

## RESEARCH ARTICLE

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# Content Quality of YouTube Videos on Human Papillomavirus Vaccine: A Systematic Analysis

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### Abstract

**Background:** The growing dependence on digital platforms for health-related information has positioned YouTube as a key provider of vaccine-related content in India. Nonetheless, the quality, reliability, and completeness of the information accessible on this platform are still questionable. This study sought to assess the content, quality, and reliability of YouTube videos pertaining to HPV vaccination within the Indian context. **Methods:** Search terms “Cervical Cancer Vaccination” and “HPV Vaccine” were used to cross-sectionally analyze YouTube videos. Screening the first 200 videos yielded 81 suitable English or Hindi videos. Data on video attributes and engagement was captured. Audio-Visual Quality (AVQ), Global Quality Score (GQS), modified Quality Criteria for Consumer Health Information (mDISCERN), and Video Information and Quality Index assessed quality and dependability. The new Content Score for Cervical Cancer Vaccination (CSCCV) was developed based on national and international guidelines to assess content completeness. **Results:** A total of 81 videos were analyzed and median duration of the videos 169 seconds, Health-related channels accounted for 51(63.0%) of uploads, and doctors or medical experts serving as speakers in 46(56.8%) of cases. Although none of the videos depicted HPV vaccination unfavourably, engagement metrics did not align with the level of information presented. Videos involving medical professionals exhibited markedly higher mDISCERN scores ( $p = 0.001$ ), signifying enhanced reliability. The overall content completeness was moderate, exhibiting notable deficiencies in guideline-based information. **Conclusion:** YouTube videos regarding HPV vaccination in India are predominantly favourable, although they exhibit variability in dependability and comprehensiveness. Enhancing expert-driven, guideline-compliant, and multilingual digital resources is crucial for promoting HPV vaccine adoption and advancing cervical cancer prevention initiatives in India.

**Keywords:** Cervical Cancer, HPV Vaccination, YouTube, Health Information Quality

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### Introduction

Cancer is a public health problem leading to one in six deaths globally. It bears a disproportionate burden on women because of deaths due to cervical and breast cancer, the two most common forms of cancer in women [1]. In 2020, World Health Organization (WHO) launched the global strategy to eliminate cervical cancer as a public health problem (less than 4 cases per lakh population) by 2030 [2]. Under this initiative, the 90–70–90 target outlined 90% of girls to be vaccinated by age 15 years, 70% of women to be screened with a high-performance test at least two times by age 45 years, and 90% of women identified with cervical precancer or cancer to be treated [2]. Cervical cancer is the second most common cancer in women in India. In India, the age-standardized incidence rate is 14.7 per 100,000 women, and the age-standardized mortality rate is 9.2 per 100,000 women [3]. The risk

factors for cervical cancer include poor genital hygiene, early age at marriage, high risk sexual behaviour, multiple sexual partners and repeated pregnancies. However, proven effective measures i.e., immunization against the oncogenic strains of Human Papilloma Virus (HPV) and screening for HPV makes cervical cancer a preventable health condition. The availability and accessibility of services for cervical cancer screening, immunization and treatment and follow up screening has been limited in Low- and Middle-income countries (LMICs) [4]. This is due to the overburdened public health system, lack of trained manpower and access to services, higher costs of vaccines, unavailability of vaccine in public funded immunization programs and insufficient resources for program implementation [5, 6].

The challenges in cervical cancer prevention are manifold. There is low level of awareness regarding the aetiology and prevention strategies in the general

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population [7, 8]. Screening tests, including the cervical cytology and HPV testing are still socially unacceptable in India as it involves sampling from the female genital region. Women, particularly belonging to rural India, are often hesitant to undertake these screening tests [9, 10]. Due to low rates of screening, HPV vaccine is being envisioned as a potential strategy to eliminate cervical cancer in India. However the rates of HPV vaccination are low on account of the lack of awareness among the general population [11, 12]. Successful awareness and availability of correct information is a prerequisite for vaccine acceptance in the masses.

The Government of India in the recent financial budget 2023-24, has outlined financial allocation for the introduction of an indigenously prepared cervical cancer vaccine to girls 9-14 year age group as a mass vaccination drive. This would be followed by integration of HPV vaccine into the routine schedule of National Immunization Program [13].

