

Infodemic on Social Media and COVID-19 Vaccine Hesitancy

Jeevan Bhatta¹, Sakda Arj-Ong Vallibhakara, MD., Ph.D.^{2,3*}, Anil Sigdel⁴, Saurav Chandra Acharya Samadarshi⁵, Tej Prasad Dulal⁶, Bishnu Pant⁷, Sharmistha Sharma⁸

¹ ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, Thailand

² Department of Pediatrics, Faculty of Medicine, BangkokThonburi University, Bangkok, Thailand

³ Child Safety Promotion and Injury Prevention Center, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

⁴ Department of Public Health, Chitwan Medical College, Bharatpur, Chitwan, Nepal

⁵ Ministry of Social Development, Lumbini Province, Nepal

⁶ Provincial Training Center, Bagmati Province, Nepal

⁷ Health Office, Baitadi, Far Western Health Directorate, Nepal

⁸ School of Public Health, University of Alberta, Canada

This study aims to understand the current COVID-19 vaccine hesitancy context and measures to overcome it. Assessing the challenge faced by campaigns against the vaccination on social media is vital, considering the emergence of the COVID-19 pandemic. Moreover, though there has been substantial advancement in vaccines over the last century, the re-emergence of vaccine-preventable infections has prompted the World Health Organization to recognize vaccine hesitancy as a significant challenge to public health. The strategies among the general public for the hesitancy to use any vaccines for the initial period might well be fueled by health information gathered from a range of outlets, especially social media. This is a significant public health issue and may compromise people into not using the vaccines. Therefore, there is a strong need for social media to control that false plethora of information and promote the message from internationally recognized and trusted organizations and the government bodies of respective countries. This study explores infodemic in social media and its impact on utilizing the COVID-19 vaccine. This review results can benefit further public health interventions related to vaccine utilization.

Keywords: Infodemic; Social Media; COVID-19; Vaccine hesitancy; Information overload

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*** Correspondence to:**

Sakda Arj-Ong Vallibhakara, MD., PhD.

Medical Science Department, Faculty of Medicine, BangkokThonburi University,

16/10 Leabklongtaweewatana Rd., Taweewatana, Bangkok, Thailand. 10170

Email: dr.sakda@gmail.com, sakda.val@bkkthon.ac.th Phone: +66-82-5662211

ORCID: 0000-0001-5343-3297

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INTRODUCTION

Vaccination remains one of the most effective public health strategies and the foundation of managing infectious communicable diseases. Despite the apparent success of immunization, increased public acceptance is needed to preserve herd immunity, prevent outbreaks of vaccine-preventable diseases, and introduce new vaccines [1,2]. However, the acceptance and use of various vaccinations, especially vaccines, remain minimal. Currently, the entire world awaits success in COVID-19 vaccine development and approval in the battle against COVID-19. Still, most of the population is skeptical about the developed vaccines' effect and their impact on health in the long run. [3] Many recent studies have suggested that around 40% to 50% of people are not convinced of having COVID-19 vaccines [3,4].

The continuing COVID-19 epidemic in vaccine-preventable conditions has guided the World Health Organization (WHO) to recognize vaccine hesitancy as one of the top ten public health challenges [5]. Moreover, as the whole globe is looking to secure reliable COVID-19 vaccinations as the safest path ahead, vaccine hesitancy jeopardizes the ability to protect populations from vaccine-preventable diseases [3,6-7]. Vaccine hesitancy has been described as a patient-level skepticism to accept vaccinations and various opinions

about vaccination, ranging from cautiousness to deniers [5].

Social Media, COVID-19, and Vaccine Debates

Among the obstacles to universal vaccination, misinformation about the advantages, compositions, and harmful impacts of vaccination restrict the awareness of the patients and the general population. The sources from the internet are an incredibly prominent medium for collecting updating situations and knowledge on the novel coronavirus (COVID-19). The online social media information analysis methodology is called infodemiology [4,8]. 'Infodemic' is a combination of the words "information" and "epidemic" [9]. These types of information are substantially erroneous circulating on the internet, resulting in an error of understanding, fake news, deliberate misinformation, and information overloading. Such monikers can have a massive impact on the public health discourse [8].

