PUBLIC SENTIMENT TOWARDS THE COVID-19 VACCINE BOOSTER: TWITTER DATA ANALYSIS

Nurul Ulya Luthfiyana, Dewa Ngakan Gde Wahyu Mahatma Putra, Adistha Eka Noveyani

Faculty of Public Health, Universitas Jember, Indonesia

ABSTRACT

Background: COVID-19 vaccines are one of the most effective ways to prevent COVID-19 infection, and vaccine booster doses are crucial to increase immunity at a community level. However, public prejudice, as reflected on social media, may significantly impact the implementation of vaccination programs. This study aimed to investigate the sentiment of the COVID-19 vaccine booster using sentiment analysis.
Subjects and Method: This observational study collected Indonesian tweets containing COVID-19 vaccine booster keywords. We retrieved 2,201 tweets, and performed sentiment analysis using the Naïve Bayes Classifier model and identified public-concerned topics related to each sentiment.
Results: 22.67% of tweets were negative sentiments, 40.79% were neutral sentiments, and 36.52% were positive sentiments toward vaccine boosters. The neutral sentiment is mainly concerned with information and vaccination service sites. Positive sentiment focused on the effectiveness and implementation of health protocol even after booster vaccination. While negative sentiment mainly concerned booster vaccine unavailability and the side effects of vaccine booster
Conclusion: Positive sentiment towards vaccine boosters is dominant compared to negative sentiment. Topic negative view indicated that government and policymakers should be concerned about booster vaccine availability.

Keywords: COVID-19, vaccine, booster, sentiment, Twitter

Correspondence:
Nurul Ulya Luthfiyana. Faculty of Public Health, Universitas Jember. Jalan Kalimantan I/93, Kampus Tegal Boto, Jember. Email: ulya.luthfiyana@unej.ac.id

BACKGROUND

A new type of coronavirus found in humans since an extraordinary event appeared in Wuhan, China, in December 2019, was later named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV2) and caused Coronavirus Disease-2019 (COVID-19). COVID-19 has become a global pandemic in 234 countries worldwide since then (World Health Organization, 2020). Vaccination is the administration of vaccines to actively generate or increase a person's immunity against a disease so that if one day they are exposed to the disease, they will not get sick or only experience mild illness and will not become a source of transmission. COVID-19 vaccination services are carried out at Health Service Facilities owned by the Central Government, Provincial Governments, Regency/City Governments, or the public/private sector that meet the requirements (Task Force for the Acceleration of Handling COVID-19, 2020).

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Indonesia started the third dose of the booster vaccination program on Wednesday, January 12, 2022. This program is one form of further effort from primary vaccination or total doses for one time or two injections depending on the type of vaccine. A booster vaccination is an effort to restore decreased immunity and clinical protection in the population based on the serosurvey results. In terms of health, there are at least three important reasons.

First, there is a tendency to decrease the number of antibodies six months after vaccination, especially during the emergence of new Covid-19 variants, including the Omicron variant. The systematic review and meta-regression analysis study (Feikin et al., 2022) shows that the effectiveness of 4 vaccines that have received Emergency Use Listing from WHO has decreased by 8% in activity in the last six months in all age groups. At the same time, for people aged 50 years and over, there was a 10% decrease in the vaccine's effectiveness and 32% in preventing the appearance of symptoms, respecttively. Second, as a form of effort to adapt people to live during the COVID-19 pandemic for long-term health. And third, fulfill every Indonesian's right to access vaccines to protect themselves and the community (World Health Organization, 2021).

The emergence of a COVID-19 vaccine which the government is now pursuing, has become a byword in social media networks. Indonesia is the 5th most active social media user in the world. Social media is a source of digital health data. Still, it has yet to be widely used to study social, public health, and economic changes efficiently and can ultimately be used as a basis for decision-making, one of which is Twitter. Twitter is one social media with microblogging platform that provides a place for the public to express their opinions and respond to events that occur up to date with a total of 500 million tweets each day in the world (Sayce, 2022). With a large number of tweets, a lot of data can be collected and analyzed, which can be used as a basis for making various policies. What can use one method of analyzing tweet text data is sentiment analysis.

