Feminized Virus: A Content Analysis of Social Media’s Representation of HPV Vaccine

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Abstract

Attempting to explore social media’s role in human papillomavirus (HPV) vaccination campaign, the present study concentrated on Weibo, the most popular microblogging service in China, and examined HPV vaccine-related information in 1,221 posts shared within 1½ years, during the time of which two key HPV vaccines were officially launched in the market in mainland China. Results of quantitative content analysis suggested an inadequate and unbalanced framework for the representation of HPV vaccination. More specifically, a majority of information came from non-expert sources; following the extended parallel process model (EPPM), the present study found that comparing with susceptibility and severity of HPV infection, HPV vaccine efficacy tends to be more emphasized with a recommending tone; in the meantime, from a gender perspective, messages on Weibo demonstrated the tendency of gender imbalance, that is, women’s responsibility for preventing sexually transmitted diseases is much more highlighted than men’s, raising concerns over gender inequality in responding to HPV infection.

Keywords

HPV vaccine, social media, information source, the extended parallel process model, gender inequality, content analysis

Human papillomavirus (HPV) is the most common viral infection that is principally transmitted through sexual contacts (Brianti et al., 2017; Dunne et al., 2007; World Health Organization [WHO], 2020). In the United States, HPV infections are very common in both men and women that about 14 million Americans, including teens, become infected each year (Centers for Disease Control and Prevention, 2020). Meanwhile in China, HPV infection rate remains a high level too. Data showed that there are approximately 579.4 million Chinese women age 15 and older who have been infected with HPV and, therefore, are at risk of cervical cancer; every year 109,741 women are diagnosed with cervical cancer, and nearly 53.8% of them die from the disease, making cervical cancer rank the third most frequent cancer among women between 15 and 44 years old (HPV Information Center, 2021). According to the WHO (2020), more than 85% of the death from cervical cancer every year occurred in low- and middle-income countries, and China’s data reflect the tendency of cervical cancer to happen more likely in women from developing countries. Nevertheless, public awareness of HPV prevention is fairly low, suggesting an urgent need for interventions targeting women in the developing world (WHO, 2020).

HPV vaccination is proved to be effective in preventing HPV infection. In 2006, the first-generation HPV vaccine Gardasil to protect against HPV types 6, 11, 16, and 18 was approved for medical use by the Food and Drug Administration (FDA) of the United States. In 2009, the FDA approved Cervarix, a vaccine specifically designed to prevent infection from HPV types 16 and 18, which are known as the most dangerous types. As of October 2019, there are 100 out of 195 countries worldwide having implemented national HPV vaccination programs (Bonanni et al., 2020; WHO, 2019). However, in China Cervarix marked by Glax Smith Kline had not been officially launched in the market until 31 July 2017 due to the delay of drug approval by the China Food and Drug Administration (CFDA) and Gardasil-9 won conditional marketing approval on 28 April 2018. Prior to the introduction of HPV vaccine in 2017, only ThinPrep Cytology Test (TCT) was available in mainland China, specifically for preventing cervical cancer.

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With regard to media coverage of HPV vaccine, mainly because of the pervasive media censorship, media in mainland China, mainstream media in particular, tend to synchronize their agenda with the government’s policies and standpoints (Hassid, 2020; Huang & Luk, 2020), accordingly the delay of the vaccine approval process made coverage of HPV vaccination insufficient in such restrictive media environment for a long while (Li et al., 2018). Li et al. (2018) investigated Chinese newspapers’ coverage of HPV vaccine from 2000 to 2016 and found that even authoritative media failed to deliver adequate and complete information about HPV and HPV vaccine to the public. Consequently, the relatively less controlled social media where a mixed landscape of mass and interpersonal communications is embedded became the essential alternative sources for HPV-related information. However, it seems that information circulated on social media is worrisome in terms of credibility, which may amplify perceived risk of HPV infection and public concern over the safety and supply of vaccines licensed for use in mainland China. In recent years, many young women living in mainland China had headed across the border to get vaccinated in Hong Kong, Macao, New Zealand, and South Korea (Z. Liu, 2019).

Moreover, from a gender perspective, the promotion of HPV vaccine could legitimize gender inequality in health communication. As suggested by research conducted in the Western contexts such as in the United Kingdom and the United States, HPV infection has been over-identified as a female-specific disease and HPV vaccine is widely recommended to females rather than both genders (e.g., Boakye et al., 2017; Daley et al., 2017; Habel et al., 2009; Hilton et al., 2010). Media campaigns for HPV vaccination is especially criticized for its feminization of HPV infection and attempt to assign the responsibility of preventing sexually transmitted infections (STIs) to women.

Given the above, the purpose of the present study is twofold. First, to our knowledge, there are very few studies on how HPV-related information is portrayed on Chinese social media. To bridge the gap, we performed quantitative content analysis of messages that are shared on Weibo, a representative social media platform in China, aiming to provide an objective overview of social media information relating to HPV and HPV vaccine that Chinese people are exposed to. Second, to shed light on gender inequality in HPV vaccination campaign, the current investigation also scrutinized how gender is represented in HPV vaccine marketing on social media in the Chinese context.

**Literature Review**

*Media Representation of HPV Vaccine*

Media, as a main force in the social construction of reality and the most available channel nowadays for social learning (Bandura, 2001; LaRose & Eastin, 2004; Lin & Chang, 2018), play an important role in influencing the audience’s knowledge, awareness, and perceptions toward particular health risks. From a journalistic perspective, news media are supposed to provide the public with information that is accurate and unbiased. However, the norms of objectivity and balance usually run into difficulty in practice that the desire to produce newsworthy stories for the sake of viewership and readership tends to outweigh the profession of journalism (Kormelink & Meijer, 2015; Yopp et al., 2014). Regardless of the dilemma, health-related issues are essentially complex in nature, involving scientific uncertainty, risk-benefit trade-off, regulatory factors, and so forth. Especially when the health threat is personally relevant, the media would be expected to gather and share information in a compelling way to facilitate individuals’ judgment and decision-making. Meanwhile, due to the economic and political reasons, the media not only set agendas to affect public perception of the importance of an issue but also select certain aspects of the issue and make them more salient in a communicating text (e.g., Entman, 1993; Matthes, 2009; Scheufele & Tewksbury, 2007). Known as the framing effect that has been extensively documented in the literature, media representation can shape audience interpretations of issues and events by using different frames, that is, inviting the audience to view the case in a particular way. In doing so, the media help people make sense of what is going on in the outside world, but the messages are neither innocent nor neutral in their representations of the reality.