Social networking has been an undeniable medium of communication between the government and the citizens. Amid this pandemic, social media are loaded with COVID-19-related contents [10]. Such issues could be exacerbated in the ongoing COVID-19 pandemic, as development, manufacturing, and subsequent vaccine

Category	Scores	Description	Recommend
Conspiracy & Junk Science	9	Systematically manipulative and fabricated content with the purpose of legitimizing implausible conceptualizations of facts and knowledge through argumentative methods that coarsely mimic those of scientific reasoning but without any sound logical or factual basis, targeting individuals or social groups as covert instigators or perpetrators of harmful actions.	Stop sharing and contributing
Fake or hoax	8	Providing manipulative and fabricated content with the purpose of misleading public opinion on socially relevant issues and provoking inflammatory responses.	Stop sharing and contributing
Political	7	Providing content that presents a partisan representation and interpretation of facts to support a political position over rival ones.	Stop sharing and contributing
Shadow	6	Domain related to URL shortening that cannot be classified a priori but would require further URL expansion.	Explore and weigh to stop sharing and contributing if it's dangerous content.
Other	5	Domains pointing to general content that cannot be easily classified, such as videos on YouTube.	Explore and weigh to stop sharing and contributing if it's dangerous content.
Clickbait	4	Domains providing content that generally distorts or intentionally misrepresents information to capture attention.	Stop sharing and contributing
Satire	3	Domains providing content that is intentionally and explicitly aiming at providing a distorted representation of events as a form of humors and/or social critique.	Stop sharing and contributing
Mainstream media	2	Domains providing content that is generally subjected to professional fact checking and abides by the rules of media accountability.	Can sharing and contributing with consideration
Science	1	Domains providing content validated via scientific scrutiny.	Can sharing and contributing with consideration

Level of Harm
Reliability Level

Figure 1. Description of the 9 categories of harm and reliability of news and information, divided into score weighting of evidence and their dissemination objectives. (modified from Gallotti R, et al, Assessing the risks of 'infodemics' in response to COVID-19 epidemics. *Nat Hum Behav* 2020; 4 : 1285-93) [31].

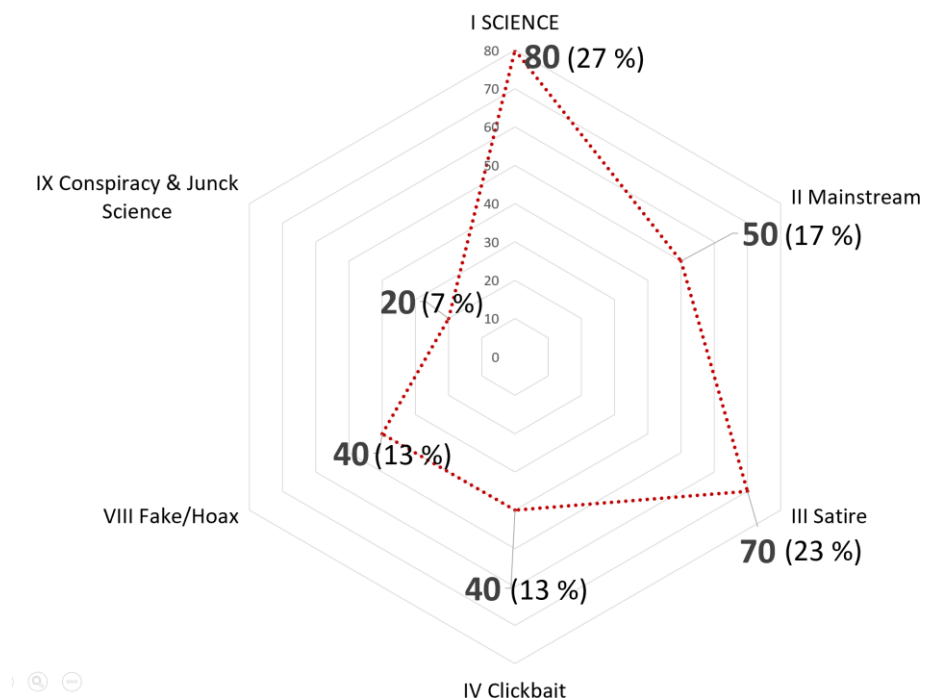


Figure 2. Study results of 9 classifications of harm and reliability weighting score