Sentiment analysis is a field of research analyzing the public's opinion, evaluation, assessment, attitude, and emotion toward an entity, such as products, services, organizations, individuals, issues, events, and topics. The main focus of the analysis is to express sentiments that include positive and negative opinions (Liu, 2012). Sentiment analysis is used to classify the opinions of positive and negative of consumers who use the product to speed up and simplify the companies' task to revisit its products' shortcomings (Andrianti, 2018). Classifying sentiment analysis using the Naïve Bayes Classifier method can provide a sentiment accuracy rate of up to 90% (Yunanto and Yulianto, 2022). Therefore, this research analyzes tweet sentiment about vaccine boosters using the Naïve Bayes Classifier method.

SUBJECTS AND METHOD

1. Study Design

The method used in this research was an observational study to analyze sentiments about COVID-19 vaccine

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booster on social media, which is Twitter.

2. Population and Sample

This research collected Indonesian tweets containing “vaccine booster” keywords from October 22, 2022, through November 12, 2022.

3. Study Variables

The study variables were sentiment

4. Operational Definition of Variables

The sentiment is an attitude, thought, or judgment prompted by feeling

5. Instruments

Instruments or tools in the form of applications used in this study, namely R Studio version 2022.02.4, and RapidMiner version 5.3.

6. Data Analysis

The data is collected using text mining that comes from documents or text from a website (web scraping) on the Twitter website using the Application Programming Interface (API) feature. The results then were carried out in the data preprocessing stage, which consisted: 1) Tokenizing; separating characters without explicit information such as space characters, punctuation marks, and certain characters, 2) Case folding; converting all characters or sentences into lowercase letters to simplify the search because not all characters are consistent in the use of capital letters (Rais et al., 2022), 3) Remove punctuation, 4) Removing duplicates data, 5) Stop word removal; process all words that have no meaning such as the words 'and', 'in', 'by' are removed so that only meaningful words are left (Syahputra et al., 2022).

After the preprocessing stage, the following process manually labeled the sentiment (negative, neutral, positive) on 500 data to obtain "training data". This training data was used by machine learning to learn which tweets have negative, neutral, and positive sentiments so that other tweet data can be automatically labeled with sentiment by machine learning.

The following process classified tweets into negative, neutral, and positive sentiments using the Naïve Bayes Classifier. The last process was assigning a value to each word by giving a weight using the Terms Frequency-Inverse Document Frequency (TF-IDF) algorithm to calculate how many occurrences of words were in the dataset (Syahputra et al., 2022). All the data analysis stages can be seen in Figure 1.

