



The role of social media in monitoring COVID-19 vaccine uptake

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The COVID-19 pandemic has affected millions of lives worldwide. To date, there are more than 50 vaccine candidates to mitigate this public health crisis and several of the vaccines are in various phases of clinical trials. In the United States, Pfizer-BioNTech and Moderna vaccines have been rolled out and distributed. Although vaccines are currently available for distribution, several challenges hinder uptake such as vaccine hesitancy, misinformation, and an inadequate distribution plan. Studies examining the likelihood of participants to get vaccinated found that only 52% of those surveyed stated they will very likely get the vaccine.¹ Hesitation may be due to public mistrust of science, including fear of the side effects, uncertainty of vaccine efficacy, mistrust of pharmaceutical companies, and that production of the COVID-19 vaccine was expedited.^{2,3} Misinformation about COVID-19 is ubiquitous online.^{4,5} One study found that 88% of misinformation about COVID-19 arose on social media and resulted mostly from distorted facts (59%) instead of being completely fabricated (38%).⁶ Unfortunately, social media platforms are inundated with misinformation and fact-checking or removing them presents challenges. In one instance, COVID-19 vaccine social media posts about the harms of getting vaccinated went viral and despite efforts to remove the posts by the platform, the damage of disseminating false side effects was irreparable.⁷ As a result of misinformation, provaccination sentiment and trust has decreased in the public. Early vaccine distribution has been complicated by supply limitations, organisational deficiency, and technical challenges.

As millions around the world patiently wait, the importance of vaccination to achieve herd immunity, minimise morbidity and mortality from COVID-19, and protect lives cannot be overstated. This

viewpoint will explore the role of social media in monitoring uptake of the COVID-19 vaccine.

1 | SOCIAL MEDIA AS A DATA SOURCE FOR SURVEILLANCE

Social media use has been rapidly growing, allowing it to be used by researchers and health departments as a tool in public health research. Social media and search engine (e.g., Google) data have been used to monitor infectious diseases such as sexual health, including HIV, opioids/substance use, Zika, measles, and chronic conditions such as asthma, depression, and sleep issues.⁸⁻¹² Because social media data can be available in near real-time, are often publicly available, and have massive amounts of data, they can potential supplement existing public health surveillance efforts by providing information that might not be feasible or cost-effective through traditional methods, such as surveys, interventions and case reports.^{13,14}

Studies show that approximately 65% of research using social media surveillance correlated well with existing surveillance programs¹⁵ providing support of social media surveillance. Artificial intelligence has afforded researchers to examine large corpora of content on social media. For example, various techniques of artificial intelligence were used to analyze social media data during public health crises: natural disasters, epidemics, and pandemics, ranging from prediction/early warning to impact and damage assessment to recovery to mitigation.¹⁶ Additionally, artificial intelligence may also be used to detect false information (i.e., fake news) in social media.



During the campaign, President Joe Biden pledged to spend \$300 billion on innovation funding which may be used to bolster research and development in artificial intelligence, among other things. Increased funding may lead to more research on nonmilitary use of artificial intelligence, and in particular how it can assist in mitigating public health crises.

2 | COVID-19 IN SOCIAL MEDIA

Social media has had a strong impact on COVID-19 information understanding and public opinion. The public share their thoughts and opinions on social networking sites, microblogging platforms, online forums, video-sharing platforms, and multimedia messaging applications about COVID-19. Topics shared vary and include: virus origin, sources, impact on economy and health, and mitigation efforts. One study found that YouTube and Twitter had the highest volume of COVID-19-related post content and comments compared to other social media platforms.¹⁷ With respect to the COVID-19 vaccine, YouTube videos garnered millions of views, mostly from news sources, but even consumer uploaded content received 25% of cumulative views.¹⁸ Aside from public discussion and engagement, high profile individuals (i.e., celebrities, political leaders) post on social media frequently. Often times, posts by political leaders impact and dominate the conversation on social media and may sway public opinion.

Amidst all the COVID-19-related information, pertinent knowledge about public behaviours and experiences surrounding the vaccine may be gleaned. Comments on popular YouTube channels and videos may provide insight to public opinion as well as commenter behaviour. Tweeters, people who post on Twitter, may share their experience as well as the experience of someone they know. Table 1 provides examples of sample social media posts on popular social media platforms. Users may post images of vaccination cards or selfies of a healthcare provider injecting the vaccine on Facebook or Instagram. Subreddit threads of those

who already received the vaccines may give insight into post-vaccine experiences and side effects.

The challenge of sifting through millions of posts and comments may be ameliorated by employing the various techniques and branches of artificial intelligence. Designers and programmers may utilise algorithms to be able to filter through the noise and focus on specific keywords and tags. Young and colleagues used Twitter's advanced programming interface to collect tweets with specific keywords about sexual risk behaviours surrounding HIV and data on HIV cases. Study results showed a positive relationship between HIV-related tweets and HIV cases.¹⁹ Ugarte et al.²⁰ examined public opinion about COVID-19 by monitoring tweets before and after President Donald Trump's COVID-19 clinical status via specific key phrases and words. Public opinion about the seriousness and verity of COVID-19 changed slightly based on the President's health status and was captured in near real-time on Twitter. A similar approach may be taken when monitoring COVID-19 vaccine uptake in social media by using specific keywords or hashtags (metadata tag used for cross referencing content in social media) such as #covid19 vaccine, #covidvaccine, #modernavaccine, and so on. Artificial intelligence may also be used for image recognition to screen through user uploaded images in addition to screening for specific keywords.

3 | CONCLUSION

In times of crisis, novel approaches to monitor public opinion and behaviour may warrant exploring digital tools that are widely utilised. The surveillance of COVID-19 vaccine uptake through social media may provide real-time insight that may inform and benefit public health agencies and healthcare providers. As artificial intelligence techniques continue to evolve, its continued advancement may be invaluable in monitoring social media data.

TABLE 1 Sample of posts on popular social media sites using the tag #covid19vaccine

Social media platform	Sample post ^a
Facebook	<i>Received my second COVID vaccine yesterday and feeling badly. But it's all good. Last night I had chills, body pains, and a headache, but I know that's just my body reacting to the vaccine... Rest assured, I had a normal, albeit unpleasant, reaction to the #covid19vaccine. (Post accompanied by image).</i>
Twitter	<i>My elderly parents on their way to getting their #covid19vaccine. So happy! (Tweet accompanied by image).</i>
Instagram (caption)	<i>I received the 2nd dose of the #Moderna #covid19vaccine today. I am relieved, and hoping everyone gets their first dose soon. Everyone should be vaccinated before life can go back to a semblance of normalcy. It will feel good when every last person who chooses to be vaccinated is vaccinated.</i>
Reddit (COVID-19 vaccine subreddit)	<i>After the first shot, my arm was really sore. As a healthcare worker, I get the flu shot yearly. This vaccine caused a bit more soreness but no big deal. My second shot was at noon, I felt fine all evening and thought I was in the clear. But I woke up in the middle of the night feeling pain... I felt feverish, my head hurts, and felt exhausted. It's currently day two and hope I feel better tomorrow. Still glad I got the vaccine since Covid would be so much worse.</i>
TikTok (caption)	<i>Day 3 post Covid-19 vaccine and I'm feeling great. #pfizervaccine #covidvaccine #healthcareworker.</i>

^aQuotes have been modified to protect individuals from being identified by or linked to this report.

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CONFLICT OF INTERESTS

The authors have no conflict of interests to report.

DATA AVAILABILITY STATEMENT

There are no data associated with this manuscript.

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