distribution are anticipated to play a prominent role in preventing the virus. Compared to previous pandemics, the general population worldwide has massive access to the internet or social media networks [11, 12]. Furthermore, using an effective isolation technique, working/learning online from home, and physical distancing, COVID-19 has increased and enhanced the use of social media as individuals attempt to communicate with each other [13]. There is a lot of misinformation and unverifiable reports impacting COVID-19. Possible effects and harmful consequences of vaccination have already started to surface on social media sites, seeking to weaken consumer trust towards the use of appropriate vaccines [2,14].

Moreover, several previous research and literature have shown that vaccine hesitancy is a pervasive problem worldwide, with a wide range of explanations given for vaccine refusal. The most critical factors were perceived threats versus gains, personal values, and a lack of information and understanding [15,16]. The rationales as mentioned above can be applied to COVID-19 vaccine hesitancy, as observed in recent studies that found a strong link between intent to get coronavirus vaccines and perceived safety, a link between a negative attitude toward COVID-19 vaccines and unwillingness to get the vaccines, and a link between religiosity and lower intention to get COVID-19 vaccines [17,18]. These factors can also be linked with the false information that is conveyed on social network sites.

Currently, 4.5 billion people globally have access to the internet, with an average increase of 7.1 percent worldwide users [19]. Out of 7.82 billion people, 50.64% of people use at least one social media platform. However, when we look into platform penetration rates from people in eligible audiences, 83.36% of global internet users and 90.71% of 4.20 billion mobile internet users are on social media. A person spends 2 hours 24 minutes on social media on any device on average time. People appeared to spend more time on the internet throughout the pandemic and consequent lockdown, and social media usage has increased. The most commonly used social media are YouTube, Facebook, Twitter, Instagram, TikTok, WhatsApp, etc. Social networking sites enable users' groups to build, connect and communicate with others, with multiple channels for various information sharing. Social networking has often been identified as attracting large population groups and distributing information efficiently [20,21].

The significant obstacles to social media and the dissemination of information are the "bubble Filter" that was defined by Elipariser in 2011 [22]. This filtering algorithm is used to collect the topic of searching from the same user. It predicted and yielded related results that were similar to the question. This algorithm is applied to any scenario on search engines and social media platforms such as Facebook, Youtube, and Twitter. In 2020, they were more than 8,000 papers [23] in PubMed with the wording " COVID-19" as a Tsunami of information; the avalanche of data became unaffordably