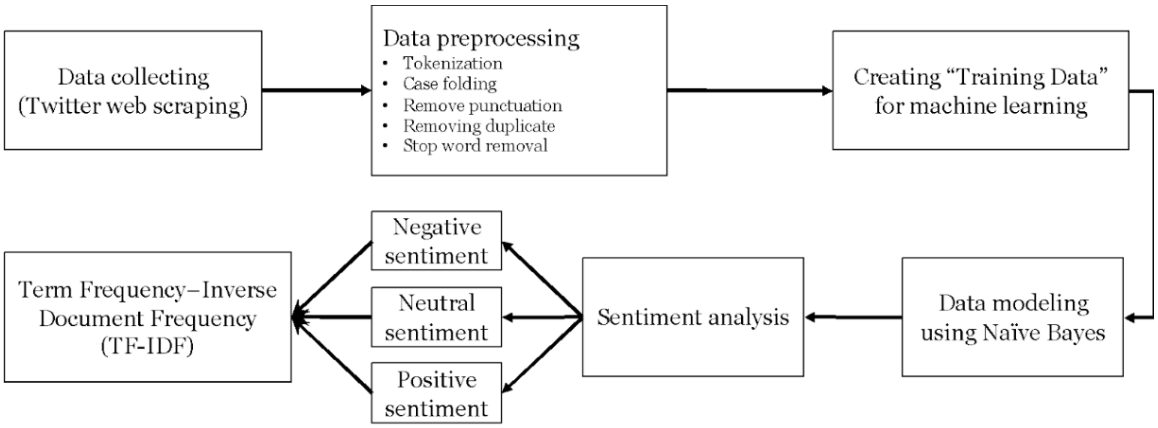

Figure 1. Data Collecting and Analysis Stage

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RESULTS

The collection of tweet data with the keywords "Vaccine Booster" was carried out from October 22, 2022, through November 12, 2022, resulting in 4,204 data. The tweet data then went through a data preprocessing and cleaning process so that the remaining 2,201 data were left. The next step was manually labeling 500 tweets with the sentiment (negative, neutral, positive) to obtain "training data". This training data was used by machine learning to learn which tweets have negative, neutral, and positive sentiments so that another 1,701 tweets data can be automatically labeled with sentiment by machine learning. A total of 2,201 tweets analyzed by sentiment using the Naïve Bayes Classifier model has obtained: 22.67% of tweets were negative sentiment, 40.79% of tweets were neutral sentiment, and 36.52% of tweets were positive sentiment about vaccine booster. The sentiment polarity distribution of the tweets is shown in Figure 2.

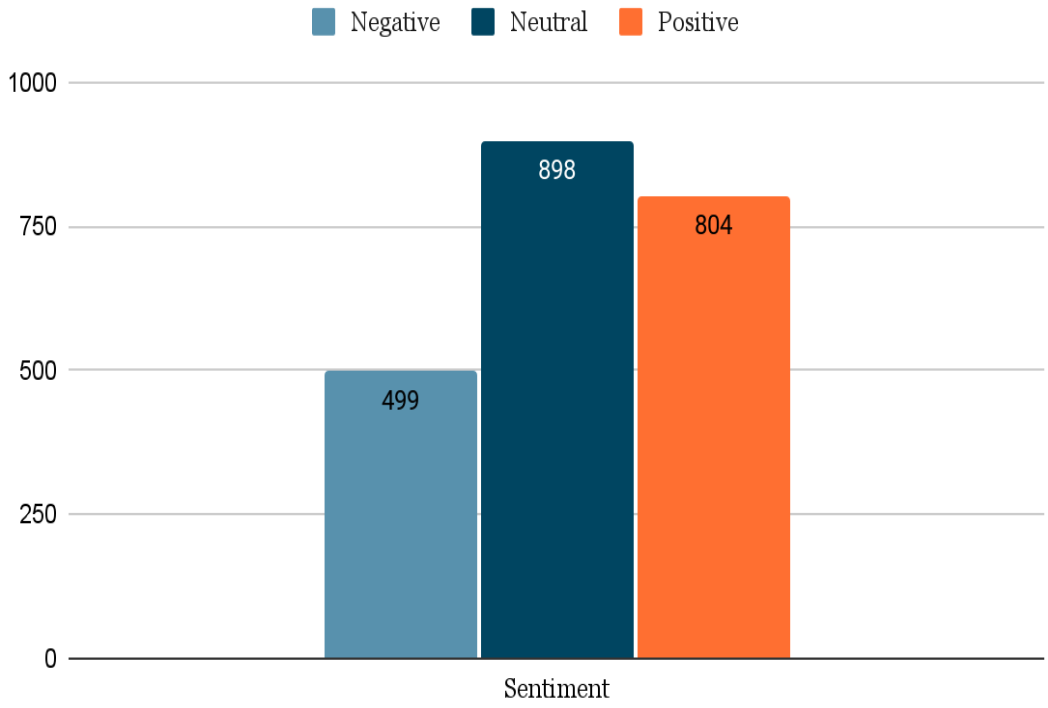

Figure 2. Sentiment Polarity Distribution of the Tweets about Vaccine Booster

We analyzed the top words in the tweets related to each sentiment. As shown in Figure 3, neutral sentiment mainly concerned information and vaccination service sites. Positive sentiment focused on the effectiveness and implementation of health protocol even after booster vaccination. While negative view mainly concerned vaccine booster unavailability and the side effects of a vaccine booster.