In the context of HPV vaccination, the potential impacts of media representation on the public’s perceptions and actions toward HPV vaccine has been discussed in diverse social, cultural, and media contexts. For instance, a meta-analysis reviewed 13 published studies of news media coverage of the HPV vaccine in the United States since FDA licensure in 2006. Findings discovered two important themes in news coverage, which are “a rising focus on political controversy” and “a consistent emphasis on the vaccine as for girls,” suggesting an association between media coverage and the sluggish vaccination rates among adolescents (Gollust et al., 2016). Based on immunization data from 243,415 girls, retrospective analysis of 8,524 news items and Google search activity, a longitudinal study between 2009 and 2016 conducted in Denmark found a significant negative correlation between media coverage and vaccination uptake. More specifically, the findings demonstrated that the decline in vaccination uptake coincides with both an increase in Google searches for “HPV side effects” and the increasingly critical media coverage (Suppli et al., 2018). Bodemer et al. (2012) performed a systematic analysis of websites and newspaper articles relating to HPV vaccine in Germany and Spain to investigate if the media provide complete, transparent, and accurate information about cervical cancer as well as the effectiveness and costs of the vaccine. However, their findings indicated that both media types in both countries failed to provide correct and transparent information about the effectiveness of the vaccine, which may limit public understanding of HPV risk reduction.
Analysis of Chinese media’s representation of HPV and HPV vaccine has emerged in recent years. For instance, Xiao and Su (2020) examined 224 online news articles published 12 months before and after the approval of the HPV vaccine in China, and they found that in contrast to information about vaccine efficacy, costs and the populations recommended for vaccination increased after the approval, the mentioning of safety concerns decreased significantly. In the meantime, gender bias that frames HPV as a female problem remained consistent over time. Li and Zheng (2020) focused on HPV-related information on Zhuhu, a popular social media platform for questions and answers. They analyzed 115 articles published in 2017 and 2018 and found a few dominant themes, including the association between HPV and cervical cancer, HPV severity, and benefits of vaccination, suggesting the need for comprehensive and detailed knowledge about HPV vaccination to be communicated to the public. As mentioned earlier, traditional media representation of the HPV vaccine is quite little due to the delayed introduction of HPV vaccines in China, which consequently makes online media an essential channel for Chinese people to seek for relevant information. In fact, existing evidence has suggested the potential impacts of social media on HPV vaccine uptake as well as awareness, knowledge and attitudes about HPV and HPV vaccination (see Ortiz et al., 2019, for a systematic literature review). In the Chinese context, there is study using online experiment to find an association between exposure to conspiracy social media messages and less favorable attitudes toward the HPV vaccine among young adult users (L. Chen et al., 2021). To our knowledge, research on how HPV and HPV vaccine are represented in social media in China is still rare. To fill the gap, this study centers on one of the most representative social media platforms in China to shed light on social media representation of HPV vaccine after the approval of CFDA. The following research question is proposed accordingly:

RQ1. How do Weibo messages portray the epidemiological information of the HPV vaccine?

The Extended Parallel Process Model

The extended parallel process model (EPPM) is widely applied to public health campaigns, which proposes that an individual’s perceived threat and efficacy beliefs are determinants of behavioral decisions (Witte, 1992, 1994). According to this theoretical model, persuasion effect is more likely to happen with a person who perceives both severe health threats and high abilities of his or her own to cope with the risks. The EPPM then proposes four critical elements, including susceptibility, severity, self-efficacy, and response efficacy, that are supposed to influence the effectiveness of fear appeal (a strategy using fear as motivator in persuasive messages) in health communication messages (Witte, 1992, 1994). Perceived threat is constructed by two dimensions, one is perceived susceptibility, referring to an individual’s perception of the likelihood of the health threat; the other one is perceived severity, referring to how an individual perceives the seriousness of the potential consequences caused by the threat. With regard to efficacy beliefs, one dimension is self-efficacy, which is an individual’s confidence in his or her own abilities to control the risk; the other dimension is response efficacy, which is an individual’s belief in the effectiveness of the recommended actions to avoid the threat.

In health communication research, the EPPM is extensively adopted to assess the persuasiveness of communication messages relating to a wide variety of public health issues. For instance, Turner et al. (2013) applied the model to evaluate news coverage of the 2006 diethylene glycol poisoning crisis in Panama. Their content analysis uncovered that the threat of the poisoning was overly emphasized comparing with the efficacy of avoiding being poisoned, especially in newspaper coverage only threat tended to be underlined. Bekalu and Eggermont (2015) used the EPPM to identify health-related constructs in the lyrics of 23 AIDS songs that are widely used to aid prevention efforts in Ethiopia. Content analysis found significantly more efficacy messages than threat messages, which may lead to unsatisfactory persuasion efforts among audiences who perceive lower or no threat of HIV/AIDS.