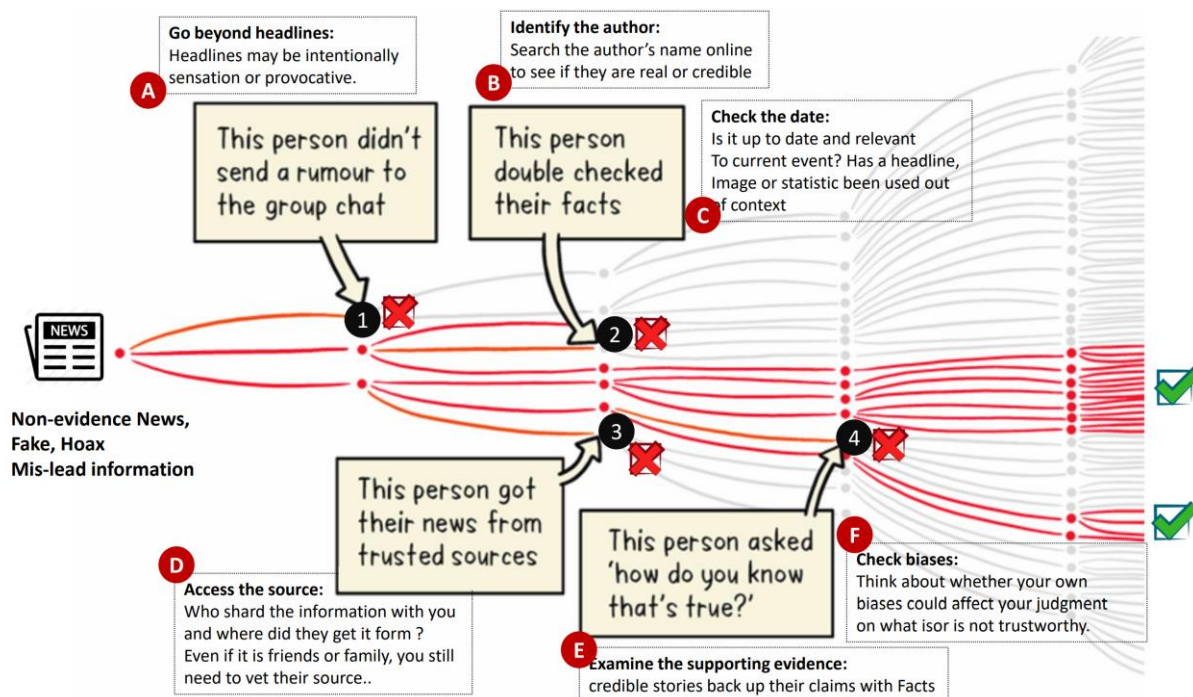


Figure 3. Methodology for navigating and filtering the infodemic, diagram demonstrated how to block infodemic (modify from: Let's flatten the infodemic curve; <https://www.who.int/news-room/spotlight/let-s-flatten-the-infodemic-curve>) [32].

mixed of accurate and fake news, or in other terms, "infodemia" [24, 25]. An infodemic is too much information, including counterfeit or misleading information in the digital and physical environment.

We cannot deny the advantages of social media, such as new information can quickly spread during the COVID-19 pandemic, diagnostic, treatment, and follow-up protocol. But the downsides of possible dissemination of fake data, myths, anxiety & depression information. It is advisable to not contribute to the infodemic and follow a responsible use of social media when disseminating information.

The contents of COVID-19 vaccines are common seeks. They are easily accessible through various social media channels, with several study contents about vaccinations. Before the COVID-19 pandemic, several studies demonstrated that a substantial number of people showed anti-vaccine sentiments, with a large number of those posts made with no evidence. Moreover, a survey during the COVID-19 pandemic on YouTube video reported more than one-fourth of the content regarding COVID-19 featured misinformation and accumulated more than 60 million views [26, 27]. The vaccine debate on social media has increased across times, with developments frequently related to products in the modern world. Anti-vaccine Twitter discussion and debate seem to have been a significant increase in 2015, coinciding with a Measles outbreak in 2014– 2015 with the Twitter trending anti-vaccine book Vaccine

Whistleblower (#cdcwhistleblower) and the release of the movie Vaxxed (#vaxxed)[28]. In most recent times, with Twitter stating a COVID-19 linked tweet per 45 milliseconds and the #coronavirus (hashtag) became its 2nd most used hashtag in 2020, the accelerated dissemination of COVID-19 and the ensuing global crisis has become such a topic of substantial social media debate. However, falsified information regarding COVID-19, potentially hazardous treatment, and vaccine continue to increase on social platforms [29]

Additionally, the influence of social networking is exacerbated by an external factor: the deliberate dissemination of disinformation in addition to misinformation. Various analysis has shown that Russian bots and troll farms have promoted large-scale anti-vaccination posts on Western social media. Such advertisements may very well be part of a much larger campaign to compromise public health in developing and developed countries politically. The propagation of such conspirators could have significant implications, including the proliferation of hypotheses connecting 5G cellular networks to the spread of COVID-19, which has contributed to the destruction of mobile networks. Overall, such findings have found that the increased amount of pro-and anti-vaccine content varies by the forum and that anti-vaccine material often leads to higher user interaction than its pro-vaccine posts. These sorts of engagement can be connected to the frequency of significant recent issues and the operation of non-

human profiles. People with disabilities, elderly, illiterate, or less literate are a particular group of users more prone to these social media infodemics [30].