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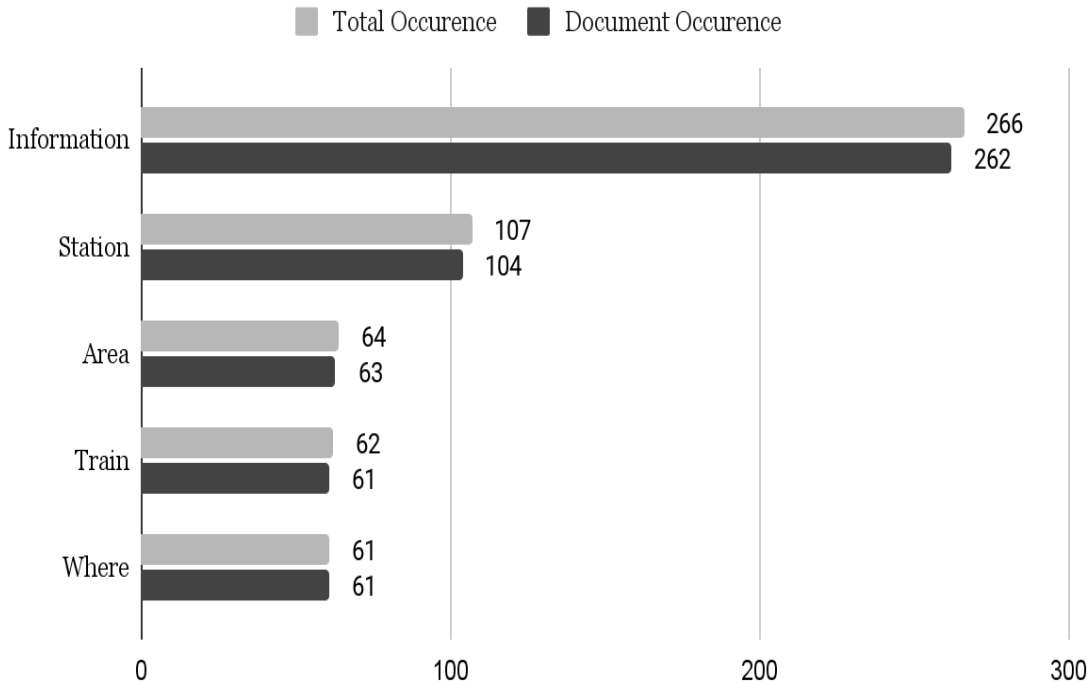
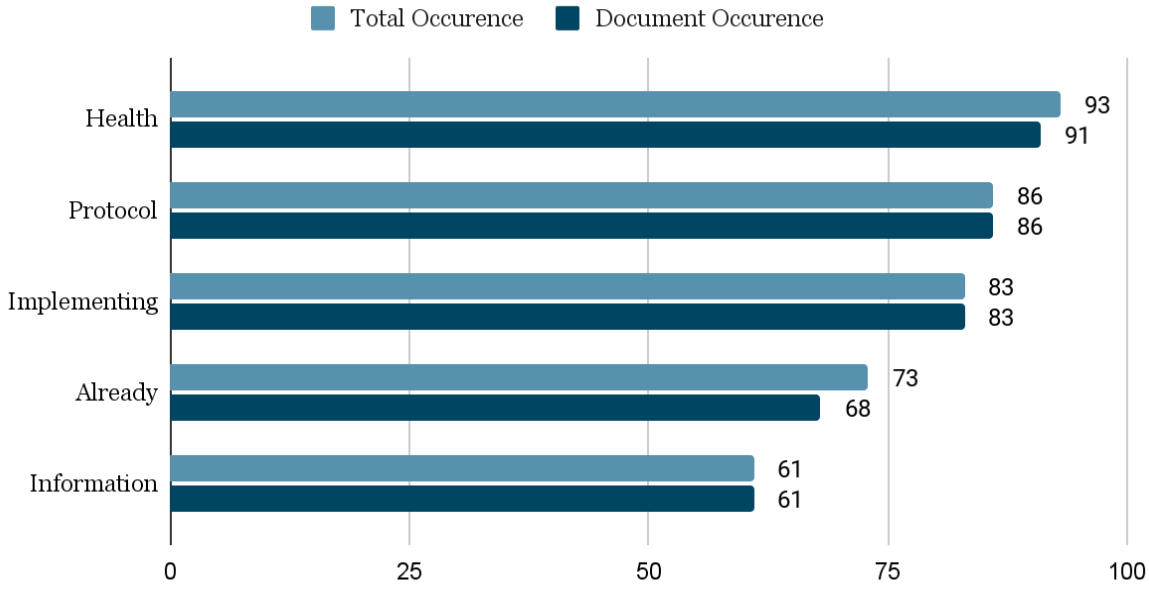