India is experiencing a digital health revolution with deep penetration of social media even in the rural areas. In this digital world, YouTube has a significant role as a source of health-related information in India. The potential of YouTube as a tool for health awareness is well established, with several sources contributing to informative content [14]. However, lack of a peer review process and scrutiny of information leads to questions on the credibility of the information being shared. Therefore, we conducted this study to evaluate the content, quality and reliability of videos related to cervical cancer vaccination available on YouTube. Additionally, this study will also guide healthcare providers towards priority issues to address while creating videos and leveraging social media to educate the population seeking information on cervical cancer vaccination.

## Materials and Methods

### Study Design

A cross-sectional study to assess the content completeness, quality, and dependability of YouTube videos about HPV vaccine that were accessed via YouTube India.

### Search criteria

Google Trends were utilized to ascertain frequently employed search phrases by the general population, as advised by for digital health study [15]. The phrases “Cervical Cancer Vaccination” and “HPV Vaccine” emerged as the most commonly searched terms in India. Video searches were performed on YouTube India (<https://www.youtube.com>) utilizing Google Chrome in incognito mode to reduce customization bias. All videos were retrieved on 10 May 2024, and the extracted data and quality assessments were performed thereafter using the information available on the platform at that time. Each term was individually searched in two incognito windows, without the application of filters and sorted by relevance, the default option of YouTube.

### Eligibility Criteria

In YouTube, most users in general, consume the first 100 videos shown by the search engine [16]. Therefore, we included 100 videos for each search term, totalling our tally to 200 videos.

### Inclusion criteria

Videos pertinent to HPV vaccine or cervical cancer vaccination, available in English or Hindi, and featuring audible information were incorporated into the study.

### Exclusion Criteria

Videos less than one minute or exceeding fifteen minutes. Redundant videos manifesting in both search results, Videos in languages other English or Hindi, Silent videos, Content unrelated to HPV vaccination were excluded from the study. Videos shorter than 1 minute were excluded because they generally contain brief promotional clips, advertisements, or incomplete information that does not provide sufficient educational content for meaningful evaluation. Videos longer than 15 minutes were excluded because, according to earlier research assessing YouTube health content, viewers typically prefer shorter, more succinct informational videos, and longer videos frequently include lengthy discussions, interviews, or webinars that might not accurately reflect the viewing habits of average users [17, 18].

Following the application of eligibility criteria, 81 videos were incorporated into the final analysis.

### Data Extraction

The following parameters were recorded for each included video: Overall views, number of likes, length in seconds, and days elapsed since the upload, the audio language and the country it originates from, likes for every 1,000 views. Categories of sources include news channels, health platforms, educational platforms, and individual creators. Type of speaker: medical professional, patient, non-medical individual, or unknown. The viewing rate was determined using the formula outlined in earlier YouTube evaluation studies [19].

Viewing rate index= (Number of likes / Days since upload) × 100

### Quality and Reliability Assessment

Two trained researchers independently assessed all videos using validated scoring systems. Score for assessing technical quality in audio-visual content (AVQ). The Global Quality Score (GQS) is utilized to assess the usefulness and credibility of information [20, 21]. The Modified DISCERN (mDISCERN) tool is employed to evaluate reliability, bias, and clarity [21]. The Video Information and Quality Index (VIQI) is used to analyze flow, accuracy, quality, and precision. Any discrepancies were addressed through discussions with a senior researcher to ensure consistency. Range of scores used for AVQ, GQS, mDISCERN and VIQI mentioned in Supplementary Table 1.

### Content Completeness Assessment (CSCCV)

The CSCCV tool was developed based on key

informational components recommended in guidelines from the Centers for Disease Control and Prevention (CDC), Government of India national guidelines, and the [22–24] (Supplementary Figure 1). These guidelines were reviewed to identify essential informational domains related to HPV vaccination, including eligibility, dosing schedule, target population, benefits, safety, and preventive role. A total of 14 parameters were formulated to represent critical information elements. Each parameter was scored 1 (present/correct) or 0 (absent/incorrect). The tool was pilot-tested on 10 videos prior to its application in the final dataset to ensure clarity and applicability (Figure 1).

