



RESEARCH PAPER



Coverage of HPV-Related Information on Chinese Social Media: a Content Analysis of Articles in Zhihu

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ABSTRACT

Information about human papillomavirus (HPV) disease and its vaccination has been increasingly communicated and discussed on social media platforms. The current study aims to investigate the coverage of HPV-related information on one of the most popular Chinese social media – Zhihu. Data for this study were user-generated articles, which were identified and collected by a Python web crawler with keyword searching. The final sample included a total of 115 articles, covering a two-year period between 2017 and 2018. Each article was coded for several key characteristics, including HPV epidemiological information, health belief model (HBM) constructs, framing strategy, and responses to the article. Results suggested that most of the articles reported HPV's relationship to cervical cancer, HPV severity, and vaccination benefits. Thematic framing was more often used by the Zhihu articles to disseminate HPV-related issues, and a significant relationship between framing strategy and information coverage was found. The study has not only theoretically extended the literature of online HPV vaccine information coverage, but also practically suggested the needs to communicate comprehensive and detailed knowledge about HPV vaccination on Chinese social media.

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Introduction

Human papillomavirus (HPV) is the most common sexually transmitted disease (STD) worldwide. Most sexually active people can be infected with HPV at some point in life. Although HPV infection usually causes no symptoms, it has a close link to cervical cancer, which led to the death of approximately 311,000 women in 2018 and became the second most common cancer in women living in less developed regions.¹ High-risk HPV may also lead to other cancers and illnesses in both women and men, such as oropharyngeal cancers, anal cancers, vulvovaginal and penile cancers, as well as genital wart.² As such, HPV vaccine was developed to prevent HPV-related diseases. HPV vaccine was also recommended by World Health Organization to incorporate into national immunization programs for many countries.³ As the world's largest developing country, China has an HPV prevalence rate of 15.6% in women with normal cervical cytology.⁴ Despite the high prevalence and risk, not until late 2016 did the China Food and Drug Administration approve its first licensed bivalent HPV vaccine for women up to age 26 years.⁴ The late license is mainly caused by the government regulation that requires all pharmaceutical products licensed in China to be tested in China-based clinical trials. The delay of available HPV vaccine may result in a general low level of knowledge about HPV and its vaccination in mainland China.^{5,6}

Media has become the main source for people to obtain HPV-related information, which plays an important role in

their decision-making process of whether to uptake HPV vaccination or not.^{7,8} Nowadays, social media are considered as one of the most preferred places for people to get information about HPV vaccine.⁹ Compared to traditional media such as newspaper or television, social media is able to provide more time-sensitive and customized health information, as well as allow communication and interaction among users. Many recent content analyses have been conducted to understand the information coverage of HPV infection and its vaccination on different social media platforms, such as Twitter,^{10,11} YouTube¹² and Instagram.¹³ However, while HPV disease is common worldwide and is widely discussed on various social media platforms, to the best of our knowledge, till now no studies have been conducted on Chinese social media about this disease. Given the delay approval of HPV vaccine, the discussion of HPV-related topics on Chinese social media may occur in different patterns when compared to those in previous studies. Meanwhile, cultural factor may also contribute to the variations on Chinese social media. Li et al.,¹⁴ highlighted the different online health information seeking and sharing behaviors between people in Chinese and Western culture. The cultural differences in the perception of online health information are also supported by Song et al.,¹⁵ who compared users from Hong Kong and United States. As a result, the findings from previous content analysis may not be applicable in the Chinese context.

In order to address the research gap, the current study aims to investigate the information coverage and

communication patterns of HPV infection and its vaccine on Chinese social media. The study targets on the user-generated articles in the platform of Zhihu,¹ a leading Chinese social media with a special aim for knowledge contribution and sharing. Launched in 2011, Zhihu is one of the most popular Chinese social media sites with over 160 million registered users and 26 million daily active users in July 2018.¹⁶ Besides the main feature of user-generated questions and answers, users in Zhihu are also encouraged to publish articles with in-depth and professional knowledge on a particular area or topic. There are several reasons for targeting on Zhihu articles. Firstly, different from other social media that are designed for social and entertaining purposes, Zhihu is originally built for knowledge contribution. In the context of HPV-related information seeking, Zhihu can provide users with more reliable and professional information. Secondly, the typical Zhihu users are generally well educated, with 80% of them self-reporting a bachelor's degree or above. They prefer to read long articles and enjoy serious discussions with other users,¹⁷ which can potentially affect behavioral outcomes. Lastly, compared to superficial and perhaps emotional contents in other social media, articles published in Zhihu provide deeper and more comprehensive arguments. They tend to have a high-value density for in-depth analysis of knowledge sharing behaviors. As a result, Zhihu articles can be a potential and important source for the in-depth analysis of HPV-related information coverage on Chinese social media.

