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Hashtag as a new weapon to resist the COVID-19 vaccination policy: a qualitative study of the anti-vaccine movement in Brazil, USA, and Indonesia

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ABSTRACT

In 2019, the World Health Organization (WHO) named the anti-vaccine movement one of the top 10 global health threats. This trend has shown that it can diminish public faith in government and increase public distrust of scientific results in the health sector, including the use of the COVID-19 vaccine. **The purpose** of this study is to examine the anti-vaccine movement on Twitter social media platform, which uses Hashtag to protest vaccination regulations in the COVID-19 pandemic. The content analysis, relationship analysis, and word cloud analysis models were used in this study, which used a **descriptive qualitative approach**. The primary data source for this study is Hashtag, which are used to focus on three aspects. First, establish which information in Brazil, the United States, and Indonesia leads the anti-vaccine COVID-19 narrative. Second, how does the Hashtag link between each country work? Third, which narrative dominates the use of Hashtag in each of the three countries? According to the findings of this study, in Brazil, 69.2% of Twitter Hashtag associated to the COVID-19 vaccination were negative, compared to 59.4% in the USA and 62.8% in Indonesia. In general, the Hashtag used in the three countries to oppose COVID-19 vaccination policies have a clear and significant relationship. In Brazil, the Hashtag #covidiot was the most popular, while in the United States, #covivaccine was the most popular, and in Indonesia, #anti-vaccine was the most popular.

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Introduction

In this digital age, people have total freedom to receive health information, including vaccine information, via the internet and social media. This syndrome is also exploited by anti-vaccine organizations to spread vaccine-related misinformation. As a result, the rise of anti-vaccine groups has become one of the major roadblocks to immunization programs for governments and health activists in many nations. The enormous popularity of social media has sparked concerns about the future impact of anti-vaccination content on vaccine refusal.¹ Vaccine misinformation is swiftly spreading on social media and has gone viral, threatening not only public health but also families, doctors, and public health activists who promote immunization.²

Previous research has indicated that the anti-vaccine movement has a negative impact on vaccine trust. The anti-vaccine movement may have aided the reintroduction of measles to the United States, according to a 2019 report.³ Vaccine mistrust is hastening the return of rare diseases to epidemic proportions, resulting in lower immunization coverage and many children who do not receive vaccines, as well as lowering public trust in government institutions and causing public skepticism of scientific findings in the health sector.⁴

This could be related to the fact that the anti-vaccine community focuses on vaccination hazards, whilst the pro-vaccine movement focuses on vaccine prevention.⁵ Currently, the search for COVID-19 anti-vaccines is ongoing and evolving as the pandemic spreads.⁶ As a result, leveraging family-

oriented personal emotional messaging to promote and execute immunizations becomes challenging for government agencies.⁷

The anti-vaccine movement and social media

Anti-vaccination is a phenomenon that has occurred in the past, particularly when infectious diseases were involved.⁸ Ward et al. discovered that scientists frequently misdefine this anti-vaccine organization since it is highly broad and often has conflicting purposes, according to his research on the safety of the swine flu vaccination, which broke out in France in 2009.⁹ Hagood and Mintzer Herlihy classify anti-vaccination activists into three categories: vaccine rejection, vaccine resistance, and vaccine doubter.¹⁰

According to Ward et al. social scientists and health professionals must be able to distinguish between the anti-vaccine movement, the marginal anti-vaccine movement, and the seasonal vaccine critical movement. The purpose of this classification is to have a better understanding of how vaccine-related discussions start and where they may become politicized.¹¹ The anti-vaccine movement arose as a result of political, cultural, and personal factors, and one common tactic used by this movement is to cast doubt on vaccine safety, press for individual's right to choose whether or not to receive vaccinations, and demand that research be conducted to address activist concerns.¹²

The public's distrust and mistrust of vaccines is one of the difficulties addressing the COVID-19 epidemic. These doubts stem from a lack of understanding, religious misinterpretation, and anti-vaccine propaganda.¹³ Furthermore, the anti-vaccine movement frequently claims that COVID-19 is tied to the government and pharmaceutical businesses, and that it serves as a pretext for the government's restrictions on civil liberties.¹⁴ The belief that COVID-19 is a medical fraud, along with a lack of trust in government institutions and evidence-based knowledge, has harmed public immunization.¹⁵

The Center for Countering Digital Hate (CCDH) report states that 31 million people on Facebook follow anti-vaccine organizations, while another 17 million watch anti-vaccine films on YouTube. According to the same study, the anti-vaccine movement generates \$1 billion in annual revenue for social media companies, with \$989 million coming from Facebook and Instagram, which advertise to 38.7 million followers of anti-vaccine accounts.¹⁶ Researchers uncovered 1,637,712 vaccine-related tweets using network analysis, with 154 pro-vaccine Hashtag and 125 anti-vaccine Hashtag; 86% of users only posted pro-vaccine Hashtag, while the remaining 12% only posted anti-vaccine Hashtag.¹⁷ While studying the anti-movement on social media, it's also critical to understand the main persons, or influencers, behind it. On social media, online influencers' voices are generally regarded as a reliable source of information that can represent the views of their followers.¹⁸

According to a study conducted in the United States (USA), the anti-vaccine movement on social media was connected to increased mother concerns about the vaccine, resulting in a decrease in child HPV vaccination rates.¹⁹ Susceptibility and severity of sickness were revealed to be the main worries of parents in Indonesia who were following the anti-vaccine movement on Facebook and making vaccine decisions.²⁰ People's attitudes have also been influenced by their experiences with vaccines, the role of health care professionals, and anti-vaccine lobbying, which began as skepticism and eventually evolved into outright refusal of vaccines.²¹ Meanwhile, in Brazil, public mistrust of politicians and the pharmaceutical business has spurred vaccine skepticism. Furthermore, a lack of trust in scientific research as well as a large amount of false information widely shared on social media are obstacles that must be overcome for Brazil to achieve communal immunity.²²