#### Data Analysis or Statistical Analysis

Data were entered into Microsoft Excel and analyzed utilizing SPSS version 29.0 (IBM Corp., Armonk, NY, USA). Continuous variables were evaluated for normal distribution with the Shapiro–Wilk test and were summarized using the median and interquartile range (IQR). Categorical variables were presented as frequencies and percentages.

The Kruskal–Wallis test was employed to compare quality and reliability scores (AVQ, GQS, mDISCERN, VIQI) and CSCCV scores across different speaker categories, video sources, and languages.

All statistical tests were conducted as two-tailed, with a p-value of less than 0.05 being statistically significant.

## Results

A total of 81 YouTube videos pertaining to HPV vaccination were included in the final analysis (Table 1). Videos that were less than 1 minute long, totalling 17, and those that exceeded 15 minutes, amounting to 7, were excluded. Additionally, the videos that were repeated or duplicated (n=41 videos) and appeared in both searches were excluded. Our study focused on the English and Hindi languages, leading to the exclusion of videos in any other language (n=15 videos). Additionally, two videos without audio were excluded. Among the 200 videos, 37 were deemed irrelevant to the topic of our study, resulting in their exclusion.

The median view count was 6,323, accompanied by a median likes count of 66 (IQR: 17–223). The median video duration was 169 seconds (IQR: 126–275). The majority of videos were uploaded with a median of 679 days after their upload.

Most videos were in English 62(76.5%), whereas 19 (23.5%) were in Hindi. Health-related channels represented the biggest share at 51 (63.0%), followed by news channels at 23 (28.4%) and educational channels