Literature review and research questions

The coverage of health information on media has a significant impact on people's relevant perceptions, attitudes, and behaviors toward a health issue.^{12,18} Incomplete and unbalanced information presented in media can lead to the misunderstanding of the health issue and further problematic actions. For instance, Li et al.,¹⁹ found that less than half of the Chinese newspapers disclosed the relationship between HPV and male-related cancers or genital warts, and fewer articles reported the transmission of HPV in sexual behaviors. It would result in low perceived benefits of HPV vaccination among males, and a low public awareness of sexual transmission of HPV. Given that no previous studies have been done to analyze the new media coverage of HPV vaccine-related information in the Chinese context, it remains unclear what epidemiological information are presented on Chinese new media, including HPV prevalence and harms.

More importantly, among the previous studies investigating the coverage of HPV vaccination on new media platforms,^{13,20,21} very few of them provided a theoretical framework for the basis of their analysis. Considering the presence of HPV-related topics on social media websites under a theoretical framework can provide a more targeted examination of whether the content is comprehensive and reliable. The Health Belief Model [HBM; 22] is one of the most widely used theories to explain and predict health-related behaviors, particularly in regard to the adoption of disease prevention practices.^{23,24} The HBM focuses on individual beliefs about health conditions, and defines several key constructs that

influence health behaviors: (a) susceptibility: individual's perception of the risk of acquiring a sickness or disease); (b) severity: belief of severe consequence of contracting the disease; (c) benefits: potential positive benefits of the recommended health action; (d) barriers: perceived barriers to the recommended health action; (e) cues to action: exposure to factors that prompt the health action; and (f) self-efficacy: confidence in ability to succeed. Studies have found that HBM constructs are associated with HPV vaccine intention and uptake among Chinese women.^{25,26} Li et al.'s study,¹⁹ applied the HBM to examine HPV information coverage in Chinese newspapers. Their findings suggested that information on benefit, cues to action, self-efficacy, and susceptibility were more frequently found in Chinese news articles.

Thus, in order to extend the findings of previous studies and systematically analyze the coverage of HPV vaccination information in Zhihu articles, the following research questions were proposed:

RQ1: What HPV epidemiological information was reported in the Zhihu articles?

RQ2: To what extent did the Zhihu articles present information related to HBM constructs?

RQ3: Were there any relations across HBM constructs presented in the Zhihu articles?

Framing is a commonly studied concept in mass communication, which is defined as "to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described" [27, p. 52]. Based on Goffman,²⁸ the way that messages framed on mass media could have an impact on individual's attitude and behavior. In the study of social and political issues on media, Iyengar,²⁹ divided framing into two types: thematic and episodic framing. Messages with thematic framing place an issue in a broad and general societal context, while those with episodic framing present an issue in an isolated and personal example. Thematic and episodic framing of health-related issues on media could lead to different influences on public knowledge, perception, responsibility attribution, and support for the recommended solutions to the issue.³⁰

Framing strategy could be shaped by cultural values. For example, research suggested that Western media prefer episodic framing and often frame causes and solutions of social and health problems at the individual rather than societal level.³¹ In contrast, thematic framing was found to be more frequently used by Chinese newspapers to present health issues.^{19,32} However, it remains to be seen whether the same conclusion can be applied to the HPV information on Chinese new media. On the other hand, thematic and episodic framing may have different emphases on covering public health issues. Compared to episodic framing which focuses on vivid and personalized storytelling, thematic framing tries to employ systematic evidence of widespread outcomes, statistical trends of morbidity and mortality, discussion of risk

factors and their social indicators, and reports on intervention and treatment.^{33,34} As a result, articles in thematic framing are more likely to include epidemiological information and HBM constructs rather than those in episodic framing. But the relation between framing strategy and information coverage is somewhat less studied in prior literature. In order to investigate the framing strategy of HPV information on Chinese new media, as well as its association with the coverage of epidemiological information and HBM constructs, the following research questions were asked:

RQ4: What framing strategies were used by Zhihu articles to present HPV-related information?