The predictive power of the EPPM has been well documented in the literature. For instance, in a study on intention of Zika vaccine uptake, Guidry et al. (2019) conducted an online survey that addressed key variables of the EPPM to contribute to message design in Zika vaccine promotion campaign. Data collected from 339 American women suggested a significant direct effect of perceived susceptibility, self-efficacy, and response efficacy on Zika vaccine uptake intention; in the meantime, an indirect effect of perceived severity on intention was also found by path analysis. Ivanova and Kvalem (2021) conducted a survey among 270 women living in Norway to examine the predictive power of the EPPM constructs on defensive avoidance of breast cancer screening and intention to attend mammography within the next 2 years. The results indicated that defensive avoidance was negatively associated with perceived susceptibility to breast cancer and response efficacy of mammography screening; however, it was positively associated with fear toward breast cancer. With regard to the prediction of intention to attend screening within the next 2 years, response efficacy of mammography screening was found to be a positive predictor. M. Chen and L. Chen (2021) developed a factorial experiment by using an expanded EPPM to explore effective campaign strategies for promoting smoking cessation among Chinese smokers. Their results showed significantly positive effects of self-oriented threat, other-oriented threat, and efficacy on cessation intentions. The findings also suggested that messages with the combination of other-oriented threat and efficacy led to the greatest willingness to quit smoking.
As aforementioned, there is still a very limited number of studies on how HPV-related issues are represented by communication messages in the Chinese context. The present study adopted the EPPM given its powerful applicability in diverse contexts of public health issue, attempting to shed light on the impacts of social media representation on public reactions to HPV vaccination. Accordingly, the following research question is proposed on an exploratory basis:

RQ2. How do Weibo messages portray the HPV vaccine in terms of the four EPPM elements (i.e., perceived susceptibility, perceived severity, self-efficacy, and response efficacy)?

Gender in Media Representation of Sexually Transmitted Diseases

Gender identity is constructed through social learning, and a series of external social forces, including family, education, behavioral norms, and so on, would affect the process (Bussey & Bandura, 1999). Applying the constructionist perspective to the context of sexually transmitted diseases (STDs), study of Campbell (1995) on the prevention of AIDS among heterosexuals in the United States argued that the focus of AIDS prevention on women is misguided, which neglects the power differentials between men and women, making women responsible for safer sex practices. As a major external social force, the media are critical agents of socialization that convey cultures and communicate ideologies to form gender identity (e.g., Collins, 2011; Gutierrez et al., 2020; O’Shaughnessy et al., 2016). Hust et al. (2008) analyzed sexual contents in television, magazines, music, and movies in the United States that are popular among adolescents and found rare sexual health information. Moreover, their qualitative analysis revealed that across all four media gender stereotypes tended to be reinforced, for instance, men seek sex and women are supposed to take responsibility for preventing pregnancy and STIs. Media discourse has also been found to be able to strengthen gender inequality in sexual health in intimate relationships. For instance, Martin et al. (2014) conducted a qualitative analysis of 85 negatively toned newspaper articles on sexual health topics published in the UK press in 2010 to detect how sexual health risks and responsibilities are framed. Results showed that the articles portrayed men as a source of sexual health risk but suggested procedures and safety measures to women to control the risk, which could teach the “norms” regarding sexual situations to young people. As suggested by the cultivation theory (Gerber et al., 2002), biased representation by the media will mislead young people’s perceptions and judgments of appropriate and inappropriate behaviors between sexes in their gender socialization.

With regard to gender in media representation of the HPV vaccine, in Canada, for instance, even after the recommendation of HPV vaccination in males by the government, only 49% of newspaper articles mentioned male eligibility, whereas 93% of the articles mentioned that girls are eligible for the vaccine and 85% of the articles associated HPV with cervical cancer (Perez et al., 2016). The presence of gender inequality in media messages does not seem to benefit males either. Focus-group interviews by Stanley et al. (2018) found that male college students in the United States who identified themselves as heterosexual agreed that both partners of an intimate relationship should take sexual health responsibility equally; however, they tended to use heteronormative gender discourses to justify the inequality. For instance, they believed that men are “biologically wired to think more about sex than women are,” thought “males can just be more reckless with their sexual actions,” and considered college women to be “more mature at this point in their lives.” This may consequently cause young men to overlook their vulnerability to negative sexual outcomes. A scope review by Laserson et al. (2020) indicated that male HPV vaccine adherence in the United States and Canada is still low among young males ages 18–26 years old. A meta-analysis of 39 studies on knowledge of HPV and HPV vaccine, the intention to vaccinate, and HPV vaccination uptake among male college students also suggested that it is necessary to further increase the knowledge about HPV and HPV vaccine uptake among college men in the United States (Kasyanova, 2022).

Meanwhile in China, limited knowledge about the HPV vaccine and low vaccination rate were found by empirical studies among young people (e.g., Y. Liu et al., 2020; You et al., 2020). Another cause for concern is the gendering of HPV and the HPV vaccine. In fact, there is no screening test for HPV in men in China. Only having testing for women puts major pressure on them and contributes to justification of women’s responsibility for preventing HPV. Moreover, HPV vaccination campaigns are primarily targeting women, and the HPV vaccine is widely known as gongjingai (cervical cancer) yimiao (vaccine). To contribute to a systematic overview of gender inequality in HPV vaccine messages in Chinese social media, the third research question is proposed as follows:

RQ3. How is gender represented in Weibo messages relating to HPV vaccine?

Method

Sampling

Quantitative content analysis was conducted to address the research questions. We searched for posts containing the keywords “HPV” and “HPV vaccine” on the open Chinese social media Weibo, which has many features that resemble those of Twitter. Emerged in August 2009, Weibo is the most popular microblogging website in China with around 573 million monthly active users as of the fourth quarter of 2021, about 95% of which use the app version on mobile devices.
Cohen’s kappa calculated for each coding term. The resulting coefficients selected posts (9.83% of the sample), and Cohen’s kappa was acceptable (Cohen’s kappa = .07) degree of agreement between two coders (Baxter et al., 2015).