Referring to the results of the research mentioned in the previous paragraph, it is interesting to examine the anti-vaccine movement in Brazil, the United States and Indonesia. The fact that these three countries are among the five largest democracies in the world is the reason for their inclusion.²³ Information transparency, freedom of speech, and freedom of assembly are all benefits of democracy. Another explanation is that three of the top five internet users in the world are from Brazil, the United States, and Indonesia. According to a report published by *Statista*, the USA is also the largest user of the Twitter platform in the world, while Brazil is ranked fourth and Indonesia is ranked fifth.²⁴

The purpose of this study was to investigate the anti-vaccination movement on social media, which uses Hashtag to criticize vaccination policies in the fight against the COVID-19 pandemic in Brazil, the United States, and Indonesia. It will

be possible to identify what material dominates the anti-vaccine narrative in Brazil, the United States, and Indonesia, how Hashtag are related in each country, and what narrative dominates Hashtag use in these three countries using Hashtag as the major data source. Hashtag are keywords that are used to help people find things on Twitter, and they were used in this study. Hashtag is a symbol (#) that was first used as a marker for tweets related to a topic by Chris Messina, Twitter's digital marketing specialist, in the summer of 2007.²⁵ Hashtag are now used not only on Twitter, but on a variety of other social media platforms as well.

Methods

This study used a qualitative approach with a descriptive analytic method, which is seen to be the most efficient means of explaining the anti-vaccine movement on social media, particularly Twitter. The study's primary data source is a Twitter Hashtag that expresses criticism to the vaccine campaign. This strategy was used so that the data may be described in a methodical, factual, accurate, and consistent manner with the Hashtag facts. The study took place from April to December 2020.

Data collection

The data for this study was collected using NVivo 12 Plus's NCapture feature. The NCapture is a web browser add-on that records web content including website content, social media, and other content documentation like scientific articles and opinion collections from online media and social media observers. In this study, the Ncapture tool on Nvivo 12 Plus was primarily used to collect data on Twitter social media associated to Hashtag that resist vaccines in Brazil, the United States, and Indonesia.

The data obtained is then imported, coded, and analyzed to find answers to research questions (Figure 1). To identify what material dominates the anti-vaccine narrative in Brazil, the United States, and Indonesia, how is the relationship between Hashtag, and what narrative dominates the use of Hashtag in these three countries will be analyzed using three analytical models. Crosstab analysis will be used to analyze Hashtag content, visualize, and collect data/words that have similarities and differences regarding the anti-vaccine movement on Twitter. Cluster analysis will be used to analyze the relationship between Hashtag. On the other hand, word cloud analysis is used to look at narratives, phrases, or concepts that appear frequently and are commonly used as Hashtag (Figure 1).

The anti-vaccine movement in Brazil, the USA and Indonesia

Content analysis

Crosstab analysis was employed in this study for content analysis. Data from Twitter social media platform was used, which consisted of eight Hashtag and three nodes as parameters. The following is a representation of the Hashtag evaluation (Table 1):

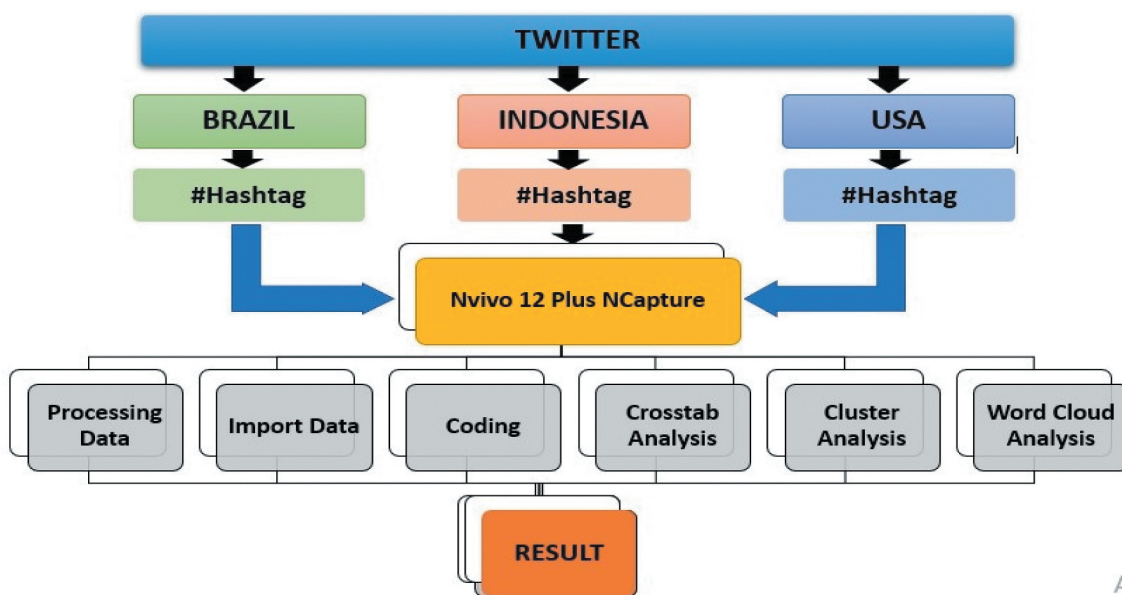


Figure 1. The process of collecting and processing data.

Table 1. Content analysis of twitter hashtag related to COVID-19 vaccine in Brazil.

Hashtag	Protest The Vaccine	Reject The Vaccine	Support The Vaccine	Total
#AntiVacc	25%	50%	25%	100%
#AntiVaccine	26,8%	47,4%	25,8%	100%
#antivaxx	26,7%	61,1%	12,2%	100%
#AntiVaxxer	16,3%	61,2%	22,4%	100%
#Covidiots	5,1%	82,7%	12,2%	100%
#NoVaccine	2%	92,9%	5%	100%
#StopVaccine	0%	100%	0%	0%
#unsafevaccines	0%	100%	0%	0%
Total	15,1%	69,2%	15,6%	100%

Source: Nvivo 12plus analysis.