RQ5: Did the framing strategies in Zhihu articles relate to the coverage of a) HPV epidemiological information, and b) HBM constructs?

There have been also increasing studies exploring the factors that influence responses of HPV-related posts, such as likes and comments.^{12,13,35} For instance, a study on Instagram¹³ found that posts mentioning cancer and HPV screening were more likely to have a higher number of likes. Despite these studies showed the potential relationship between the coverage of HPV information and responses to posts, no existing research has been conducted on testing the impacts of epidemiological information and complete HBM constructs on users' responses. Meanwhile, message framing strategy was often found to affect people's responses and behaviors across studies in other health-related domains.^{36,37} It would be worthwhile to investigate how framing strategy influences users' responses to HPV articles, particularly on Chinese social media. Therefore, the following research questions were proposed:

RQ6: Did the coverage of a) HPV epidemiological information, and b) HBM constructs in Zhihu articles affect users' responses (including votes and comments)?

RQ7: Did the framing strategy in Zhihu articles affect users' responses (including votes and comments)?

Method

Data collection

Data for this study were collected by a Python web crawler, using the Chinese language search keywords of “疫苗” (vaccine), “宫颈癌” (cervical cancer), and/or “HPV”. The crawler accessed to Zhihu on 4th March 2019 and collected the HPV-related articles. However, there were a huge number of relevant articles posted in Zhihu, and their focuses were often affected by the time. Considering the delay of HPV vaccine in China, we limited the search to those posted within recent 2 years, in order to provide a time-sensitive picture of the HPV-related information on Zhihu. Furthermore, the following articles were eliminated in the screening process to ensure the final data quality: (1) articles without mention of HPV

vaccine or cervical cancer vaccine; (2) articles with the majority of content (more than 80%) irrelevant to HPV infection or vaccine; (3) articles primarily focusing on the vaccine's history or market (e.g., with very limited HPV health information); (4) articles shorter than 100 Chinese words in length.

Data coding

The initial search yielded a total of 133 articles. After the data screening process, 115 articles were included in final pool. Only the texts in the articles were extracted for coding, other information such as images or videos were excluded. According to the RQs provided above, each included article was then coded for several key characteristics, including HPV epidemiological information, HBM constructs, framing strategy, and responses to the article. More specifically, HPV epidemiological information was coded by items including HPV's relationship to cervical cancer, other cancers, and genital warts, as well as the fact of sexual transmission. HBM constructs were coded by assessing the presence of content related to susceptibility, severity, benefits, barriers, cues to action, and self-efficacy information. Additionally, a new construct of ‘costs’ (e.g., price of HPV vaccine and other costs) was coded separately from ‘barriers’ in the original HBM, because the high financial cost is reported to be a main barrier to improve HPV vaccine coverage in China.³⁸ In regard to framing strategy, an article was coded as thematic framing if it placed HPV-related issues into a broader social context or focused on trends over time; it was coded as episodic framing if it presented the issues by offering a specific example (e.g., personal story), case study, or event-oriented report. Responses to the article involved number of votes and number of comments, which were extracted directly from the data.

Two bilingual coders (LJ and ZH), who are Chinese native speakers, coded the involved articles. Both of them have strong research background in health communication and informatics. Prior to coding, the two coders independently coded 14 randomly selected articles (over 10% of the total sample) to establish intercoder reliability, which was assessed by the Krippendorff's alpha.³⁹ The reliability scores ranged from 0.86 (lowest) to 1.0 (highest) across all the included variables, indicating a high agreement between the two coders' judgments.

Data analysis

Data were analyzed through IBM SPSS Version 25. Descriptive statistics were first run to assess the frequencies of epidemiological information, HBM constructs, and framing strategy. Pearson Chi-Square analyses were further performed to assess a) the relations between epidemiological information and HBM constructs; b) the internal relations within HBM constructs; c) the relations between framing strategy and epidemiological information; and d) the relations between framing strategy and HBM constructs. Furthermore, hierarchical ordinary least squares regression analysis was conducted to examine the effects of epidemiological information, HBM constructs, and framing strategy on the responses of articles.

A log transformation was performed on the two dependent variables (i.e., number of votes and number of comments) before the regression analysis, due to an initial inspection of non-normal distributions among them.

