#Gardasil on Twitter: An exploratory study examining message and source characteristics of human papillomavirus (HPV) vaccine-related tweets

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Genital human papillomavirus (HPV) is the most common sexually transmitted virus in the U.S. HPV is associated with cervical, vaginal, and vulvar cancers in women, penile cancer in men, and anal and oropharyngeal cancers in both men and women. HPV can also cause genital warts and warts in the throat. While HPV infection is widespread, cervical cancer disproportionately affects low-income and minority women.

HPV vaccines have the potential to either reduce or exacerbate disparities in HPV-related diseases and cervical cancers, depending on vaccine uptake. The U.S. Food and Drug Administration (FDA) recently approved a new vaccine that has the potential to prevent approximately 90% of anal, cervical, vaginal, and vulvar cancers. The recombinant HPV 9-valent vaccine (Gardasil 9, Merck) covers 9 HPV types—5 more than Gardasil and 7 more than Cervarix. While all 3 FDA approved HPV vaccines—Gardasil 9, Gardasil, and Cervarix—have demonstrated positive effects in reducing multiple types of cancer, the vaccine remains controversial. Reasons include the fact that the vaccine prevents a virus that is transmitted only by sexual contact, differentiating it from most, but not all other compulsory vaccines; the cervical cancer prevalence and death rate in the U.S. is relatively low; there is a large anti-vaccine segment in the U.S.; many contend that giving children this vaccine implies a tacit consent to engage in sexual activity and/or will give young people a false sense of protection from STIs and will lead to earlier engagement in sexual intercourse; and many believe that children already have too many vaccinations on the immunization schedule, vaccines in general are “bad,” the HPV vaccine is not safe, and/or long-term side effects are unknown.

Given these vaccine-related controversies, HPV vaccine uptake is very low, especially in key priority populations in the U.S., and such health inequities remain a critical public health and cancer prevention concern. In 2012, for example, the weighted proportion of girls who initiated the vaccine at <13 years of age was 55.9%. While that proportion continued a statistically significant trend each year since 2008, by the end of 2012, receipt of ≥1 dose of HPV vaccine among girls reached 27.1% of 11-12-year-olds, 47.9% of 13-15-year-olds, and 57.1% of 16-18-year-olds. However, according to 2010 data, the percentage of 11-17-year-old females who completed all 3 vaccinations was only 14.2%. Further, vaccine initiation (not completion) among boys remains at approximately 18% for all age groups. And African-Americans are less likely to have initiated vaccination compared with whites.

Social media represent a potential vaccine promotion modality, as Black, Latino/as, and adolescents and young adults who are within the indicated age-range for receiving the HPV vaccine are heavy users of social media. One of the best known social media platforms is Twitter, which currently has 310 million monthly active users. As of Fall 2014, 59% of teens use Twitter. Among adult Internet users, 29% of Non-Hispanic Blacks and 31% of 18 to 29 year-olds report using Twitter. These young people represent important priority populations for HPV vaccine promotion efforts. However, virtually nothing is known about Twitter post (tweet) content, including what HPV- and HPV-vaccine related information is shared, or the sentiment toward the HPV vaccine on Twitter. The main aim of this qualitative content analysis was to examine message, context, and source characteristics related to Twitter content regarding the HPV vaccine over a 3 month period of time. Specifically, our aims were to describe the source characteristics of tweeters (people and organizations) who post messages on Twitter about HPV and the HPV vaccine, examine the types of HPV- and HPV vaccine-related information that is shared on Twitter, and assess the general sentiment toward the HPV vaccine among social media users who tweet about the vaccine.

METHODS

To address our study aims, we purchased social media data directly from Twitter. Those data included all tweets (matching our search criteria) that were posted in December 2014 and January and February 2015. A total of 47,944 tweets met our criteria: 32,019 tweets matched the keywords HPV AND vaccine; 17,656 tweets matched the keyword Gardasil; 564 tweets matched the keyword Cervarix; and 5,951 tweets matched the following criteria: (cervical OR vulvar OR vaginal OR anal OR genital warts) AND (vaccine). From this sample, we removed all non-English tweets using the search function in the “twitter_lang” field. Non-English language tweets are identified by the BCP 47 language identifier tag in the “twitter_lang” field. Only tweets tagged as ‘en’ (n=45,260) were retained for this study.