The parameter has the most significant number of “protest the vaccine” #AntiVaccine with 26.8%, followed by #antivaxx with 26.7%, and #AntiVacc with 25%. There are two Hashtag whose narratives have a 100 percent percent in the parameter “Reject the Vaccine,” where the primary topic is refusing vaccines, namely #StopVaccine and #unsafevaccines, and the Hashtag #NoVaccine, which has a pretty significant percentage of 92.9%. #AntiVaccine has the greatest number with 25.8%, followed by #AntiVacc with 25%, and #AntiVaxxer with 22.4% in the parameter “Support the Vaccine,” which supports vaccinations in their content (Figure 2). The parameter has “protest the vaccine,” the most significant number acquired by #AntiVaccine with a percentage of 26.2%, followed by #CoronaHoax with a figure of 15.3%, as shown in the (Table 2.). #CovidVaccine is in third place with 8% (Table 3). Two Hashtag receive a 100% proportion in the criteria “Reject the Vaccine,” whose primary content is refusing vaccines, namely #StopVaccine and #vaccinehoax. With a percentage of 73.3%, #nolockdown was another Hashtag that gained much attention. #CovidVaccine received the most significant number in the “Support the Vaccine,” which favors vaccinations, with 43.4%, followed by #AntiVaccine with 28.2%, and #CoronaHoax with 22.4% (Figure 3).

In the “Protest the Vaccine” component, it can be seen that only one Hashtag has a value, namely #antivaccine, with a percentage of 15.3%, while the other Hashtag have no value or 0%. The “Reject the Vaccine” parameter has many Hashtag, including #antivaksin, #TolakDivaksinSinovac, #TOLAKVAKSIN, #TolakVaksin, and #tolakvaksin, all of which reject vaccines with a score of 100% (Figure 4). #antivaccine received 57.1% of the vote, while #truenormal received 25%. The maximum result was obtained #truenormal with 75% and #antivaccine with 27.6% in the “Support the Vaccine” parameter with the main text supporting the Vaccine. In comparison, other Hashtag were worth 0% (Table 3).

Relation analysis

Cluster analysis is used in this work for relationship analysis. On a scale of -1, 0, and 1, the lower limit is 0, and the upper limit is 1. A score of 1 indicates a solid association, a score of 0 suggests an ambiguous relationship, and a score of -1 indicates no relationship at all.

The top 5 gains in the cluster (Table 4) show a relationship between #AntiVaxxer and #AntiVaccine, which is in the first position with a value of .7. Furthermore, #antivax and #AntiVaccine have a link with the number .6 (Figure 2). #Covidiots is in third place with a score of .6, while #antivaxx is in fourth place with a score of .6. The fourth position goes to #Covidiots with #AntiVaccine, which has a value of .6, and the fifth place goes to #AntiVaxxer with #antivaxx, which has a value of .6 (Table 4).

There is a link between #vaccinesideeffect and #CovidVaccine with a value of .7 and is in first place in the cluster table which displays the top 5 gains (Figure 3). Furthermore, there is a .7 link between #CovidVaccine and #AntiVaccine in the second place. #vaccinesideeffects is in third place, with a score of .6. #AntiVaccine is in fourth place,

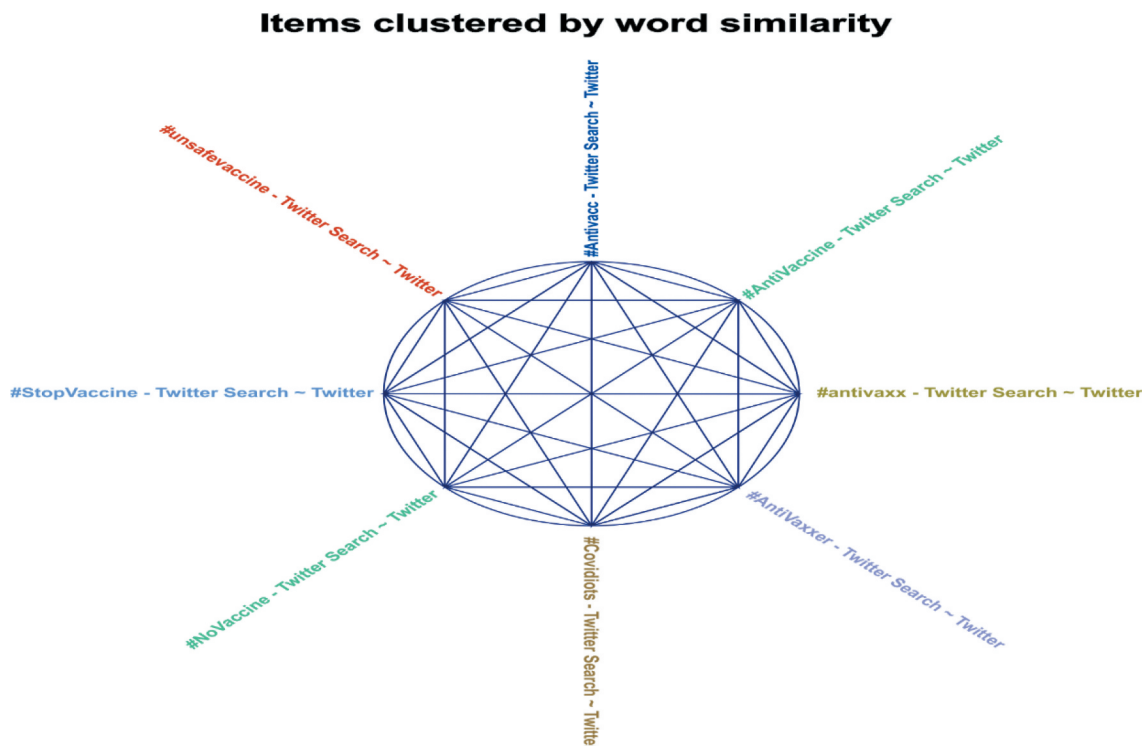


Figure 2. Cluster analysis of twitter hashtag related to COVID-19 vaccine in Brazil. Source: Nvivo 12plus Analysis.