To be specific about the coding scheme, the following themes and subthemes were coded in our content analysis: (a) information source (i.e., official media, medical institution, Internet-based media, public institution, professional, non-professional); (b) tone (i.e., positive, neutral, negative); (c) the presence of epidemiological information (i.e., prevention of cancer, prevention of STIs, recommended gender, recommended age, risk of vaccine, side effects, follow-up test after vaccination); (d) the presence of EPPM terms (i.e., susceptibility, severity, self-efficacy, response efficacy); (e) the presence of gendered information (i.e., gender for HPV vaccination, gender for HPV infection, cancer, STDs, susceptibility, severity, self-efficacy, response efficacy, expression of HPV vaccine in Chinese). Definition, example, and interrater reliability (Cohen’s kappa) for each term are shown in Appendix.

Results

Sources and Tone of HPV Vaccine Information

Sources. Numbers of posts relating to HPV vaccine published by different sources were significantly different (χ² = 476.158, p < .001). More specifically, more than half of the posts were published by the media (official media: n = 319, 26.1%; Internet-based media: n = 383, 31.4%). Public institutions and non-professionals published nearly 30% of the posts (public institution: n = 172, 14.1%; non-professional: n = 182, 14.9%). However, posts by medical institutions and medical professionals only accounted for 13.2% of the total number of posts (medical institution: n = 22, 1.8%; professional: n = 139, 11.4%).

Tone. There was significant difference in tone of the posts relating to HPV vaccine (χ² = 23.278, p < .001). Over half of the posts (n = 646, 52.9%) showed positive attitudes toward HPV vaccine and its effects in preventing diseases. Posts with neutral tone (n = 465) occupied 38.1% of all the posts. Proportion of posts showing negative attitudes was lower than two percentage (n = 20, 1.6%). Furthermore, our results revealed that official media tended to post more positive messages, whereas Internet-based media and medical institutions were more likely to publish information with a neutral tone.

Epidemiological Information

Among the seven types of epidemiological information, “prevention of cancer” (n = 917, 75.1%), “recommended gender” (n = 904, 74.0%), and “recommended age” (n = 810, 66.3%) were the most frequently mentioned subthemes. It is worth noting that among the posts that mentioned the effectiveness of HPV vaccines in preventing cancers (n = 917), cervical cancer was specifically highlighted (n = 851, 92.8%) comparing with other cancers such as oral cancer (n = 114, 12.4%) and genital cancer (n = 255, 27.8%). However, only about one third of our sample mentioned the effectiveness of HPV vaccines in preventing STIs (“prevention of STIs”: n = 377, 30.9%). Information about regular testing after HPV vaccination was not frequently shared on Weibo (“follow-up test after vaccination”: n = 427, 35.0%).

In the meantime, nearly half of the posts contained information about the long-term consequences and uncontrollability of HPV vaccines (“risk of vaccine”: n = 536, 43.9%), and less than a quarter of the posts mentioned the immediate reactions after the injection of the HPV vaccine (“side effects”: n = 276, 22.6%).
**Information Characteristics by EPPM Elements**

In terms of the four elements suggested by the EPPM that can determine persuasion effects of health communication messages, generally speaking, there were more Weibo posts conveying efficacy beliefs relating to HPV vaccination than posts conveying threat of HPV infection. More specifically, posts containing information about the benefits of and barriers to HPV vaccination (“response efficacy”: \( n = 857, 70.2\% \)) appeared most frequently on Weibo. Among these posts, 88.3% mentioned the effectiveness of HPV vaccines in preventing STIs and cancers (“benefits”: \( n = 757 \)) and 63.4% mentioned the difficulties relating to HPV vaccine uptake (“barriers”: \( n = 543 \)). In the meantime, about half of our sample contained information about the measures and guidance for preventing HPV infection (“self-efficacy”: \( n = 653, 53.5\% \)), among which costs (\( n = 520, 79.6\% \)) and places (\( n = 490, 75.0\% \)) to get vaccinated were mentioned most frequently.

With regard to threat messages, 35.3% of our sample contained information about the high infectivity of HPV, routes of HPV infection and risk of having multiple sex partners (“susceptibility”: \( n = 431 \)), while 26.4% contained information about the consequences of HPV infection (“severity”: \( n = 322 \)).

**Gendered HPV Vaccine Information: An Overview**

Among posts conveying specific gender-oriented information relating to HPV vaccination (“gender for HPV vaccination”: \( n = 904, 74.0\% \)), almost all of them (\( n = 896, 99.1\% \)) suggested women to get HPV vaccine, whereas only one third of them (\( n = 300, 33.2\% \)) recommended both men and women to get vaccinated (\( \chi^2 = 199.245, p < .001 \)). Gender bias was also found in 169 posts that mentioned the risk of infertility due to HPV vaccination. Almost all these posts (\( n = 166, 98.2\% \)) reminded women who were preparing for pregnancy to delay their vaccine uptake; however, only three posts (1.8%) warned men who were preparing for fatherhood of the risk of HPV vaccine (\( \chi^2 = 157.213, p < .001 \)).

With regard to gender-oriented information about HPV infection (“gender for HPV infection”: \( n = 748, 61.3\% \)), significant gender difference was found in relevant posts (\( \chi^2 = 308.245, p < .001 \)). More specifically, a majority of these posts (\( n = 545, 72.9\% \)) only mentioned women as vulnerable population, about a quarter of the posts (\( n = 198, 26.5\% \)) mentioned that both men and women can be infected with HPV, and posts that merely described HPV infection among men were less than 1% (\( n = 5, 0.7\% \)).

For gender-oriented information about cancers caused by HPV (“cancer”: \( n = 871, 71.3\% \)), over 80% of the posts mentioned the role of HPV vaccine in preventing cancers that only affect women such as cervical cancer and vaginal cancer (\( n = 747, 85.8\% \)); however, only about 14% mentioned HPV-related cancers that affect both men and women (\( n = 121, 13.9\% \)). Meanwhile, although much fewer in number, posts containing information about STDs caused by HPV (“STDs”: \( n = 377, 30.9\% \)) demonstrated a gender balanced frame. That is, the number of posts connecting HPV infection to STDs among women (\( n = 110, 29.2\% \)) was almost the same as that of posts discussing the connections among men (\( n = 96, 25.5\% \)).