Results

RQ1, 2, and 3: epidemiological information and HBM constructs

The descriptive statistics of key characteristics in the included Zhihu articles are presented in Table 1. Overall, most of the articles (76.8%) reported HPV's relationship to cervical cancer, while less than half of them reported its relationship with other cancers (41.7%) and genital warts (42.6%). Fewer articles (37.4%) explicitly stated that HPV is sexually transmitted. For the presence of HBM constructs, benefits of HPV vaccination were most frequently found in Zhihu articles (77.4%), followed by severity of HPV infection (72.2%). Around half of the articles also included susceptibility of contacting HPV (55.7%), cues to taking the vaccination action (54.8%), and self-efficacy information to obtain the vaccine (47.8%). Barrier-related information (31.3%) and financial costs of HPV vaccination (36.5%) were less covered in the articles.

Furthermore, the internal relations within the HBM constructs were examined (Table 2). Findings from the Pearson Chi-Square analyses indicated that the presence of self-efficacy information was significantly related to other HBM constructs, except for cues to action. Strong significant relationships between any two constructs of susceptibility, severity, and benefits were also found in Zhihu articles. Barriers were also significantly associated with cues to action.

RQ4 and 5: framing strategy and effects

Thematic framing was a more popular communication strategy (74.8%) used by the Zhihu articles to disseminate HPV-related issues, compared to episodic framing which was only employed by 25.2% of the articles. More importantly, there

Table 1. Descriptive statistics of the key characteristics in included articles (N = 115).

Characteristics	Number ^a	Percentage
<i>Epidemiological information</i>		
Relationship to cervical cancer	86	74.8%
Relationship to other cancers	48	41.7%
Relationship to genital warts	49	42.6%
Fact of sexual transmission	43	37.4%
<i>HBM constructs</i>		
Susceptibility	64	55.7%
Severity	83	72.2%
Benefits	89	77.4%
Barriers	36	31.3%
Costs	42	36.5%
Cues to action	63	54.8%
Self-efficacy information	55	47.8%
<i>Framing strategy</i>		
Thematic framing	86	74.8%
Episodic framing	29	25.2%
<i>Responses to articles</i>		
Number of votes ^b	26.64	94.15
Number of comments ^b	20.36	118.74

Note: ^a Number of articles in which the relevant information is presented. ^b Data were presented as mean and standard deviation.

Table 2. Pearson Chi-Square (χ^2) analyses of internal relations among HBM constructs (N = 115).

No.	HBM constructs	1	2	3	4	5	6
1	Susceptibility	–					
2	Severity	55.64***	–				
3	Benefits	22.07***	40.32***	–			
4	Barriers	0.15	0.82	1.06	–		
5	Costs	0.86	2.05	1.34	0.60	–	
6	Cues to action	0.54	0.50	1.01	6.43*	2.41	–
7	Self-efficacy information	10.46**	10.28**	6.17*	12.50***	17.90***	3.34

Note: Asymptotic significant level (2-sided) at *** $p < .001$, ** $p < .01$, and * $p < .05$.

was a significant relationship between framing strategy and information coverage in the articles. In regard to epidemiological information, HPV relationship to cervical cancer ($\chi^2(1) = 27.93$, $p < .001$), other cancers ($\chi^2(1) = 9.57$, $p = .002$), genital warts ($\chi^2(1) = 20.23$, $p < .001$), and sexual transmission ($\chi^2(1) = 9.23$, $p = .002$) were more likely to be reported in thematic framing articles rather than episodic framing articles. For HBM constructs, thematic framing articles had a greater likelihood to include susceptibility ($\chi^2(1) = 23.18$, $p < .001$), severity ($\chi^2(1) = 22.64$, $p < .001$), and benefits ($\chi^2(1) = 23.50$, $p < .001$), than episodic framing articles. However, articles with episodic framing were more likely to involve costs ($\chi^2(1) = 10.92$, $p = .001$) and self-efficacy information ($\chi^2(1) = 27.19$, $p < .001$) compared to those with thematic framing.

RQ6 and 7: article responses and associated factors

Lastly, two separate hierarchical regression analyses were performed to investigate the effects of epidemiological information, HBM constructs, and framing strategy on the responses of Zhihu articles. Most of the variables were found to have non-significant impacts on number of votes and number of comments. Only the effect of barriers was “approaching” significant, on number of votes ($\beta = 0.19$, $p = .066$) and number of comments ($\beta = 0.18$, $p = .060$). Surprisingly, a weak but significant negative effect of benefits was found on number of comments, with $\beta = -0.29$, $p = .012$). Small R^2 was observed in the two regression models, with .114 for number of votes and .275 for number of comments. In other words, the included variables only explained 11.4% of the variance of number of votes, and 27.5% of the variance of number of comments.