During COVID-19 Pandemic, the researcher conducted the searching term “#COVID-19” and “#Vaccination” in Thailand, searching in search engines, Google, and social media networks such as Facebook, Twitter, Youtube, and other social platforms. The Searching results showed an average of at least 300 information/day during the peak pandemic period. Those consisted of positive and negative the posts, comments, News, Infographics, and recommendations during the people debate about the role of COVID vaccination (Which appropriate providers ? how many doses are needed? How are side effects and morbid mortality after vaccination) compared with natural COVID-19 infection ?).

For the 9 classifications of harm and reliability weighting scores, see figure 1 [31]. The study showed that 80 news and posts (27 %) were based on category I score: Science (Domains providing content validated via scientific scrutiny), 50 News and comments (17%) in category II score: Mainstream & Media (Domains providing content that is generally subjected to professional fact-checking and abides by the rules of media accountability.) which can be sharing and contributing to make validity and understand about and role, efficacy, and side-effect of COVID vaccination. The author found 70 news and posts (23 %) with was category III score: Satire (Domains providing content that is intentionally and explicitly aiming at delivering a distorted representation of events as a form of humor and/or social critique), and 40 information (13 %) in the category of IV score: Clickbait (Domains providing content that generally distorts or intentionally misrepresents information to capture attention). In which category III and IV scores should be explored for facts, and stop sharing and contributing if they intend to distort factual knowledge or truth. We found 40 posts and news (13%) related to category VIII score: Fake or Hoax (Providing manipulative and fabricated content to mislead public opinion on socially relevant issues and provoke inflammatory responses), and 20 posts (7 %) in category IX score: Conspiracy & Junk science (Systematically manipulative and fabricated content to legitimize implausible conceptualizations of facts and knowledge through argumentative methods that coarsely mimic those of scientific reasoning but without any sound logical or factual basis, targeting individuals or social groups as covert instigators or perpetrators of harmful actions), see Figure 2. In the higher risk/harm and low-reliability group, the information almost came

from individual comments, posts affected by adverse effects of vaccination, or some professionals who debated their concern about the adverse or side effects of mRNA vaccine modified or affect human genetics. In contrast, low harm and high-reliability group posts or comments mostly came from standard NEWS channels (BBC, ABC, FDA News, CDC), WHO, US FDA, UNICEF, medical knowledge web services, and applications such as WebMD, Children Medical institutes and unbiased science broadcast. Clickbait posts came from Facebook or local or commercial NEWS and forums that bring readers interested in reading and sharing.

To solve the infodemic problem, WHO suggests the criteria for responsible social media disseminated information by 1) preferential use of established professional forums or communication groups to deliver information. 2) Clear identification of the information source – allows users to judge the likely integrity and quality of information. 3) Declaration of conflicts of interest, when appropriate. 4) Identify methods to verify the source when appropriate or necessary: website address if source not readily accessible by simple search strategies or institutional email address of the originator. 5) Transparent methods for peer review and feedback, for example, utilizing transparent FOAM platforms for post-publication peer review processes and providing the author/institutional contact details so that criticisms can be directed directly to originators. 6) Transparently acknowledge and document collaborations with identified professional experts and adjust information to meet necessary contextual needs. 7) Pursue a traditional peer review process as soon as feasible and, if appropriate, reference peer review results once obtained, see Figure 3.

CONCLUSION

It's essential to resolve the problem of misleading news regarding vaccine hesitancy without diminishing the positive influence of social media. Moreover, with the re-emergence of vaccine-preventable illnesses such as COVID-19, WHO has recognized vaccine hesitancy as a significant global health threat. Currently, the general population has access to various social media platforms in a digitalized world. The increasing trend of the use of social media has been providing multiple hoaxes or false news, including bots that promote vaccine hesitancy. Hence, there is a need to make various structural changes on social media while debunking or taking decisive actions against the misinformation profile. The use of celebrities and social influencers to fight the hoax against vaccine hesitancy could be a strong alternative

as most people tend to follow them. There should be involvement of government and international stakeholders. Evidence-based health care practice should be provided accurate information over social media without any political purposes or any hidden financial exploitation.

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