(A)



(B)

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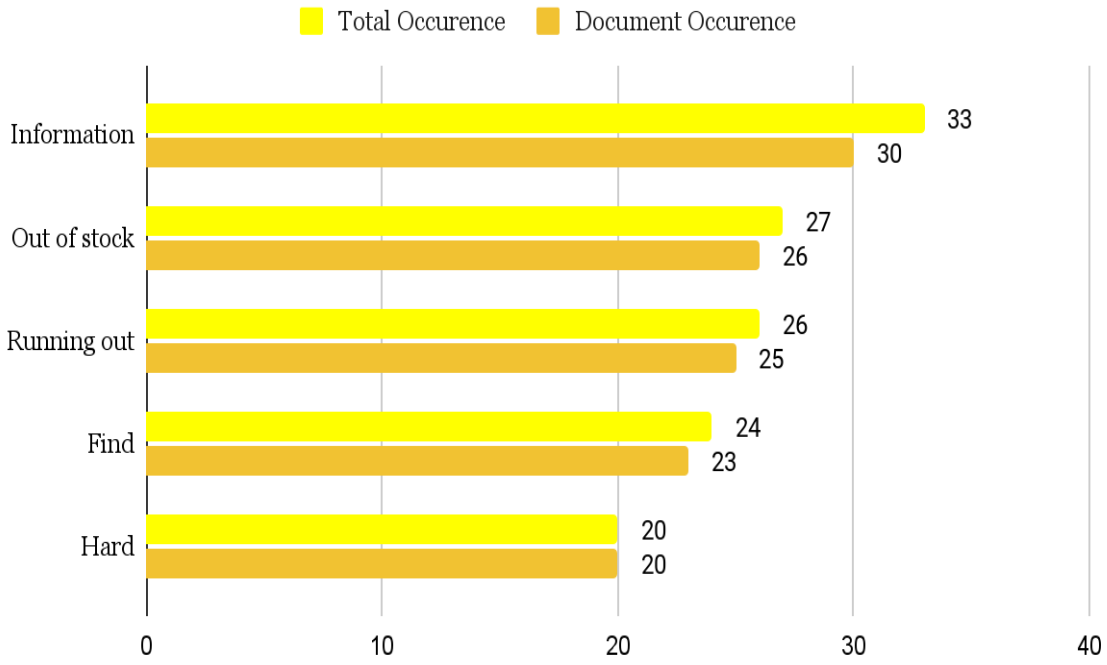

(C)

Figure 3. Top 5 Words (translated into English) related to "Vaccine Booster" in Neutral Sentiment (A), Positive Sentiment (B), and Negative Sentiment (C) Tweets.