We developed a coding document to manually extract information from this sample of tweets, focusing on source and message characteristics, including tone/sentiment towards the HPV vaccine. After piloting the coding document with a small sample of Twitter data, we then randomly selected 1,000 tweets, from the 47,944 tweets pulled from Twitter, for manual coding and analysis. Two researchers independently coded all tweets for certain source and message characteristics. All tweets were coded for sentiment using the following categories: neutral, negative, ambiguous, positive, and other. Message tone was also coded using dichotomous yes/no variables on whether the tweets contained the following: concerns about civil liberties, that the vaccine is a hoax, and that the vaccine is dangerous. Tweets were also coded for specific information about the HPV vaccine (e.g., message frames, or mention of the HPV vaccine being a: cancer prevention tool, STI prevention tool, and genital wart prevention tool; whether the tweet mentioned: that the HPV vaccine is approved for males and females, that it is approved for ages 9-26, any vaccine safety concerns).

All analyses were completed using IBM® SPSS® Statistics. Means and standard deviations were calculated for continuous variables. Frequencies and percentages were calculated for all categorical variables.

RESULTS

Of the 1,000 manually coded tweets, just over half (n=548, 54.8%) were posted by an individual. Four hundred and four tweets (40.4%) were by posted from an organizational account. Among the 548 tweets posted by individuals, the largest identified individual types were parents (n=52, 9.5%), journalists (n=45, 8.2%), and physicians (n=40, 7.3%). Only one tweet came from a dentist or dental professional, and no tweets from children were identified from the profiles. Among the 404 tweets posted by organizations, the largest identified organizational types were health information providers (n=176, 43.6%), businesses (n=151, 37.4%), non-profit/advocacy groups (n=67, 16.6%), and healthcare organizations (n=54, 13.4%).

In terms of source popularity, influence, and reach, Twitter profiles varied greatly. Only 3.6% of all tweets (n=36) were posted by a Twitter-verified celebrity. The median number of followers at the time of tweet was 433 followers (M=2,559.43, SD=12,150.74), ranging from a low of 0 to a high of 179,112 followers. The median number of profiles the tweeters followed at the time of tweet was 413 (M=3,518.19, SD=17,279.85), ranging from a low of 0 to a high of 369,846 profiles. The median number of tweets posted on the user's profile was 9,770 (M=41,017.18, SD=102,678.32), ranging from a low of 2 to a high of 1,741,997 tweets posted.

More than half of tweets (n=571, 57.1%) were coded as having a positive tone (i.e., approving of the HPV vaccine). Less than one-fifth of tweets were coded as having a negative tone (n=188, 18.8%), whereas 195 tweets (19.5%) were coded as having a neutral tone (i.e., not approving or disapproving of the HPV vaccine). Forty-six tweets were coded as having either an ambiguous tone (1.4%; i.e., containing both disapproving and approving content regarding the HPV vaccine) or other tone (3.2%; i.e., those tweets that did not fit into any of the other categories). Despite almost 20% of tweets being coded as negative, only a small percentage of tweets contained specific negative content about the vaccine, such as the vaccine being dangerous (5.1%; e.g., Gardasil kills, poisons, or injures), concern regarding civil liberties (1.0%; e.g., government wants mandate the vaccine, which threatens citizen freedom), or the vaccine being a hoax (0.9%).

Message frames varied slightly in this sample. The largest frame related to the HPV vaccine as a cancer prevention tool, as 17.6% of tweets mentioned that the vaccine can prevent cancer. Seven percent of tweets framed the vaccine as an STI prevention tool, and 0.4% mentioned the vaccine prevents genital warts.

Very few tweets included HPV vaccine-related information. Although rare, the most frequently included information in tweets were that girls and women are eligible to receive the vaccine, concerns about the safety and/or unknown risks associated with the vaccine, that boys and men are vaccine-eligible, the vaccine-eligible age range, and side effects (included in 4.8%, 2.8%, 2.4%, 1.4%, and 1.4% of tweets, respectively).

Few tweets were delivered from a first person perspective. Twenty-three (2.3%) tweets included a personal account from individuals who discussed a firsthand experience with HPV or the HPV vaccine. Only 0.6% originated from the perspective of a parent or relative of a potential or actual HPV vaccine recipient.

Finally, few tweets included information about HPV, such as its link with cervical cancer, its link with other cancers, and how HPV can be transmitted. In addition to the data presented here, our presentation will also include a temporal analysis of tweets, overall and by sentiment.

DISCUSSION

Our results suggest HPV vaccine sentiment on Twitter is positive, but that tweets exclude critical vaccine information. Limitations include our focus on Twitter, ignoring other platforms, and our use of keywords more likely employed by health professionals. Nonetheless, to our knowledge, this is the first attempt to systematically analyze HPV vaccine Twitter content. Our findings provide preliminary support for vaccine (and

possibly other sexual health) promotion through Twitter. With this understanding of what is being discussed on Twitter regarding the HPV vaccine, we can start conceptualizing the development of HPV vaccine promotion strategies and messaging for social media.