Discussion

This study provides the first analysis of user-generated articles about HPV infection and vaccine on Chinese social media. Particularly, the data were collected from Zhihu, a popular social media platform for knowledge contribution and sharing. It allows a more comprehensive and in-depth understanding of HPV-related information coverage in Chinese online context. Overall, the majority of Zhihu articles tend to label HPV as a trigger for “cervical cancer disease” to the public, while only a small portion of them mention its link to other non-cervical conditions or sexually transmitted

infection. This finding resonates with earlier research on the coverage of HPV information on online news sites and social media in other countries.^{13,21} The incomplete coverage of HPV-related information on social media not only leads to a misunderstanding of HPV, but also causes a problematic perception of HPV vaccine among the readers. For instance, people are more likely to emphasize the vaccine's effect on cervical cancer, but ignore its value in treating other cancers and illnesses. Meanwhile, since HPV is less mentioned as a sexual-transmitted disease, the public would have a low awareness of HPV vaccine as an STD prevention tool.

Furthermore, the study used a theoretical coding scheme grounded under HBM to investigate the HPV information coverage among Zhihu articles. Consistent with traditional Chinese newspapers,¹⁹ most of Zhihu articles covered the key information to promote HPV vaccine including the severity and susceptibility of HPV infection as well as the benefits of HPV vaccine uptake. In other words, Zhihu articles tend to portray HPV infection as a common health issue in the public through emphasizing the high probability of contracting HPV disease and the seriousness of this disease, followed by presenting the benefits of HPV vaccine. It also reveals the fact that both online and offline Chinese media hold positive opinions on HPV vaccine, and this will lead to an increase in the public's awareness of HPV and intention to uptake HPV vaccine. Additionally, a certain amount of Zhihu articles illustrated the detailed process of HPV vaccination, such as susceptibility of contacting HPV, self-efficacy, and cues to action, which might help to foster actual behaviors from intentions. However, the barrier and financial costs information was often missing in many articles. The incomplete picture of HPV vaccination in these Zhihu articles may also lead to some critical problems. For instance, Madden et al.'s study,⁴⁰ pointed out a concern that teenagers may generate a false sense of security if they neglect the limitations of HPV vaccine, and possibly have even more risky sexual behaviors after they get vaccinated.

Consistent with the findings from traditional Chinese media,^{19,32} the dominant use of thematic framing strategy was also observed in the Zhihu articles. This may be influenced by China's collectivistic culture, in which people tend to emphasize big pictures over specifics, and value group well-being over individual needs.³² The thematic framing strategy is beneficial for fostering the understanding of broader health facets of HPV, such as including more epidemiological information and vaccine benefits. However, the lack of personal stories makes it difficult for readers to see themselves as potentially affected by the disease and develop the motivation to get vaccinated.¹⁹ In addition, thematic framing emphasized less on the costs and steps to get vaccine, resulting in a lower behavior change for HPV vaccination.

The responses of Zhihu articles were affected by neither information coverage nor framing strategy. The findings here suggest that in general what and how HPV information was presented in a Zhihu article did not have a significant impact on the number of votes and comments for this article. Nevertheless, it is interesting to find that barriers for HPV vaccine were an "approaching" significant factor positively related to number of votes and comments for the Zhihu articles

whereas reporting benefits of HPV vaccine can lead to fewer users' responses. This finding suggests that users might be very familiar with the benefits of HPV vaccination uptake due to its massive coverage on social media, and thus they show indifference to this type of articles. Instead, they are more likely to care about what factors will impede the uptake of HPV vaccine and respond to the articles highlighting these negative aspects. In addition, while the majority of factors were not related to the users' responses to the articles, there might be other more important factors to excite the responses to the articles on Chinese social media. A study from Ji et al.,⁴¹ found that the presence of a responsibility frame is related to more likes and reposts of environmental issues on Weibo (another Chinese social media). A YouTube study¹² revealed that videos with negative tone have a higher mean number of likes than videos with positive or ambiguous tones. Future studies need to examine the effects of these potential factors on users' reactions to HPV articles on Chinese social media.