Table 2. Content analysis of twitter hashtag related to COVID-19 vaccine in the USA.

Hashtag	Protest The Vaccine	Reject The Vaccine	Support The Vaccine	Total
#AntiVaccine	26,2%	45,4%	28,2%	100%
#CoronaHoax	15,3%	62,2%	22,4%	100%
#CovidVaccine	8%	48,4%	43,4%	100%
#nolockdown	7,8%	73,3%	18,9%	100%
#novaccination	50%	50%	0%	100%
#stopvaccine	0%	100%	0%	100%
#vaccinehoax	0%	100%	0%	100%
#vaccinesideeffects	6%	65%	29%	100%
Total	12,9%	59,4%	27,6%	100%

Source: Nvivo 12plus analysis.

Table 3. Content analysis of twitter hashtag related to COVID-19 vaccine in Indonesia.

Hashtag	Protest The Vaccine	Reject The Vaccine	Support The Vaccine	Total
#antivaccine	15,3%	57,1%	27,6%	100%
#antivaksin	0%	100%	0%	100%
#TolakDivaksinSinovac	0%	100%	0%	100%
#TOLAKVAKSIN	0%	100%	0%	100%
#tolakvaksin	0%	100%	0%	100%
#TolakVaksin	0%	100%	0%	100%
#truenormal	0%	25%	75%	100%
Total	12,4%	62,8%	24,8%	100%

Source: Nvivo 12plus analysis.

with a score of .6. #CovidVaccine is in fourth place with #CoronaHoax with a value of .6, while #vaccinesideeffec and #CoronaHoax have a relationship with a result of .6 (Table 5).

Narration analysis

Narration Analysis is a paradigm for gathering descriptions of occurrences or events and then compiling them into stories. In this study, testimonies of immunization refusal in Brazil were collected from social media. Additionally, these narratives will be evaluated to see which narratives emerge most frequently and are used as content by anti-vaccine organizations in Brazil. In the word cloud analysis, it can be observed that vaccine rejection is primarily expressed through Hashtag like #covididiots, but there are also Hashtag like #antivaxxer, #lockdown, and others (Figure 5).

Testimonies of vaccine refusal in the USA were gathered from social media for this study. These tales will also be analyzed to discover which ones appear the most frequently and are used as content by anti-vaccine groups in the USA. In the word cloud analysis, most vaccine rejections utilize Hashtag like #covivaccine, but there are also Hashtag like #heardimmunity, #lockdown, and others (Figure 6).

For this study, social media was used to obtain testimonies of vaccine refusal in Indonesia. These stories will be evaluated to see which ones appear the most frequently and are used by anti-vaccine groups in Indonesia as content. In the word cloud analysis, most vaccine rejection utilizes Hashtag like #antivaccine, but there are other Hashtag like #antivaccsin, #tolakdivaksin, and others (Figure 7).

Discussion

This study is based on how the anti-vaccine movement is particularly active on social media, with Twitter being the most popular platform used by this group. According to