In terms of gendered information by EPPM elements, results showed significant gender difference in threat and efficacy messages on Weibo. For “susceptibility,” women were more likely to be seen as the population susceptible to HPV infection than men (\( \chi^2 = 308.245, p < .001 \)). The messages also tended to portray women as victims of HPV infection. For “severity,” cancers that only affect women were more likely to be mentioned as consequences of HPV infection than other cancers (\( \chi^2 = 558.000, p < .001 \)). Among “self-efficacy” information, more posts mentioned prevention measures that targeted women rather than men (\( \chi^2 = 221.705, p < .001 \)). Similarly, more “response efficacy” information targeted women rather than men to describe the benefits (\( \chi^2 = 154.195, p < .001 \)) and barriers (\( \chi^2 = 85.828, p < .001 \)) relating to HPV vaccine uptake. It seems that Chinese social media tended to convey to the public that women should take more responsibility in protecting sexual health.

Regarding the Chinese expression of HPV vaccine, nearly half of our sample (\( n = 602, 49.3\% \)) labeled HPV vaccine as *gongjingai* (cervical cancer) *yimiao* (vaccine).

**Discussion**

**Unbalanced Representation and the Absence of Professional Voice**

Our findings suggested an unbalanced representation of HPV vaccine on Weibo, a representative Chinese social media, which is consistent with the evidence given by analysis of how China’s mainstream newspapers covered HPV vaccine (Li et al., 2018). More specifically, HPV vaccination tended to be highly connected to the incidence of several major cancers, cervical cancer in particular; however, its effectiveness in preventing STIs was much less mentioned. The emphasis on cancer prevention in HPV vaccine promotion on social media might greatly draw public attention to the vaccine because the deadly consequences of HPV infection had been highlighted. However, such representation may simultaneously lead sexually active people to relax vigilance in terms of STIs prevention on a daily basis. It is worth noting that other types of epidemiological information, including information about the long-term risks of HPV vaccination, follow-up testing after getting vaccinated, and the side effects of HPV vaccine uptake, were relatively less shared as well. Also, from the perspective of the EPPM, on preventing HPV infection, there were more efficacy messages (self-efficacy and response efficacy) shared on Weibo than threat messages (susceptibility and severity). Taken together, it seems that
Chinese social media tried to convince the general public to simply take real action rather than provide them with an educational and individual-oriented framework for balancing risks and benefits of HPV vaccination.

Meanwhile, regarding the sources of information, messages posted by individual professionals and medical institutions were much fewer than messages from other sources. In fact, our analysis found 86.8% of the messages coming from organizations and individuals who were not known for professional knowledge and experience in the medical field. Considering the joint force of social media and marketization, the spreading of information provided by non-expert sources may raise concerns over the accuracy and credibility of information, especially when media messages, from both official media and Internet-based media, were skewed toward promoting HPV vaccines.

**Weakened Male Responsibility and Increased Risks**

The current investigation found Chinese social media’s tendency to reinforce gender norms and stereotypes in sexual health communication. That is, the male role in maintaining sexual health for both themselves and their sexual partners was greatly weakened in Weibo messages. This is reflected not only in posts conveying information about HPV prevalence and susceptibility to HPV infection but also in information about how HPV is associated with cancers and STIs among men. Moreover, nearly half of the messages that we analyzed roughly attached the label “gongjingai (cervical cancer) yimiao (vaccine)” to HPV vaccines, which might further reduce men’s awareness of sexual health risks and perceived responsibility for sexual health in intimate relationships. Meanwhile, only about one third of the messages that contained gender-oriented information relating to HPV vaccination recommended men to get vaccinated and quite a few of them gave detailed guidance or explained the role of HPV vaccination in protecting men’s health.

The lack of male presence in media representation may have men feel less connected to HPV vaccination campaigns, and consequently contribute to low perceived risk of HPV infection and low willingness to take up the HPV vaccine. In fact, sexually active men in China seem to be exposed to increasingly high risk of HPV infection and threatened by its consequences. For instance, according to the study of Lu et al. (2020), the number of new cases of and deaths from HPV-attributable penile cancer more than doubled between 2005 and 2015. In 2015, there were 9,706 male cancer cases and 5,170 male cancer deaths caused by HPV infection; comparing with females, for all HPV-attributable cancers that occurred in both sexes, males demonstrated higher age-standardized mortality rates (Lu et al., 2020). Social media is supposed to be a better channel than traditional media in terms of spreading health information and voicing out unbiased and diverse opinions. However, this advantage was not displayed in the context of HPV vaccination campaign in China. Instead, Chinese social media seem to resemble traditional media representation to maintain the reality of gender inequality that merely highlights women’s risks and responsibility for preventing HPV infection.

Furthermore, the biased framework neglects sexual health risks among men who have sex with men (MSM). The estimation of the burden and trends of HPV-attributable cancers in China indicated that, for anal cancers, new cases and deaths were more likely to occur in males, which differed from the findings in some European countries and the United States (Lu et al., 2020). Such a representing framework may contribute to muted health discourse among MSM, who are unlikely to benefit from vaccinated women and may even be unaware of the risk of HPV infection. It seems hard for them to seek for HPV-related prevention information.

**Strengthened Female Responsibility and Decreased Gender Equality**

In contrast to the weakened male responsibility, women’s responsibility for preventing HPV infection was extensively emphasized in social media representation. Our analysis of the EPPM elements in Weibo messages showed that women’s risk of HPV infection was highly amplified that a majority of the posts used fear appeal to frame women as the victim of HPV infection and to correlate it with female-specific diseases. Women were also identified as the target population for HPV vaccination without any endorsement from medical professionals. It seems that social media functions as an accomplice in the social construction of gender roles in sexual relationship and in the reinforcement of women’s responsibility to protect both themselves and their partners from sexual health risks. Our findings confirmed the worries that the feminization of HPV infection may continue to hinder the amelioration of gender inequality in sexual health education and HPV vaccination campaigns. Along with the diffusion of biased health information, this gendered form of inequality is being legitimized.