The study has a few limitations. Firstly, the sample of articles was limited to one popular Chinese social media – Zhihu. Information about HPV infection and vaccine is also actively disseminated and discussed in other Chinese social media channels such as Weibo⁹ and Wechat.⁴² It would be helpful for future studies to examine whether similar findings can be applied to these channels. Secondly, this study only focused on the textual data within the articles. It is possible that other elements in the articles, such as pictures, videos, and even external links, also offer HPV disease and vaccination information. Including all the various data formats within the articles/posts is an important step for future content analysis of social media. Thirdly, while our findings suggested how HPV-related information was covered and framed, we cannot provide an understanding of how such information is perceived and utilized in decision-making. More production- and process-oriented research (e.g., experiment or survey of social media users) needs to be conducted to directly assess the impact of information coverage and framing strategy on people's perception and behavior change toward HPV. Lastly, the study only applied HBM as the theoretical framework to examine the coverage of HPV-related information on Chinese social media, which might limit the comprehensiveness of the findings. Although HBM is among the most widely utilized theories in health communication, it does not account for individuals' attitudes or beliefs that might influence the acceptance of HPV vaccine, nor does it account for external factors such as environmental or economic factors that may prohibit or promote the recommendation of HPV vaccination uptake.⁴³ Future studies with other relevant theories would offer extended knowledge about the dissemination of HPV-related information on Chinese social media.

Despite the limitations, this study has highlighted several theoretical and practical implications. From a theoretical perspective, the results have extended the literature of HPV information coverage on Chinese social media, through the application of HBM theory. In particular, the finding indicates that although these user-generated articles attempt to highlight the seriousness of HPV disease and encourage the public to take HPV vaccine, some important information (i.e., financial costs

and barriers) is often missing, which might impede users' actual behavior of vaccine uptake. Hence, examining the presence of HPV-related information in Zhihu under the guidance of HBM theory can provide us with a closer examination of how the contributing users on Zhihu portray HPV disease and its vaccination. Additionally, the examination of particular relationship between HPV information coverage and framing strategy is able to inspire future research on HPV-related information-seeking behavior. For example, users who need to acquire knowledge about HPV may need articles with thematic framing whereas users who have intention to uptake HPV vaccine are more likely to read others' personal stories about the detailed process of HPV vaccine uptake.

From a practical perspective, the incomplete HPV-related information found on Zhihu articles implies the current problems and challenges of using user-generated contents from the general public to facilitate health education. Health professionals and government agencies in China should take more responsibility to communicate comprehensive and detailed HPV disease and vaccine knowledge through both online and offline media. Furthermore, since articles with thematic framing predominate on the Zhihu platform, more episodic-oriented framing should be encouraged in the process of promoting HPV vaccination on Chinese social media, such as including vivid storytelling of how and why influential individuals get vaccinated. The effects of framing strategy can influence individuals' subsequent decisions to uptake HPV vaccine. Overall, more efforts are needed to deliver effective education on HPV infection and vaccine on Chinese social media, in order to foster high vaccination rates among Chinese people.

Note

1. <https://www.zhihu.com/>.