Items clustered by word similarity

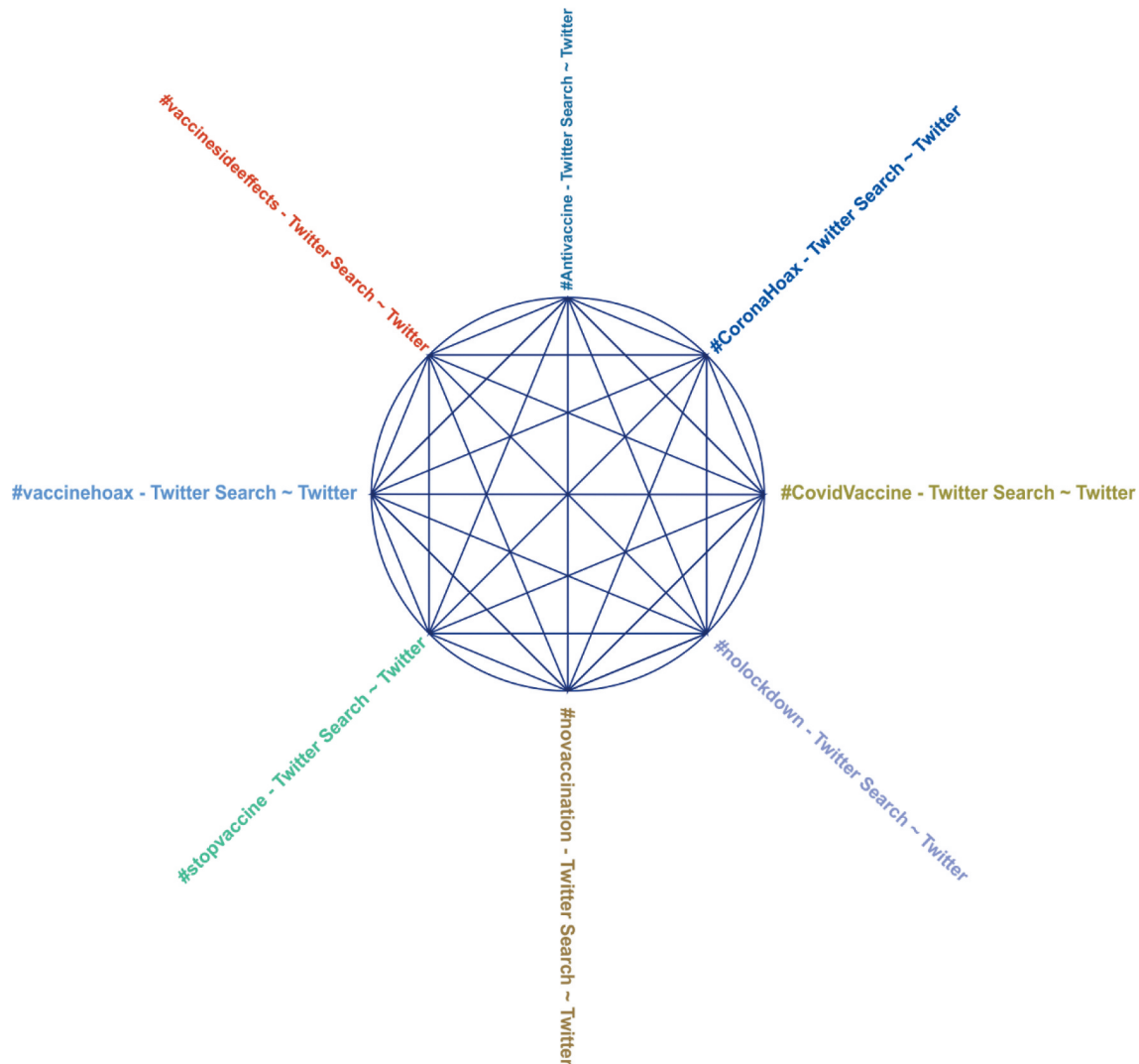


Figure 3. Cluster analysis of twitter hashtag related to COVID-19 vaccine in USA. Source: Nvivo 12plus Analysis.

content analysis, anti-vaccine groups were identified to use Hashtag including invitations to protest and reject government policy connected to COVID-19 immunization. Using Hashtag as content on Twitter is very widespread, with the expectation that the posted Hashtag will become national and worldwide hot topics. A trending Hashtag will get more attention from social media users and, in turn, will have a more significant impact on public opinion of the topics being discussed.

In this study, the relationship between Hashtag was also examined, and it was discovered that one Hashtag and another had a relationship. This indicates that anti-vaccine organizations on social media are linked to one another, at least according to the findings of this study's Pearson Correlation Coefficient model analysis. On a scale of -1 , 0 , and 1 , the lower limit in Cluster Analysis is 0 . The upper limit is 1 . 1 denotes an influential association, 0 denotes a relationship that is not readily apparent, and -1 denotes the absence of a relationship. Using the same formula to examine the

relationship between anti-vaccine content on social media in Brazil, the United States, and Indonesia, it was discovered that there is a substantial relationship between anti-vaccine groups.

Using word cloud analysis, the anti-vaccine movement's most prevalent narratives on social media oppose vaccinations and are controversial. The story is told in words, with the most popular being that vaccines are unsafe. COVID-19 is a conspiracy, not genuine, just the common cold and the business of pharmaceutical firms and black conglomerates, according to sentences commonly used before Hashtag.

The use of social media as a means to disseminate content and health information that is not supported by scientific evidence has been used by anti-vaccine groups to confuse users who access their pages.²⁶ In many cases, the reasons for refusing vaccines are due to the design of the vaccination program, the reliability of vaccine-producing sources, experience with vaccines, and the role of health workers, but it must be admitted that the anti-vaccine lobbies reinforce the attitude of those who