From the perspective of the cultural theory of risk (Douglas & Wildavsky, 1983), risk and responsibility are closely connected, and their connection can be explained by factors that are deeply rooted in cultural context. People tend to borrow cultural frameworks to find the one(s) responsible for risks (Douglas & Wildavsky, 1983). Gender norms in China emphasize “ganzheng (cleanliness)” and “zai (self-care)” in the moral image of women (Gu & Tang, 2021). Women are supposed to protect their cleanliness that is linked to chaste and shame to be morally respectable. In the Chinese context, STIs, like HPV, are stigmatized as diseases acquired by means (e.g., promiscuity and infidelity) that are considered contradictory to traditional values and moral standards. HPV infection would therefore cause increased fear and stress to
Chinese women, pushing them into action to avoid moral condemnation and the “unclean” label. Being in the disadvantaged position, women are forced to bear the burden of preventing HPV infection, which leads to their enthusiasm in participating in HPV vaccination. There is no doubt that social media in China play a positive role in raising women’s consciousness of HPV infection and sexual health; however, they still demonstrate very limited gender equality in sexual health promotion campaigns.

Conclusion and Limitations

The present study analyzed the representation of HPV vaccine in Chinese social media. Findings of quantitative content analysis suggested inadequate and incomprehensive information conveyed via HPV vaccination campaigns, especially the lack of presence of medical professionals and institutions, raises concern for the accuracy and credibility of the messages. Moreover, despite the positive role of social media in mobilizing women to get HPV vaccine, the potential negative impacts of social media messages on gender equality should not be neglected. Our analysis uncovered obvious gender bias in Weibo posts by verified accounts, in which women were more likely to be recommended to get vaccinated than men, whereas men’s responsibility for protecting sexual health was greatly weakened. With the implementation of the real name registration policy in late 2011, the Chinese government has tightened up censorship toward microblogging platforms and increased its efforts to shape and regulate online public discourse. Although official voices dominate Weibo, as an open space deeply integrated into Chinese people’s public life, as well as product of a technology company in the private sector in China, Weibo still has been facilitating relative freedom of speech due to its features, positioning, and commercially driven nature. Future research may consider analyzing HPV-related messages shared by unverified accounts to discover the public’s agenda, which could contribute to better policy-making and campaign design relating to HPV vaccination.

Findings of the present study have established a starting point for research on the effects of HPV vaccination campaign. In the meantime, the findings also provide concrete practical implications for designing HPV vaccination campaign. More specifically, instead of overly appealing to fear toward cancers, campaign messages may focus more on how HPV is transmitted and how sexually active people are vulnerable to HPV infection. These basic facts about the infection could contribute to not only the de-feminization of HPV and HPV vaccine but also a more educational approach that targets a broader range of at-risk individuals and aims at cultivating awareness of safer sex in the long run. Specific strategies may vary according to different social and cultural contexts. However, regardless of the context, research on how the audience makes meaning out of mediated messages (i.e., audience studies) is expected to facilitate the design of more persuasive campaign messages that can reach target audiences more precisely.

There are several limitations to this study that should be acknowledged. First, besides social media platforms like Weibo, messages circulated on China’s largest messaging app WeChat, a semi-public space, are also worthy of scrutiny. Future research may consider looking into other types of social media to explore their roles and effectiveness in health communication. Second, as a social media content analysis, a larger and more representative sample is desirable for better characterizing health messages. Future research may consider using big data technology to obtain a more comprehensive picture of HPV-related information on social media. Third, although we coded sources of information, the current content analysis was unable to reveal the connections between various information sources. Future research may use social network analysis to investigate information flow through ties and to see if there exists intermedia agenda setting among diverse types of sources. Fourth, as exploratory in nature, the current study covered 1½ years’ representation by verified Weibo accounts, the time during which two key HPV vaccines were officially launched in the market in mainland China. Further longitudinal studies are warranted to examine the variation in social media campaigns and discourse on HPV infection and vaccination. Certain media frames and narratives may re-emerge over time to cultivate the public’s perceptions and attitudes. Finally, discussion on gender inequality in this study was binary in nature, not including people who do not identify with male or female. This actually reflects an important gap in the entire body of literature on HPV vaccination campaign, in which studies fall into the gender binary framework without considering the complexity of gender identification. Future research may take an open-minded approach to the representation of HPV and HPV vaccine and its social implications.

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### Appendix. Coding Scheme.