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References

1. World Health Organisation. (2018). Human papillomavirus (HPV) and cervical cancer. [accessed 2019 Jan 25]. [https://www.who.int/news-room/fact-sheets/detail/human-papillomavirus-\(hpv\)-and-cervical-cancer](https://www.who.int/news-room/fact-sheets/detail/human-papillomavirus-(hpv)-and-cervical-cancer)
2. Bansal A, Singh MP, Rai B. Human papillomavirus-associated cancers: A growing global problem. *Int J Appl Basic Med Res.* 2016;6(2):84–89. doi:10.4103/2229-516X.179027.
3. World Health Organization. Human papillomavirus vaccines: WHO position paper, May 2017—recommendations. *Vaccine.* 2017;35(43):5753–55. doi:10.1016/j.vaccine.2017.05.069.
4. Ma X, Wang Q, Ong JJ, Fairley CK, Su S, Peng P, ... Zhang L. Prevalence of human papillomavirus by geographical regions, sexual orientation and HIV status in China: a systematic review and meta-analysis. *Sex Transm Infect.* 2018;94(6):434. doi:10.1136/sextrans-2017-053412.
5. Chen L, Song Y, Ruan G, Zhang Q, Lin F, Zhang J, Wu T, An J, Dong B, Sun P. Knowledge and attitudes regarding HPV and vaccination among Chinese women aged 20 to 35 years in Fujian Province: a cross-sectional study. *Cancer Control.* 2018;25(1):1073274818775356–1073274818775356. doi:10.1177/1073274818775356.
6. Hu S-Y, Hong Y, Zhao F-H, Lewkowicz AK, Chen F, Zhang W-H, ... Qiao Y-L. Prevalence of HPV infection and cervical intraepithelial neoplasia and attitudes towards HPV vaccination among Chinese women aged 18–25 in Jiangsu Province. *Chin J Cancer Res.* 2011;23(1):25–32. doi:10.1007/s11670-011-0025-3.
7. Casciotti DM, Smith KC, Tsui A, Klassen AC. Discussions of adolescent sexuality in news media coverage of the HPV vaccine. *J Adolesc.* 2014;37(2):133–43. doi:10.1016/j.adolescence.2013.11.004.
8. Gollust SE, LoRusso SM, Nagler RH, Fowler EF. Understanding the role of the news media in HPV vaccine uptake in the United States: synthesis and commentary. *Hum Vaccin Immunother.* 2015;12(6):1430–34. doi:10.1080/21645515.2015.1109169.
9. Zhang C, Gotsis M, Jordan-Marsh M. Social media microblogs as an HPV vaccination forum. *Hum Vaccin Immunother.* 2013;9(11):2483–89. doi:10.4161/hv.25599.
10. Du J, Cunningham RM, Xiang Y, Li F, Jia Y, Boom JA, ... Tao C. Leveraging deep learning to understand health beliefs about the human papillomavirus vaccine from social media. *NPJ Digit Med.* 2019;2(1):27. doi:10.1038/s41746-019-0102-4.
11. Massey PM, Leader A, Yom-Tov E, Budenz A, Fisher K, Klassen AC. Applying multiple data collection tools to quantify human papillomavirus vaccine communication on twitter. *J Med Internet Res.* 2016;18(12):e318. doi:10.2196/jmir.6670.
12. Briones R, Nan X, Madden K, Waks L. When vaccines go viral: an analysis of HPV vaccine coverage on Youtube. *Health Commun.* 2012;27(5):478–85. doi:10.1080/10410236.2011.610258.
13. Basch CH, MacLean SA. A content analysis of HPV related posts on instagram. *Hum Vaccin Immunother.* 2019;15(7–8):1476–78.
14. Li Y, Wang X, Lin X, Hajli M. Seeking and sharing health information on social media: A net valence model and cross-cultural comparison. *Technol Forecast Soc Change.* 2018b;126:28–40. doi:10.1016/j.techfore.2016.07.021.
15. Song H, Omori K, Kim J, Tenzek KE, Morey Hawkins J, Lin W-Y, Kim YC, Jung J-Y. Trusting social media as a source of health information: online surveys comparing the United States, Korea, and Hong Kong. *J Med Internet Res.* 2016;18(3):e25–e25. doi:10.2196/jmir.4193.
16. Smith C (2019). Interesting Zhihu statistics and facts (2019). [accessed 2019 Jan 28]. <https://expandedramblings.com/index.php/zhihu-statistics-and-facts/>
17. Graziani T (2018). Zhihu: China's largest Q&A platform is a content marketer's dream. [accessed 2019 Jan 28]. <https://walkthechat.com/zhihu-chinas-largest-qa-platform-content-marketers-dream/>
18. Kelly BJ, Niederdeppe J, Hornik RC. Validating measures of scanned information exposure in the context of cancer prevention and screening behaviors. *J Health Commun.* 2009;14(8):721–40. doi:10.1080/10810730903295559.
19. Li W, Nowak G, Jin Y, Cacciatore M. Inadequate and incomplete: Chinese newspapers' coverage of the first licensed human papillomavirus (HPV) vaccine in China. *J Health Commun.* 2018a;23(6):581–90. doi:10.1080/10810730.2018.1493060.
20. Attipoe-Dorcoo S, Singh V, Moodley J. A content analysis of online news media reporting on the human papillomavirus vaccination programme in South Africa. *South Afr J Gynaecological Oncol.* 2018;10(2):19–24. doi:10.1080/20742835.2018.1509928.
21. Habel MA, Liddon N, Stryker JE. The HPV vaccine: a content analysis of online news stories. *J Women's Health.* 2009;18(3):401–07. doi:10.1089/jwh.2008.0920.
22. Rosenstock IM. Historical origins of the health belief model. *Health Educ Monogr.* 1974;2(4):328–35. doi:10.1177/109019817400200403.
23. Janz NK, Becker MH. The health belief model: a decade later. *Health Educ Q.* 1984;11(1):1–47. doi:10.1177/109019818401100101.
24. Siddiqui TR, Ghazal S, Bibi S, Ahmed W, Sajjad SF. Use of the health belief model for the assessment of public knowledge and household preventive practices in Karachi, Pakistan, a Dengue-Endemic City. *PLoS Negl Trop Dis.* 2016;10(11):e0005129. doi:10.1371/journal.pntd.0005129.