Items clustered by word similarity

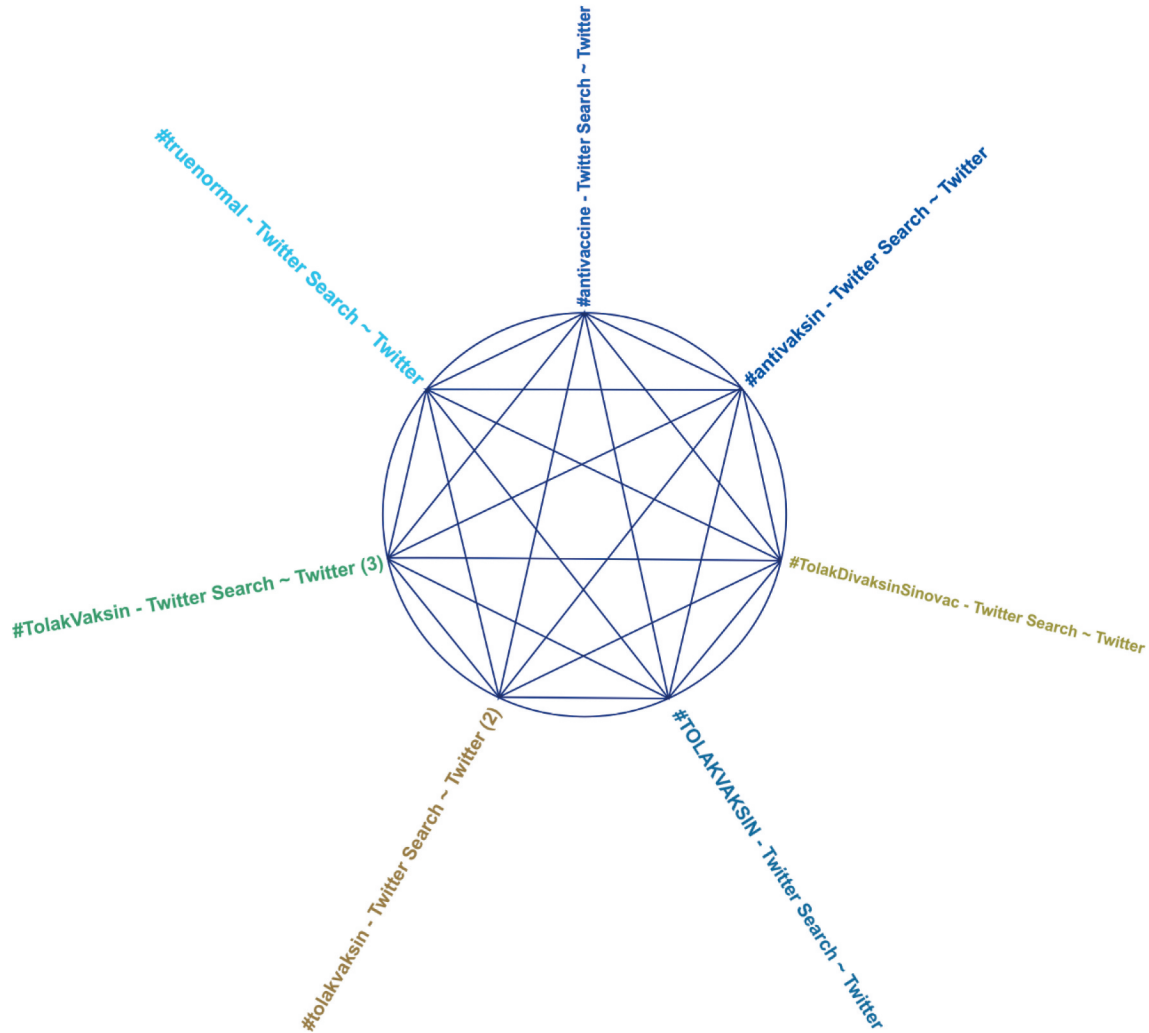


Figure 4. Cluster analysis of twitter hashtag related to COVID-19 vaccine in Indonesia. Source: Nvivo 12plus Analysis.

Table 4. The relationship between twitter hashtag related to the Covid-19 vaccine in Brazil.

Hahstag A	Hashtag B	Pearson Correlation Coefficient
#Antivaxxer	#Antivaccine	0,7
#Antivaxx	#Antivaccine	0,6
#Covidiots	#Antivaxx	0,6
#Covidiots	#Antivaccine	0,6
#Antivaxxer	#Antivaxx	0,6

Source: Nvivo 12plus Analysis.

Table 5. The relationship between twitter hashtag related to the Covid-19 vaccine in the USA.

Hahstag A	Hashtag B	Pearson Correlation Coefficient
#vaccinesideeffects	#CovidVaccine	0,7
#CovidVaccine	#AntiVaccine	0,7
#vaccinesideeffects	#AntiVaccine	0,6
#CovidVaccine	#CoronaHoax	0,6
#vaccinesideeffec	#CoronaHoax	0,6

Source: Nvivo 12plus Analysis.

Table 6. The relationship between twitter hashtag related to the Covid-19 vaccine in Indonesia.

Hahstag A	Hashtag B	Pearson Correlation Coefficient
#tolakvaksin	#TOLAKVAKSIN	1
#TolakVaksin	#TOLAKVAKSIN	1
#TolakVaksin	#tolakvaksin	1
#antivaksin	#antivaccine	0,6
#truenormal	#TOLAKVAKSIN	0,5

Source: Nvivo 12plus Analysis.

There are three evident correlations with a value of 1.00 in the Cluster Analysis, notably #tolakvaksin with #TOLAKVAKSIN, #TolakVaksin with #TOLAKVAKSIN, and #TolakVaksin with #tolakvaksin (Figure 4). Aside from that, a reasonably strong association was discovered between #antivaksin and #antivaccine, with a value of .6, and #true normal with #TOLAKVAKSIN, with a value of .5 (Table 6).

initially doubted the vaccine and end up rejecting it.²⁷ Many studies have shown that the reasons for refusing vaccination are influenced by various factors, including belief in alternative

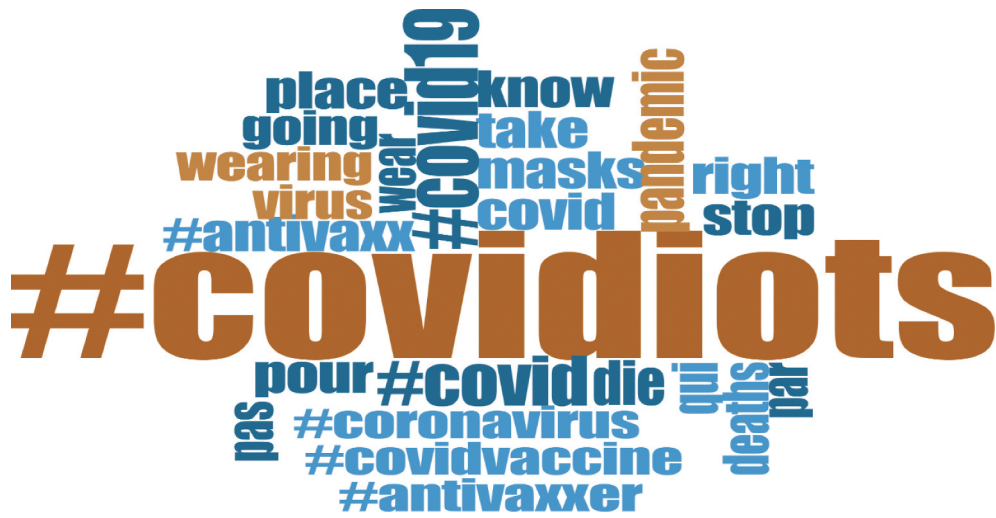


Figure 5. Word cloud analysis of twitter hashtag related to COVID-19 vaccine in Brazil. Source: Nvivo 12plus Analysis.

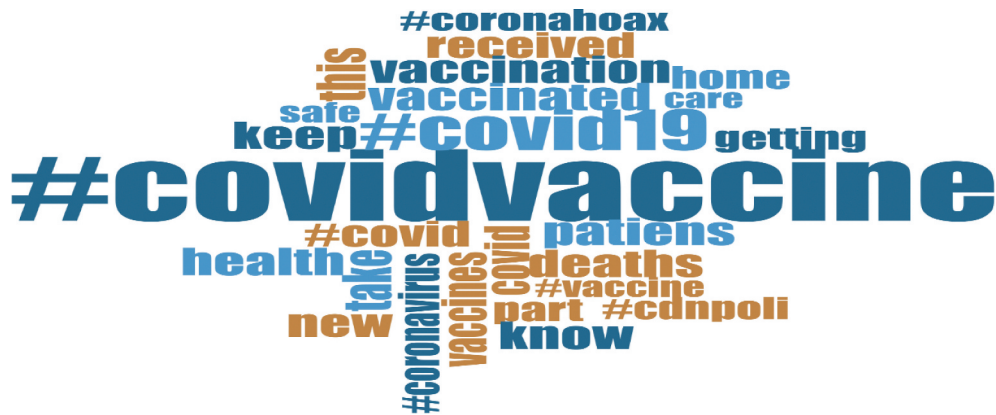


Figure 6. Word cloud analysis of twitter hashtag related to COVID-19 vaccine in the USA. Source: Nvivo 12plus Analysis.

