

How social media influences people's willingness to HPV vaccine uptake: A geospatial analysis and visualization in China

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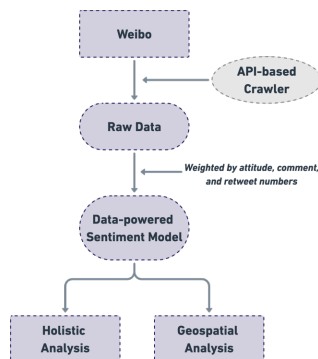
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Introduction

Cervical cancer, mainly caused by persistent infection with human papillomavirus (HPV), is ranked as the third most common malignancy after breast cancer and colorectal cancer worldwide. It becomes one of the leading causes of cancer deaths in women. Thanks to the development of medical technology, the nine-valent HPV vaccination can increase the overall prevention possibility of cervical cancer to approximately 90%. In recent years, HPV vaccine-related topics have frequently appeared on Weibo hot searches, and the development of social media has overturned the traditional medical communication channels, with more and more people using social media to acquire health-related knowledge and participate in related discussions. Through literature review, social media, that are popular outside mainland China such as Twitter, Facebook, and YouTube have achieved better results in terms of health education, health intervention, and prevention monitoring as a research platform for the HPV vaccine. But relevant effects seem to be less significant in China. To better understand how social media would influence people's willingness to the HPV vaccine uptake quantitatively, this paper queried relevant microblog data from Weibo API within the recent one and a half years, aiming to comprehensively explore public sentiment about the HPV vaccine. Then this paper further divided queried data into sub-groups to make geospatial analysis and visualization to understand the regional disparities in people's willingness to HPV vaccine uptake by provinces.

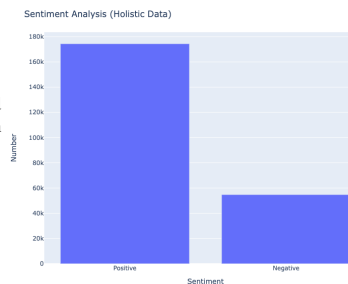
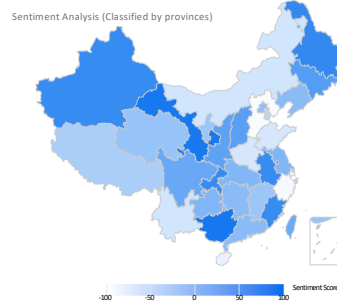
Methods

Data collection was performed by using API-based crawler technology, with keywords and hashtags posts including but not limited to #HPV#, #Cervical Cancer vaccine (translated)#, and #Nine-valent (translated)#. Till now, a total of 229,150 effective original posts from July 1, 2021, to June 31, 2022, containing either of these keywords or hashtags were collected. The metadata involved includes id, original post contents, time of sending, IP location, number of reposts, number of comments, and number of attitudes (thumbs-up). Taking different attentional levels of collected posts into consideration, i.e. retweet number, comments number, and attitude numbers, we constructed the sentiment analysis model to measure people's willingness to HPV vaccine uptake. Further, based on IP location, sentiment data are separated to go through a geospatial process to constructive a comparative study, and further help understand the regional disparities.



Results

After manipulating the raw data with the given methods, we can tell that in general people remain positive in terms of evaluating their willingness to take the HPV vaccine from the holistic data, where positive accounts for around 76% of all effective posts where we collect from the Weibo API.



Further, we separate the effective sentiment data into subgroups, to make a geospatial analysis at the province level. However, the result and visualization failed to prove a general difference and disparity among different regions. But one point that catches the researcher's attention is that there is not a featured correlation between the extent of the economic development and public positive sentiment toward the HPV vaccine uptake.

Word Cloud produced by data queried from Weibo API:



Discussion

- Social media platforms have currently grown to become one of the major channels for communicating health information. Compared with traditional health dissemination methods, new media platforms such as Weibo have great dissemination significance. But through the amount of data, intuitively we can tell that compared to other popular cancer and cancer controls, the public's attention level on the HPV vaccine and cervical cancer remains relatively low.
- At the same time, even though positive sentiment toward the HPV vaccine accounts for the majority, there is indeed negative information about it. One potential explanation is that although vaccination has helped significantly reduce mortality and morbidity, there are still many members of the public who underestimate the infectivity and potential harm of the virus due to cognitive biases, and some question the effectiveness of vaccination, resulting in increased vaccination hesitancy. And the other is the extreme imbalance between supply and demand, which resulted in a great number of noises in constructing sentiment scores.
- The following reasons might account for the insignificant differences in the geospatial analysis: (1) data scarcity; (2) did not take the frequency of posting by Weibo into consideration, i.e. multiple posts of the same user may be included in the analysis, to make an impact to the sentiment score; (3) uneven distribution of the post amount among different regions, etc.

Conclusion

As social media become more popular and common among people of all walks and all ages, the data it generated can indeed help researchers understand and catch the hot searches from time to time. In this research, we are interested in the relationship between people's sentiments on social media and the willingness to take the HPV vaccine. In general, people's sentiments toward this vaccine tend to be positive, but 24% of the negative posts also reveal a long way for the policymakers to spread correct and accurate vaccine knowledge among people. Even though the result of the geospatial analysis is not significant, it still inspires researchers several points to move forward.

Acknowledgments

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