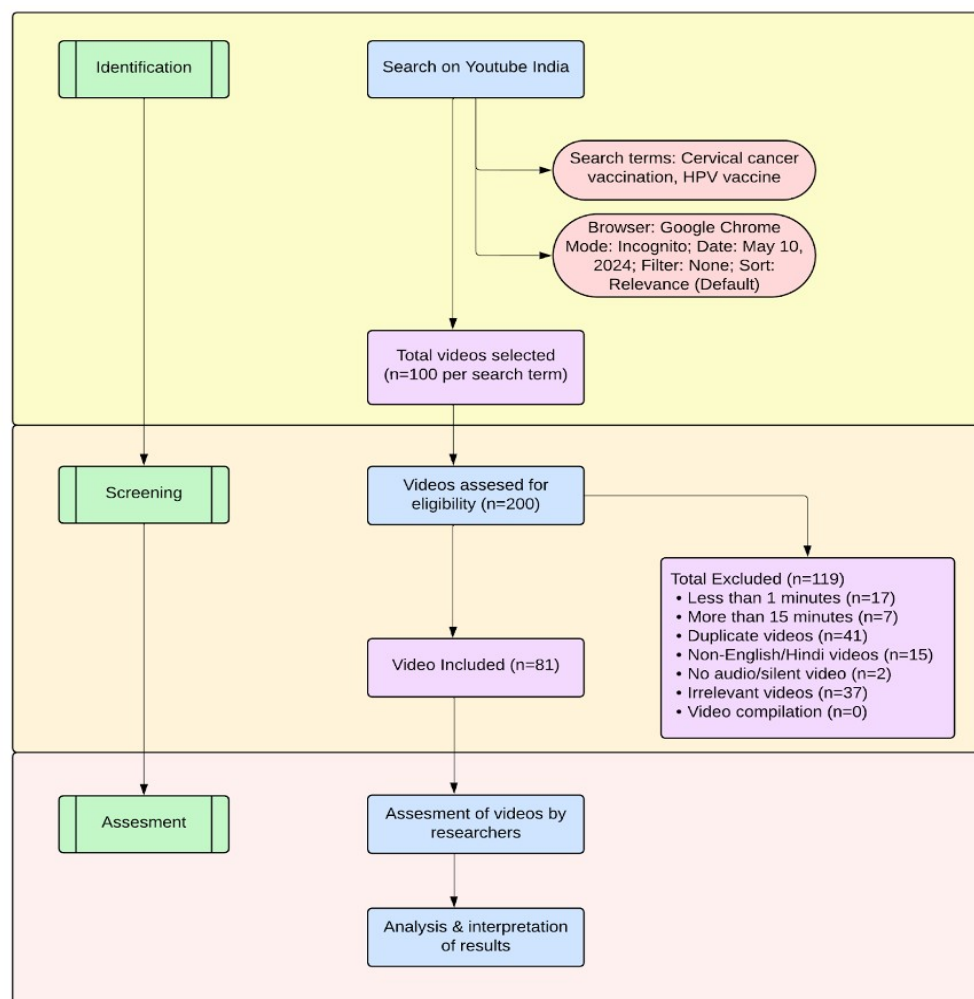


Figure 1. Systematic Plan for Assessment of the Videos

Table 1. Descriptive Characteristics of the Included Videos (n=81)

| Variables                                                        | Median (IQR)                                                                    |
|------------------------------------------------------------------|---------------------------------------------------------------------------------|
| View Count                                                       | 6323 (8.3) *                                                                    |
| Likes Count                                                      | 66 (17-223)                                                                     |
| Likes/1000 views                                                 | 10 (5-17)                                                                       |
| No. of days since uploaded                                       | 679 (3.6) *                                                                     |
| Viewing rate index (no. of views/no. of days since upload X 100) | 930.1(9.2) *                                                                    |
| Duration of video (in seconds)                                   | 169 (126-275)                                                                   |
| Language#                                                        | English<br>Hindi                                                                |
| Source of video#                                                 | Educational Channel<br>Health Channel<br>News Channel                           |
| Speaker in video#                                                | Doctor/Medical Professional<br>External Voice/Unknown<br>Non-medical Individual |

\*For log normally distributed variables geometric mean with geometric standard deviation within parenthesis were presented; # Descriptive statistics in terms of number (percentage)

Table 2. Quality and Reliability Scores by Speaker Type

|                                                                      | Speaker in video         |                         |                        | Total             | p-value |
|----------------------------------------------------------------------|--------------------------|-------------------------|------------------------|-------------------|---------|
|                                                                      | Doctor/Med. Professional | External voice /Unknown | Non-medical Individual |                   |         |
|                                                                      | Median (IQR)             | Median (IQR)            | Median (IQR)           | Median (IQR)      |         |
| AVQ                                                                  | 3 (3-3)                  | 3 (3-3)                 | 3 (3-3)                | 3 (3-3)           | 0.99    |
| GQS                                                                  | 3 (3-4)                  | 3 (2-4)                 | 3 (2-3.5)              | 3 (2-4)           | 0.244   |
| mDISCERN                                                             | 3 (2-4)                  | 2 (1-3)                 | 2 (1-2.5)              | 3 (2-3)           | 0.001*  |
| VIQI (total)                                                         | 14 (11-15)               | 14 (12-16)              | 12 (10.5-15)           | 14 (11-15)        | 0.377   |
| Content Scoring (total)                                              | 5.5 (4-8)                | 4 (2-7)                 | 4 (3-6.5)              | 5 (3-8)           | 0.184   |
| View Count                                                           | 4417.5 (1127-16323)      | 28185 (5447-79833)      | 7053 (1634.5-24408)    | 6750 (1671-26363) | 0.018*  |
| Likes Count                                                          | 38 (14-145)              | 134 (24-1500)           | 113 (17-279)           | 66 (17-223)       | 0.123   |
| Likes/1000 views                                                     | 11 (6-17)                | 6.5 (4-9)               | 10.5 (6-22)            | 10 (5-17)         | 0.229   |
| Viewing rate index (no. of views/<br>no. of days since upload X 100) | 620 (166-3203)           | 2235 (909-4851)         | 985 (281-4762)         |                   | 0.128   |

\*Significant at  $p < 0.05$

at 7 (8.6%). Medical personnel constituted 46 (56.8%) of the speakers in the included videos, while 20 (24.7%) included non-medical individuals, and 15 (18.5%) had an external or unidentifiable voice.

The median AVQ and GQS scores were similar among speaker groups, with no statistically significant variations noted (Table 2). Conversely, mDISCERN scores exhibited considerable variation based on speaker type ( $p = 0.001$ ). Videos showing physicians or medical professionals exhibited superior median mDISCERN ratings relative to those given by non-medical individuals or external/unknown speakers, signifying enhanced dependability and less bias. Analysis by video source revealed significant differences in mDISCERN scores across categories ( $p = 0.036$ ), with health channel films exhibiting superior reliability scores relative to educational and news channels. Despite higher content completeness scores (CSCCV) in videos with medical experts, this difference was not statistically significant ( $p = 0.184$ ).