DISCUSSION

This study examined Indonesian public sentiment from Twitter data that covered discussions from October 22 to November 12, 2022, when the coverage of COVID-19 Booster vaccination was only 28.01% of the national target (Ministry of Health Republic of Indonesia, 2022). The total number of tweets about vaccine boosters is still increasing daily, which might have been primarily driven by program implementation and regulations related to booster vaccination. The sentiments of most tweets were neutral, with positive sentiment exceeding negative sentiment in total. What also collected the top words for tweets related to each sentiment.

Many people are seeking information on the booster vaccination service they need and have a neutral sentiment. Without putting aside neutral sentiments, the results of this study were consistent with the published literature. Fauzan and Hikmah (2022) research explored the COVID-19 vaccination, and Rozaqi et al. (2022) research focus on booster vaccination stated that positive sentiment dominates over negative sentiment. This showed the existence of COVID-19 vaccination, including the vaccine booster in Indonesia, has received a positive response from the public.

Domination of the positive sentiment is expected due to better public health literacy, as seen from the many

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words that appear on the positive sentiment. Heiniger et al. (2022) stated that health literacy was a factor in getting vaccinated. Other research in Arab Saudi showed that perceptions that receiving the third (booster) dose reduces the risk of COVID-19 infection and associated complications (Alobaidi and Hashim, 2022). There has been a lot of evidence that mentions the effectiveness of vaccine boosters. The results of the study by Zhu et al. (2022) explained that SARS-CoV-2 infection rates among subjects who received a booster shot reduced compared with those who did not receive a booster shot of the coronavirus disease (COVID-19) vaccine. Indeed, vaccine boosters have been proven to provide immunity, and the implementation of health protocols must also be carried out. Although public sentiment was dominated by positive sentiment, there was still quite a lot of publics who had negative sentiment.

Negative public sentiment was related to obstacles in the availability of vaccines and government regulations regarding travel requirements. On October 10, 2022, the Papua Provincial COVID-19 Task Force announced that COVID-19 booster vaccine doses were unavailable for almost a month, and it is also experienced by other provinces (Government of Papua Province, 2022). Increasing vaccination coverage requires ensuring vaccine availability at vaccination sites (Afrifa-Anane et al., 2022). Even though the public's interest is high enough to get vaccinations, especially boosters, this is because booster vaccination is required for traveling outside the region. The government requires domestic travelers to get a third dose of the COVID-19 vaccine or a vaccine booster as the latest requirement.

This rule was stated in the Circular Letter (SE) of the COVID-19 Task Force No. 24/2022, which has also been followed up by the Ministry of Transportation (Task Force for the Acceleration of Handling COVID-19, 2022). In addition, the negative sentiment was also caused by the side effects of the vaccine booster. The results of research in Indonesia by (Maryani et al., 2022) explained that booster vaccination's most common frequency effects include pain at the injection site, muscle aches, headache, fever, joint pain, and fatigue.

The popularity of social media platforms benefits the government by enabling the monitoring of public sentiment regarding vaccine boosters. This can provide up-to-date information useful for more effective policymaking and establish confidence in vaccine boosters to maximize vaccine uptake. However, our data may only be representative of some of the popularion, especially the older generations. Positive sentiment is indeed more dominant when compared to negative sentiment, but parsing negative sentiments needs attention. Government and policymakers should be concerned about booster vaccine availability and provide more evidence about the effectiveness and safety of vaccines.

AUTHOR CONTRIBUTIONS

Conceptualization and data curation Nurul Ulya Luthfiyana and Adistha Eka Noveyani; methodology and data analysis, Dewa Ngakan Gde Wahyu Mahatma Putra. All listed authors

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contributed significantly to the creation of this manuscript. All authors have read and agreed to the published version of the manuscript.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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