| Theme and subtheme                  | Interrater reliability (Cohen’s kappa) | Definition                                                                 | Example                                                                                      |
|-------------------------------------|---------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| (a) Information source              |                                       |                                                                             |                                                                                               |
| Official media                      | .873                                  | Accounts of the media that are owned by governments and are allowed to conduct news interviews in China | *CCTV News, People's Daily, China Daily*                                                      |
| Medical institution                 |                                       | Accounts of organizations that provide medical service to the public        | Hospitals, medical research institutions, medical service centers                           |
| Internet-based media                |                                       | Accounts of online news media that are allowed to conduct news editing but not allowed to conduct news interviews | *Toutiao* (Chinese news and information content platform)                                      |
| Public institution                  |                                       | Accounts of non-profit organizations that serve for the public’s interests | Government agencies, educational institutions, public service organizations                 |
| Professional                        |                                       | Accounts of non-anonymous persons who are from medical fields and have medical training experiences | Doctors, nurses, medical and biological experts                                              |
| Non-professional                    |                                       | Accounts of persons who do not have professional medical training experiences but are influential in the society | Celebrities, governors, intellectuals                                                        |
| (b) Tone                            |                                       |                                                                             |                                                                                               |
| Positive                            | .864                                  | Attitudes toward the uptake of the HPV vaccine                              | HPV vaccine could not only prevent cervical cancer caused by the high-risk HPV types 16 and 18, but could also prevent genital warts. The experts said that the HPV vaccine could reduce the incidence of cervical cancer in China in a long run. |
| Neutral                             |                                       |                                                                             | Recently, the HPV vaccine has been approved by the Chinese Food and Drug Administration. The vaccine is effective in preventing HPV infection and cervical cancer. However, medical experts suggest assessing personal health condition and paying attention to the side effects of the vaccine before the uptake. |
| Negative                            |                                       |                                                                             | A young girl experienced obvious physical abnormalities after the uptake of the HPV vaccine. There is evidence showing that negative consequences of HPV vaccination may last for years and even cause infertility. |
| Prevention of cancer (yes or no)    | .870                                  | Information about the effectiveness of HPV vaccines in preventing cancers   | The HPV vaccination and regular HPV screening have led to a continuous decline in cervical cancer cases in the United States. In addition to preventing cervical cancer, HPV vaccines can also prevent oropharyngeal cancer and penile cancer. |
| Prevention of sexually transmitted infections (STIs) (yes or no) | .889                                  | Information about the effectiveness of HPV vaccines in preventing STIs       | HPV vaccines can not only prevent cervical cancer in women but also reduce the risk of STIs for both men and women. |
### Appendix. (Continued)

| Theme and subtheme | Interrater reliability (Cohen’s kappa) | Definition | Example |
|--------------------|---------------------------------------|------------|---------|
| Recommended gender (yes or no) | .829 | Information about gender to be recommended for HPV vaccination | We recommend a policy to offer female middle school students free HPV vaccination as the effectiveness of HPV vaccines in preventing cervical cancer has been verified. HPV vaccines can provide the greatest amount of protection for the population ages 16 to 26 years old. We suggest giving priority to this age group in HPV vaccination. Between May 2009 and October 2010, the Gardasil vaccine caused 16 deaths and 798 cases of serious side effects (including 213 permanent disability cases). All vaccines have side effects. Medical experts have indicated that side effects of HPV vaccines, such as fever, headache, and muscle aches, are mainly caused by the injection rather than the vaccine itself. |
| Recommended age (yes or no) | .916 | Information about age group to be recommended for HPV vaccination | |
| Risk of vaccine (yes or no) | .727 | Information about the long-term consequences and uncontrollability of HPV vaccines | |
| Side effects (yes or no) | .879 | Information about the immediate reactions after the injection of the HPV vaccine (e.g., fever, pain) | |
| Follow-up test after vaccination (yes or no) | .888 | Information about regular testing after HPV vaccination | Regardless of the type of HPV vaccines, follow-up screening test is necessary. None of the existing vaccines, including Gardasil-9, can be 100% effective in preventing infections with all HPV types. In most cases, the virus will be cleared by the body. |
| Susceptibility (yes or no) | .876 | Information about the high infectivity of HPV, routes of HPV infection, and risk of having multiple sex partners | Most sexually active people will be infected with HPV at some point of their lives. There are more than 100 varieties of human papillomavirus (HPV). However, HPV does not always cause visible symptoms. When the person is infected with high-risk type(s) of HPV, the virus can negatively affect the functioning of the organs and may eventually cause the development of precancerous lesions or even cancers. Ninety percent of HPV infections can be prevented if the person has regular HPV testing. So far, the ThinPrep cytologic test (TCT) and HPV test are the most popular tests in preventing cervical cancer. Experts suggest conducting follow-up tests regularly even after HPV vaccine. Any type of HPV vaccines can help prevent HPV infection. Do not miss the best time for vaccination. |
| Severity (yes or no) | .835 | Information about the consequences of HPV infection (e.g., specific symptoms, relationships between HPV infection and the morbidity of certain diseases) | |
| Self-efficacy (yes or no) | .826 | Information about the measures and guidance for preventing HPV infection (e.g., place and cost of HPV vaccine uptake, methods for HPV detection) | |
| Response efficacy (yes or no) | .883 | Benefits (Cohen’s kappa = .871): Information about the effectiveness of HPV vaccines in preventing STIs and cancers Barriers (Cohen’s kappa = .864): Information about the difficulties relating to HPV vaccine uptake | Although the number of people who won lottery for HPV vaccination is increasing, the winning rate of the lottery is less than 2% in Shenzhen. The Chinese female population is facing the difficulties caused by the shortage of HPV vaccine. |
Appendix. (Continued)

| Theme and subtheme | Interrater reliability (Cohen's kappa) | Definition | Example |
|--------------------|---------------------------------------|------------|---------|
| (e) The presence of gendered information | .853 | Specific gender-oriented information relating to HPV vaccination | Findings of medical research indicate that if 90% of girls are vaccinated before 15 years old, it will effectively reduce the incidence of cervical cancer. Therefore, we suggest the government consider free HPV vaccination for middle school girls. HPV vaccines can not only help women to effectively prevent the diseases caused by HPV but also help men to gain immunity to HPV infection. Men can also get the HPV vaccine to protect against diseases caused by HPV. Nobel Prize winner in medicine suggests that men should be vaccinated to take responsibility for preventing HPV infection. |
| Gender for HPV vaccination (female, both, or male) | .802 | Specific gender-oriented information relating to HPV vaccination | According to the report released by the USFDA, by age 50, more than 80% of women will have been infected with HPV at one point in their lives. The HPV vaccine is proved to be an effective way to prevent the infection. Both men and women can be infected with HPV, especially those having multiple sex partners. Even if the infected person has no obvious symptoms, the virus can be transmitted to others. HPV can cause male condyloma acuminata, which is a serious threat to men's health. Therefore, the USFDA and ACIP approved the HPV vaccine for men in 2009. |
| Gender for HPV infection (female, both, or male) | .867 | Specific gender-oriented information relating to cancers caused by HPV | HPV vaccination is an important measure to prevent cervical cancer in women. Both men and women can be infected with HPV that may lead to cancers, such as cervical cancer, penile cancer, anal cancer. From 2012 to 2016, there were more men than women diagnosed with HPV-induced oral cancer in the United States. Although men do not have a cervix, it is quite necessary for them to get the HPV vaccine. Because the vaccine can effectively prevent cancers like penile cancer and anal cancer in men. |
| Cancer (female, both, or male) | | | |