Notable disparities in view counts were observed among speaker categories ( $p = 0.018$ ). Those with external or unfamiliar voices exhibited the highest median view counts, succeeded by those featuring non-medical individuals, whilst those presented by doctors or medical experts garnered relatively lower audience. No statistically significant variations were detected among speaker groups regarding likes count, likes per 1,000 views, or watching rate index, indicating that engagement indicators did not consistently correlate with information reliability (Table 3).

No notable discrepancies were detected for AVQ or GQS among video sources. Language analysis demonstrated no significant changes in AVQ, GQS, or mDISCERN scores between English and Hindi videos, signifying equivalent quality and dependability across languages (Table 3). The overall content completeness score demonstrated moderate coverage with notable deficiencies in guideline-based recommendations.

Table 3. Video Engagement Metrics by Speaker Type and Quality Scores by Video Source and Language

|                  |                             | AQS          | GQS          | mDISCERN     |
|------------------|-----------------------------|--------------|--------------|--------------|
|                  |                             | Median (IQR) | Median (IQR) | Median (IQR) |
| Source of video  | Educational Channel         | 3 (3-3)      | 3 (2-4)      | 2 (1-3)      |
|                  | Health Channel              | 3 (3-3)      | 3 (2-4)      | 3 (2-4)      |
|                  | News Channel                | 3 (3-3)      | 3 (2-4)      | 2 (2-3)      |
|                  | p-value                     | 0.898        | 0.706        | 0.036*       |
| Speaker in video | Doctor/Medical Professional | 3 (3-3)      | 3 (3-4)      | 3 (2-4)      |
|                  | External Voice/Unknown      | 3 (3-3)      | 3 (2-4)      | 2 (1-3)      |
|                  | Non-medical Individual      | 3 (3-3)      | 3 (2-3.5)    | 2 (1-2.5)    |
|                  | p-value                     | 0.99         | 0.244        | 0.001*       |
| Language         | English                     | 3 (3-3)      | 3 (2-4)      | 2 (2-3)      |
|                  | Hindi                       | 3 (3-3)      | 4 (3-4)      | 3 (2-4)      |
|                  | p-value                     | 0.513        | 0.069        | 0.567        |

\*Significant at  $p < 0.05$ 

## Discussion

HPV vaccine is a crucial strategy for the elimination of cervical cancer, demonstrating substantial real-world effectiveness in reducing HPV infection, cervical intraepithelial neoplasia, and invasive cervical cancer across multiple population-based studies and national immunization programs [25, 26]. Longitudinal follow-up studies from countries with high vaccine coverage, including Australia, the United Kingdom, and Sweden, have shown that vaccinated populations have up to 90% fewer cases of cervical cancer. This strongly supports the WHO's plan to eliminate cervical cancer [2, 25, 26]. So, improving HPV vaccine coverage is pivotal for global and national efforts to prevent disease, aligning with India's efforts to make HPV vaccination more widely available through public health programs [2, 13].

Alongside advancements in science, the global spread of vaccine misinformation and organized anti-vaccination campaigns, particularly on digital and social media platforms, poses a substantial risk to public confidence in immunization efforts [27, 28]. Social media sites like YouTube are very important for shaping public opinion, and they need to be used to share accurate, fair, and evidence-based health information [29, 30]. The effectiveness of YouTube as a health promotion tool is greatly affected by the quality, credibility, and thoroughness of the content offered, as a large part of the population is relying more and more on internet videos for information on preventive measures like immunization [30–32]. The COVID-19 pandemic has profoundly transformed global health-seeking behaviour, elevating public understanding of preventive measures, vaccination, and risk mitigation strategies [33]. This heightened focus coincides with considerable differences in health literacy, particularly LMICs, making people both more receptive to preventive messaging and more vulnerable to misinformation [34, 35]. In this context, clear, reliable, and culturally appropriate digital communication is essential for making informed decisions about vaccines [36].

