Unlike other authors, no significant differences were detected in the number of likes according to the message tone.^{10,13,16} However, a significantly greater median of likes was observed in the videos of health professionals and user-generated content compared to those of the media. This would suggest a greater impact of these videos on the people who view them.

Differences in the message tone, by source type, are congruent with other authors, who, when evaluating information on other vaccines, observed that videos of health professionals had a more positive tone.^{10,25} For this reason, their viewing should be promoted to people seeking information about vaccines on YouTube.

Among the diversity of topics discussed in the videos, the main ones corresponded to the groups targeted for vaccination, and the safety of vaccines. The target groups for vaccination discussed are very diverse because there is a great heterogeneity in the official recommendations according to the country the information is from.

A relevant result of our research was the small number of videos disseminating hoaxes or conspiracy theories, unlike what was described in other studies about other vaccines, in which hoaxes were detected in up to 19.0% of the most viewed videos.²⁵ However, our result is congruent with the Basch's study, in which the 100 most viewed videos in English about Covid-19 vaccines were evaluated, and it was observed how only 2.0% of such videos presented hoaxes.² In our opinion, a key factor that would have contributed to these results would be YouTube's removal of more than 30,000 videos, since October 2020, that made false claims or provided misleading information about Covid-19 vaccines, without following WHO health criteria²⁹ (this measure had not been done so far for other vaccines). This represents an encouraging finding, in a context in which it is estimated that among 55–85% of the population, depending on country and infection rate, needs to be vaccinated against Covid-19 to provide herd immunity,³⁰ and that belief in Covid-19 misinformation significantly reduces willingness to get the vaccine.³¹ For this reason, it is necessary to develop strategies to control the misinformation on Covid-19 vaccines, such as the one YouTube is carrying out by removing videos with hoaxes about these vaccines, based on artificial intelligence systems and complaints from individuals and performing a second level of screening.²⁹

Other methods for combating the Covid-19 vaccines misinformation is debunking false claims,²⁸ such as we have detected in 15 videos refuting several hoaxes or conspiracy theories on such vaccines. However, this can sometimes exacerbate, rather than correct, the negative effects of misinformation,³² and can cause psychological resistance if it is perceived as attacking values or ideologies.²⁸ Perhaps this

justifies that these videos, which represented 12.7% of the videos, accumulated 16.6% of all dislikes. For this reason, more methods for combating the misinformation are necessary, such as carrying out preemptive actions to “immunize the public against misinformation”;²⁸ to do so, spread messages that emphasize the medical consensus on Covid-19 vaccine safety and efficacy is a fundamental step to bolstering public confidence and uptake.²⁸ These messages should be given through diverse mediums (e.g. YouTube), mainly by health professionals urging the general public to get vaccinated.

This research has several limitations. The methodology applied, similar to that used by other authors^{2,10,13,20,25–27,33,34} has the limitations derived from the Internet: information is changing constantly, while in this type of studies is only analyzed the information at a specific moment. Moreover, this type of studies does not allow to distinguish between the number of views and the number of viewers.^{2,10,13,20,22,25–27} Finally, the sample size, although was greater than that used in most similar research^{2,20,25–27,33,34} (typically ranging from 50³³ to 100^{2,25,34}), may have led to results that were not fully precise. Despite these limitations, this study contributes to current knowledge about information sources relevant to Covid-19 vaccination, in a context in which monitoring that the information on YouTube about Covid-19 vaccines is reliable should be a central part of Covid-19 vaccination campaigns. In addition, our findings suggest the need for a collaborative approach between the media and public health organizations to ensure that media videos provide more scientifically accurate information with a pro-vaccination tone as a tool to help people make informed decisions about Covid-19 vaccines and achieve high vaccination coverage.

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