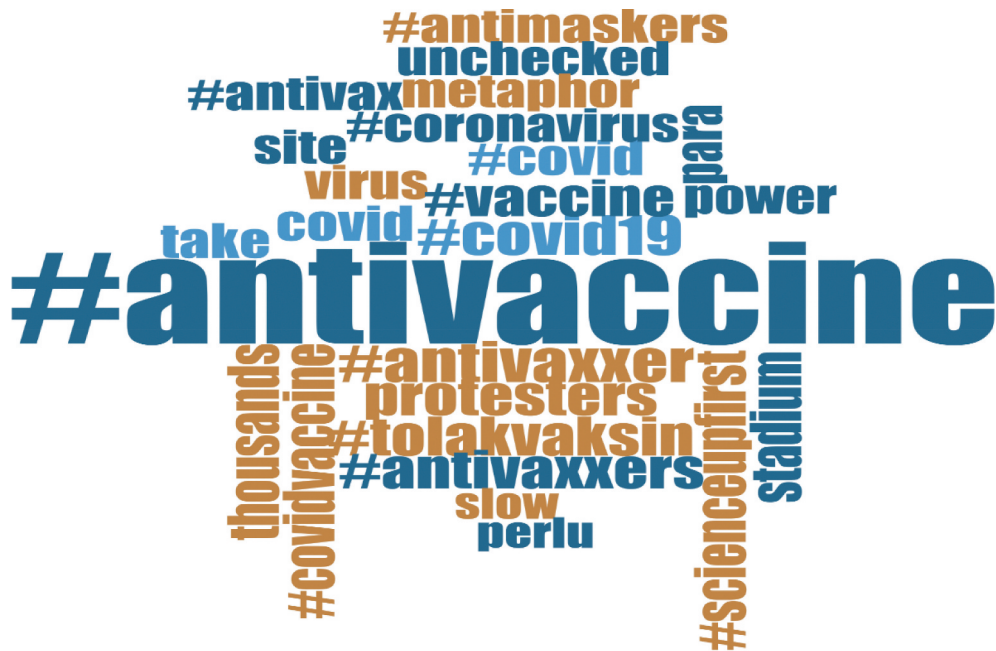


Figure 7. Word cloud analysis of twitter hashtag related to COVID-19 vaccine in Indonesia. Source: Nvivo 12plus Analysis.

medicine, belief in conspiracy theories, religious morality, personal ideology, emotional attraction or lack of trust in the authorities.²⁸ Susceptibility and disease severity are also reasons for anti-vaccine groups to make decisions regarding vaccination.²⁹ Thus, this study has strengthened and complemented previous findings that the anti-vaccine movement on social media, especially in open countries that adhere to press freedom, such as Brazil, USA and Indonesia, still exists and tries to influence government policies related to the COVID-19 vaccination program by using Hashtag as the main weapon.

The weakness of this research is that the main actors or actors who drive anti-vaccine groups in Indonesia are not found. The anti-vaccine movement in Indonesia tends to be carried out by buzzers. This can be seen from accounts that reject vaccines, are generally anonymous, and the narratives and formats used have similarities between one account and another, and are tweeted at almost the same time. In Brazil and the USA, anti-vaccine narratives can be found in the accounts of public figures, celebrities, and influential influencers, but this is not the case in Indonesia. In Indonesia, public figures, celebrities, and officials who support or oppose the government tend to agree with vaccination. Even though there are celebrities and public figures who are pro-against the anti-vaccine movement, the number is very small and inconsistent.

To stem the COVID-19 anti-vaccine movement on social media, a persuasive, massive campaign, supported by scientific evidence, and carried out by competent people must be encouraged from now on. Scientific and open vaccine development studies need to be carried out on an ongoing basis to avoid public doubts about the issue that vaccines are a business area for certain irresponsible parties. In addition, the roles of public figures, religious leaders, and community leaders are very much needed in supporting the COVID-19 vaccination program. Their influence can be used to grow public trust in the COVID-19 vaccination program.

Conclusion

According to the conclusions of this study, Hashtag that reject vaccines are relatively common in Brazil, with a rate of 69.26%, Indonesia with 62.81%, and the United States with 59.44 Hashtag that refuse vaccines. In general, Hashtag used in opposing vaccination programs in the three countries were shown to be linked. Among the five most popular Hashtag discovered, there was an evident and strong association. The Hashtag #covidiot was the most popular in Brazil, #covivaccine was the most popular in the United States, and #antivaccine was the most popular in Indonesia.