The present study indicated that the median duration

of videos was significantly short, corroborating prior research that suggests viewers prefer concise and easily comprehensible health content on YouTube [14, 37]. Most of the videos came from health-related channels, and doctors or other health experts were the main speakers. This shows that professionals are involved in communicating about the HPV vaccine. About seventy-five percent of the videos were in English, which means they reached a bigger audience [38]. Those with unfamiliar voices and non-medical individuals had higher median view counts than by doctors or medical experts showing their popularity in these social media platforms. This also highlights that medical professionals should stress upon health education channels on social media platforms as a means of enhancing health literacy and service delivery. Conversely, mDISCERN scores were high for health professionals highlighting improved quality and content of videos by them. None of the videos we looked at showed the HPV vaccine in a bad light, which is encouraging given concerns about people not wanting to get vaccinated amidst antivaccination campaigns. Ache et al. found that only around 75% of HPV vaccine-related movies showed vaccination in a good light, whereas a large number of them spread scepticism or false information [39]. This is in contrast to our findings. This shift toward a consistently favourable portrayal is particularly important as the Indian government prepares for a large-scale HPV vaccination campaign using an indigenously produced, affordable vaccine [40]. People often think that engagement-based YouTube metrics like view count, likes, viewing rate, and Video Power Index are related to the quality of the information; however, previous studies have shown that there are no significant differences in these metrics between AVQ and GQS quality categories [37, 41, 42]. There isn't a widely accepted scoring approach for judging HPV vaccine content on YouTube, but the high level of dependability shown between and within researchers in this study makes the evaluation framework more trustworthy and adaptable. The incorporation of established quality indicators alongside a context-specific content score enhances scientific rigor and enables substantive comparisons with

existing literature [37, 41,43].

### Limitations

The study has certain limitations that require consideration. The content and availability of YouTube videos fluctuate over time, and our cross-sectional study analyzed the videos accessible at a certain time period. The investigated videos were exclusively in English or Hindi, and those in other Indian languages were not examined. Certain demographic data, including age, gender, socioeconomic status, and geographic location of the viewers, was unavailable, thereby constraining more thorough studies.

The strengths of the study includes, this study thoroughly examined YouTube videos using AVQ, GQS, mDISCERN, and VIQI, which are reliable quality assessment tools. This enabled a comprehensive reliability and informative quality assessment. The study also proposed a context-specific Content Score for Cervical Cancer Vaccination (CSCCV) based on national and international HPV vaccination guidelines. This allowed rigorous evaluation of video content completeness. Results were more reliable and less biased because two professional reviewers saw the videos individually. These methods strengthen the study's evaluation of HPV vaccine-related YouTube content.

In conclusion, this study showed that there are a lot of videos on YouTube about HPV vaccination, and the majority of them provide positive information. The accuracy and completeness of the data, however, vary, especially when it comes to the guideline-based information required for well-informed decision-making. Views and likes are examples of engagement metrics that don't always accurately represent the calibre of content. In general, videos made by medical professionals were more accurate and dependable than those made by non-expert sources. These results emphasize how crucial expert-driven, evidence-based digital health communication is to raising the calibre and dependability of HPV vaccine information accessible online. These results underscore the imperative for cooperative involvement among public health agencies, educational institutions, and professional organizations to develop standardized, guideline-adherent, and culturally pertinent digital content that fosters HPV vaccine acceptance, particularly in relation to India's national cervical cancer prevention goals (2,13,36).

### Author Contribution Statement

Dr. Soumya Swaroop Sahoo, Prince Kumar, Raju Kumar, and Dr. Pragyan Paramita Parija conceptualized the study, with Dr. Abhilash contributing further to the design and literature search. All authors, including Mr. Shubham Mishra, defined the intellectual content and were responsible for the preparation, editing, and final review of the manuscript.

### Acknowledgements

#### *Ethical Approval (if applicable)*

Not applicable. As the data was collected from a

publicly available social platform, ethical approval was not deemed necessary.

### Availability of Data

The data utilized in this research was sourced from publicly accessible YouTube videos. The data extracted and the scoring sheets that support the findings are available from the corresponding author upon a reasonable request.

### Conflict of Interest

The authors declare that they have no competing interests

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