(Continued)
| Theme and subtheme                                      | Interrater reliability (Cohen’s kappa) | Definition                                                                 | Example                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sexually transmitted diseases (STDs)                   | .760                                  | Specific gender-oriented information relating to STDs caused by HPV infection | HPV is transmitted through sexual contacts and is associated with many common STDs. For **women** who are sexually active, they should consider taking serious scientific measures to prevent HPV infection. I believe that most women have heard of HPV. The virus can cause common STDs such as condyloma acuminatum. However, HPV does not specifically infect **women**. **Men** can also be infected and become carriers of the virus. **Males** infected with HPV may get condyloma acuminatum. I believe that most women have heard of HPV. The virus can cause common STDs such as condyloma acuminatum. However, HPV does not specifically infect **women**. **Men** can also be infected and become carriers of the virus. **Males** infected with HPV may get condyloma acuminatum. HPV is transmitted through sexual contacts and is associated with many common STDs. For **women** who are sexually active, they should consider taking serious scientific measures to prevent HPV infection. |
| Susceptibility (female, both, or male)                 | .854                                  | Specific gender-oriented information relating to the high infectivity of HPV  | Eighty percent of **women** may be infected with HPV once in their life time. As a virus that is mainly transmitted through sexual contacts, HPV is found to be associated with incidence of STDs and cervical cancer. Both **men** and **women** can be infected with HPV. And the infection is spread without gender bias. Research has shown that the male body can clear HPV naturally without medical treatment. However, less than 10% of them will produce antibodies. Thus, **men** are more likely to be infected with HPV multiple times in their lives. Infections with high-risk types of HPV will threat **women**'s health, which may cause cervical cancer. HPV can infect both **men** and **women**. The risk of HPV-induced cancers among persons with HPV is 9 times higher than the risk among non-infected persons. Study has shown that there are more **males** got oral cancer due to HPV infection than females. |
| Severity (female, both, or male)                       | .793                                  | Specific gender-oriented information relating to the negative consequences of HPV infection | HPV can infect both **men** and **women**. The risk of HPV-induced cancers among persons with HPV is 9 times higher than the risk among non-infected persons. Study has shown that there are more **males** got oral cancer due to HPV infection than females. |
| Self-efficacy (female, both, or male)                  | .797                                  | Specific gender-oriented information relating to the measures and guidance for preventing HPV infection | Due to the shortage of HPV vaccines, we recommend **women** ages 25 to 26 years old to use WeChat to make appointment for HPV vaccine uptake. Please log into the official account, input your personal information correctly, including your ID number, gender, birthday, address, contact number, and upload your ID certification. Demand for HPV vaccine is large. Regardless of gender, **both men** and **women** should be vaccinated against HPV infection. We suggest you consider coming to Hong Kong for HPV vaccine uptake. In Hong Kong, the supply is sufficient and the vaccination is professional. In Macau, we offer the service to **males** who would like to get the HPV vaccine. Males who are willing to be vaccinated can make an appointment in advance and pay the fees online. Due to the shortage of HPV vaccines, we recommend **women** ages 25 to 26 years old to use WeChat to make appointment for HPV vaccine uptake. Please log into the official account, input your personal information correctly, including your ID number, gender, birthday, address, contact number, and upload your ID certification. Demand for HPV vaccine is large. Regardless of gender, **both men** and **women** should be vaccinated against HPV infection. We suggest you consider coming to Hong Kong for HPV vaccine uptake. In Hong Kong, the supply is sufficient and the vaccination is professional. In Macau, we offer the service to **males** who would like to get the HPV vaccine. Males who are willing to be vaccinated can make an appointment in advance and pay the fees online. Due to the shortage of HPV vaccines, we recommend **women** ages 25 to 26 years old to use WeChat to make appointment for HPV vaccine uptake. Please log into the official account, input your personal information correctly, including your ID number, gender, birthday, address, contact number, and upload your ID certification. Demand for HPV vaccine is large. Regardless of gender, **both men** and **women** should be vaccinated against HPV infection. We suggest you consider coming to Hong Kong for HPV vaccine uptake. In Hong Kong, the supply is sufficient and the vaccination is professional. In Macau, we offer the service to **males** who would like to get the HPV vaccine. Males who are willing to be vaccinated can make an appointment in advance and pay the fees online. |
**Appendix.** (Continued)

| Theme and subtheme                                                                 | Interrater reliability (Cohen's kappa) | Definition                                                                                       | Example                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Response efficacy (female, both, or male)                                        | .760                                 | Specific gender-oriented information relating to the benefits of or barriers to HPV vaccination | From media coverage of HPV vaccination in recent years, many *young girls* have realized the benefits of the HPV vaccine. However, the market for HPV vaccines in China always faces a short supply. HPV vaccination is an effective way to prevent HPV infection and reduce the risk of relevant cancers. Regardless of gender, *both men and women* should get the vaccine at an early age. Due to the limited supply of HPV vaccines in mainland China, HPV vaccination is only open to women. But Hong Kong and Macau accept both men and women to get vaccinated. Although HPV vaccines can effectively help men prevent HPV infection, due to the insufficient supply of HPV vaccines in mainland China, HPV vaccination is not recommended for men. |
| Expression of HPV vaccine in Chinese (yes or no)                                 | .892                                 | Whether HPV vaccine is labeled as *gongjingai* (cervical cancer) *yimiao* (vaccine)            | The cervical cancer vaccines are available in many cities in China.                                                                                                                                   |