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References

- Puri N, Coomes EA, Haghbayan H, Gunaratne K. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases; 2020. pp. 2586–93. doi:10.1080/21645515.2020.1780846.
- Pan RJ. The modern plague of antivaccine extremists. *Ann Allergy Asthma Immunol.* 2020;125(1):6–7. doi:10.1016/j.ana.2020.01.015.
- Hotez PJ. COVID19 meets the antivaccine movement. *Microbes Infect.* 2020;22(4–5):162–64. Elsevier Masson SAS. doi:10.1016/j.micinf.2020.05.010.
- Pullan S, Dey M. Vaccine hesitancy and anti-vaccination in the time of COVID-19: a Google Trends analysis. *Vaccine.* 2021;39(14):1877–81. doi:10.1016/j.vaccine.2021.03.019.
- Meilani D, Martha E, Pratomo H, Hasanah IJ, Sopamena Y, Rungreangkulkij S. Analysis of measles vaccination refusal on social media (Facebook) among anti-vaccine communities in Indonesia. *Kesmas.* 2021;16(1):21–27. doi:10.21109/KESMAS.V16I1.3478.
- Izzati AN, Utomo B, Indarwati R. Factors related to vaccine hesitancy in anti-vaccine group on Facebook. *J Ners.* 2020; eISSN(2):2020. doi:10.20473/jn.v15i2.18907.
- Germani F, Biller-Andorno N. The anti-vaccination infodemic on social media: a behavioral analysis. *PLoS One.* 2021;16(3): e0247642. doi:10.1371/journal.pone.0247642.
- Ortiz-Sánchez E, Velando-Soriano A, Pradas-Hernández L, Vargas-Román K, Gómez-Urquiza JL, Cañadas-De la Fuente GA, Albendín-García L. Analysis of the anti-vaccine movement in social networks: a systematic review. *Int J Environ Res Public Health.* 2020;17(15):1–11. MDPI AG. doi:10.3390/ijerph17155394.
- Benecke O, DeYoung SE. Anti-vaccine decision-making and measles resurgence in the United States. *Glob Pediatr Heal.* 2019;6:2333794X19862949. doi:10.1177/2333794X19862949.
- Wilson SL, Wiysonge C. Social media and vaccine hesitancy. *BMJ Glob Heal.* 2020;5(10). doi:10.1136/bmjgh-2020-004206.
- Milošević dorđević J, Mari S, Vdović M, Milošević A. Links between conspiracy beliefs, vaccine knowledge, and trust: anti-vaccine behavior of Serbian adults. *Soc Sci Med.* 2021;277:113930. doi:10.1016/j.socscimed.2021.113930.
- Gunaratne K, Coomes EA, Haghbayan H. Temporal trends in anti-vaccine discourse on Twitter. *Vaccine.* 2019;37(35):4867–71. doi:10.1016/j.vaccine.2019.06.086.
- Argyris YA, Kim Y, Roscizewski A, Song W. The mediating role of vaccine hesitancy between maternal engagement with anti- and pro-vaccine social media posts and adolescent HPV-vaccine uptake rates in the US: the perspective of loss aversion in emotion-laden decision circumstances. *Soc Sci Med.* 2021 May;114043. doi:10.1016/j.socscimed.2021.114043.
- Smith TC, Reiss DR. Digging the rabbit hole, COVID-19 edition: anti-vaccine themes and the discourse around COVID-19. *Microbes Infect.* 2020;22(10):608–10. doi:10.1016/j.micinf.2020.11.001.
- Clift K, Rizzolo D. Vaccine myths and misconceptions. *JAAPA.* 2014 Aug;27(8):21–5; quiz 26. doi:10.1097/01.JAA.0000451873.94189.56.
- Featherstone JD, Barnett GA, Ruiz JB, Zhuang Y, Millam BJ. Exploring childhood anti-vaccine and pro-vaccine communities on twitter – a perspective from influential users. *Online Soc Networks Media.* 2020;20:100105. doi:10.1016/J.OSNEM.2020.100105.

17. Gandhi CK, Patel J, Zhan X. Trend of influenza vaccine Facebook posts in last 4 years: a content analysis. *Am J Infect Control*. 2020;48(4):361–67. doi:10.1016/J.AJIC.2020.01.010.
18. Hussain A, Ali S, Ahmed M, Hussain S. The anti-vaccination movement: a regression in modern medicine. *Cureus*. 2018;10(7). doi:10.7759/CUREUS.2919.
19. Ward JK. Rethinking the antivaccine movement concept: a case study of public criticism of the swine flu vaccine's safety in France. *Soc Sci Med*. 2016;159:48–57. doi:10.1016/j.socscimed.2016.05.003.
20. Hagood EA, Herlihy SM. Addressing heterogeneous parental concerns about vaccination with a multiple-source model. *Hum Vaccines Immunother*. 2013;9(8):1790–94. doi:10.4161/HV.24888.
21. Powell K. Facing anti-vaccine movements: Myths and facts about adverse events. *Int J Infect Dis*. 2012;16:e57–e58. doi:10.1016/J.IJID.2012.05.141.
22. Ullah I, Khan KS, Tahir MJ, Ahmed A, Harapan H. Myths and conspiracy theories on vaccines and COVID-19: potential effect on global vaccine refusals. *Vacunas*. 2021;22(2):93–97. doi:10.1016/J.VACUN.2021.01.001.
23. Burki T. The online anti-vaccine movement in the age of COVID-19. *Lancet Digit Heal*. 2020;2(10):e504–e505. doi:10.1016/S2589-7500(20)30227-2.
24. Leader AE, Burke-Garcia A, Massey PM, Roark JB. Understanding the messages and motivation of vaccine hesitant or refusing social media influencers. *Vaccine*. 2021;39(2):350–56. doi:10.1016/J.VACCINE.2020.11.058.
25. Bivar GCC, De Aguiar MESC, Santos RVC, Cardoso PRG. Covid-19, the anti-vaccine movement and immunization challenges in Brazil. *Sci Med (Porto Alegre)*. 2021;31(1):e39425. doi:10.15448/1980-6108.2021.1.39425.
26. HITC. The world's 7 largest democracies – where do America and India fit in?; 2017. <https://www.hitc.com/en-gb/2017/10/22/the-worlds-7-largest-democracies-where-do-america-and-india-fit/>.
27. statista.com. • Twitter: most users by country | Statista; 2021. [Online]. <https://www.statista.com/statistics/242606/number-of-active-twitter-users-in-selected-countries/>.
28. glints.com. Hashtags: understanding and how to use it in marketing; Nov 2021. <https://glints.com/id/lowongan/hashtag-adalah/#.Yd1C5I4zbIV>.
29. Ortiz-Sánchez E, Velando-Soriano A, Pradas-Hernández L, Vargas-Román K, Gómez-Urquiza JL, Albendín-García L. Analysis of the anti-vaccine movement in social networks: a systematic review. *Int J Environ Res Public Heal*. 2020;17(15):5394. doi:10.3390/IJERPH17155394.