25. Chen J, Leung D. Factors associated with human papillomavirus vaccination among Chinese female university students in Hong Kong. *Am Int J Social Sci.* 2014;3:56–62.
26. Wang D (2015). HPV vaccination: knowledge, attitudes and beliefs in the Chinese population. [Doctor of Philosophy]. University of Edinburgh. doi:10.1094/PDIS-09-14-0954-PDN
27. Entman RM. Framing: toward clarification of a fractured paradigm. *J Commun.* 1993;43(4):51–58. doi:10.1111/j.1460-2466.1993.tb01304.x.
28. Goffman E. *Frame analysis: an essay on the organization of experience.* Vol. 6, Cambridge MA (US): Harvard University Press; 1974.
29. Iyengar S. Is anyone responsible?: how television frames political issues. Chicago (IL): University of Chicago Press; 1991.
30. Zhang Y, Jin Y. Thematic and episodic framing of depression: how Chinese and American newspapers framed a major public health threat. *Athens J Mass Media Commun.* 2017;3(2):91–106. doi:10.30958/ajmmc.
31. Kim S-H, Carvalho JP, Davis AC. Talking about poverty: news framing of who is responsible for causing and fixing the problem. *Journal Mass Commun Q.* 2010;87(3–4):563–81. doi:10.1177/107769901008700308.
32. Zhang Y, Jin Y, Tang Y. Framing depression: cultural and organizational influences on coverage of a public health threat and attribution of responsibilities in Chinese news media, 2000–2012. *Journal Mass Commun Q.* 2014;92(1):99–120. doi:10.1177/1077699014558553.
33. Kim S-H, Anne Willis L. Talking about obesity: news framing of who is responsible for causing and fixing the problem. *J Health Commun.* 2007;12(4):359–76. doi:10.1080/10810730701326051.
34. Lawrence RG. Framing obesity: the evolution of news discourse on a public health issue. *Harvard Int J Press Polit.* 2004;9(3):56–75. doi:10.1177/1081180X04266581.
35. Ache KA, Wallace LS. Human papillomavirus vaccination coverage on YouTube. *Am J Prev Med.* 2008;35(4):389–92. doi:10.1016/j.amepre.2008.06.029.
36. Cheng T, Woon DK, Lynes JK. The use of message framing in the promotion of environmentally sustainable behaviors. *Soc Mar Q.* 2011;17(2):48–62. doi:10.1080/15245004.2011.570859.
37. Tsai S-P. Message framing strategy for brand communication. *J Advert Res.* 2007;47(3):364–77. doi:10.2501/S0021849907070377.
38. Yin Y. HPV vaccination in China needs to be more cost-effective. *Lancet.* 2017;390(10104):1735–36. doi:10.1016/S0140-6736(17)32606-5.
39. Krippendorff K. *Content analysis: an introduction to its methodology.* 2nd ed. Thousand Oaks (CA): Sage; 2004.
40. Madden K, Nan X, Briones R, Waks L. Sorting through search results: A content analysis of HPV vaccine information online. *Vaccine.* 2012;30(25):3741–46. doi:10.1016/j.vaccine.2011.10.025.
41. Ji Q, Harlow S, Cui D, Wang Z. Discussing environmental issues in chinese social media: an analysis of greenpeace China's Weibo posts and audience responses. *J Social Media Soc.* 2018;7:37–60.
42. Ma X (2019, May 4–9). Community-Sourced Itinerary for HPV Vaccine: A Case Study of the Use of WeChat Group to Reconstruct Healthcare Solution. Paper presented at the CHI 2019, Glasgow, Scotland UK.
43. Gillam SJ. Understanding the uptake of cervical cancer screening: the contribution of the health belief model. *Br J Gen Pract.* 1991;41:510–13.