Social Media Data Analytics for Outbreak Risk Communication: Public Attention on the "New Normal" During the COVID-19 Pandemic in Indonesia

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ABSTRACT

Background: After two months of implementing a partial lockdown, the Indonesian government had announced the "New Normal" policy to prevent a further economic crash in the country. This policy received many critics, as Indonesia still experiencing a fluctuated number of infected cases. Understanding public perception through effective risk communication can assist the government in relaying an appropriate message to improve people's compliance and to avoid further disease spread.

Objective: This study observed how risk communication using social media platforms like Twitter could be adopted to measure public attention on COVID-19 related issues "New Normal".

Method: From May 21 to June 18, 2020, we archived all tweets related to COVID-19 containing keywords: "#NewNormal", and "New Normal" using Drone Emprit Academy (DEA) engine. DEA search API collected all requested tweets and described the cumulative tweets for trend analysis, word segmentation, and word frequency. We further analyzed the public perception using sentiment analysis and identified the predominant tweets using emotion analysis.

Result: We collected 284,216 tweets from 137,057 active users. From the trend analysis, we observed three stages of the changing trend of the public's attention on the "New Normal". Results from the sentiment analysis indicate that more than half of the population (52%) had a "positive" sentiment towards the "New Normal" issues while only 41% of them had a "negative" perception. Our study also demonstrated the public's sentiment trend has gradually shifted from "negative" to "positive" due to the influence of both the government actions and the spread of the disease. A more detailed analysis of the emotion analysis showed that the majority of the public emotions (77.6%) relied on the emotion of "trust", "anticipation", and "joy". Meanwhile, people were also surprised (8.62%) that the Indonesian government progressed to the "New Normal" concept despite a fluctuating number of cases.

Conclusion: Our findings offer an opportunity for the government to use Twitter in the process of quick decision-making and policy evaluation during uncertain times in response to the COVID-19 pandemic.

1. Introduction

For over 100 days, the whole world has been fighting against the coronavirus disease 2019 (COVID-19) pandemic with various trends among different or even within the same regions [1]. Some countries show positive signals in terms of a declining number

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of new cases [2]. Meanwhile, other countries reported having an upward trend of new cases that continue to climb to their peak. Moreover, some other countries affected early by the pandemic are starting to see recurrent cases.

Meanwhile in Indonesia, it was just about 3 months after the government announced Indonesia's first two confirmed cases of COVID-19 in the capital city, the number suddenly rise to 45,891 cases, the highest in the Southeast Asia region [1,3]. *Severe acute respiratory syndrome coronavirus* 2 (SARS-CoV-2), the strain of coronavirus that causes COVID-19, had spread across all 34 provinces in Indonesia [4]. In terms of death numbers, more than 2,000 people in Indonesia have died due to SARS-CoV-2. This number may be much higher as there is still a possibility of an under-reported case number in the country due to asymptomatic infection [4]. Moreover, as the world's fourth most populous country, Indonesia's testing rate remains low. So far up to June 22, Indonesia only conducted 639,385 tests against 273 million population, or around 2,338 tests per million population [1]. Therefore, some of the suspected cases died either before being tested or while waiting for the test result.

Acknowledging the risk, starting in April 2020, the Indonesian government had released large-scale social restrictions (Indonesian: *Pembatasan Sosial Berskala Besar*, locally abbreviated as PSBB) which bans gathering of more than five people [4]. PSBB is equal to partial lockdown, which requires offices, schools, places of worship, and public spaces to close [4]. At the same time, for countries who had successfully reduce the transmission of coronavirus, they began to transform towards a "New Normal".

The terminology of "New Normal" refers to the changes of a certain lifestyle following a crisis that is different from the prior condition. This term has been increasingly used during the COVID-19 pandemic as people have to adjust to a new behavior introduced by the WHO which includes wearing masks, washing hands frequently, physical distancing, etc., to mitigate risk and prevent virus transmission [5]. Since SARS-CoV-2 is very contagious, the WHO implied the government must ensure the COVID-19 transmission has been controlled in the country before transform towards a "New Normal" [4].

However, weighed under the burden of economic growth, the Indonesian government progressed to adapting the protocol of "New Normal" by easing restrictions two months after implementing PSBB [4]. This policy received so many critics because cases are still increasing due to people's poor compliance with physical distancing and wearing masks along with a lack of enforcement and policy inconsistencies [4].

To help bridge the gap between government actions and public response during the COVID-19 outbreak, the WHO has issued an interim guideline, requiring countries to perform effective risk communication [6,7]. Risk communication is the dissemination of real-time information from public health officials or experts to the public at risk so that they can use the information to mitigate those risks [8]. The goal of risk communication is to raise public awareness, share vital information, improve preparedness and response, encourage protective behavior, and increase risk mitigation [8,9].

Risk communication uses a diverse range of communication actions and channels to generate risk messages simultaneously to the affected population [8]. It requires reliable actions delivered through trusted communication channels to reduce public anxiety and avoid misinformation. In the case of the COVID-19 pandemic, the uncertainty about the virus, its origins, signs, prevention, and management has created massive public perceptions as there are so many sources and information need to be absorbed by the affected population. Nowadays, with the rapid spread of mobile phones and internet technology, social media have a great role to ensure successful risk communication during a pandemic [6,10].

Social media can play a critical role in shaping public perception during health events such as global pandemic [11]. It offers a great opportunity for public health officials and experts to quickly broadcast vital information across a large number of people. It can serve as conversation channel that can collect public perceptions towards the risk messages [9,11]. It can also be the source of false and misleading information [12]. Therefore, social media can be a potential benefit and also a barrier to establish effective risk communication strategies and responses.

Twitter is one of the social media platforms, which allows users to exchange ideas and discuss various topics [13,14]. Other studies also revealed how the public using the Twitter platform to express their feelings and perceptions during previous emerging infectious disease outbreaks [15–17]. With the number of Twitter users in Indonesia that reached 11.3 million users [18], it offers the opportunity to learn how the public responds to government risk communication messages and epidemic control measures [19]. This paper studies public attention on the "New Normal" implementation during the coronavirus outbreak in Indonesia. We used Twitter-based data analytics to analyze public perspectives and emotional tendencies related to "New Normal" implementation so that the government can build trust and respond appropriately to control the disease outbreak.

2. Methods

2.1. Overview

This research collected data from Twitter using Twitter Crawling technique by Drone Emprit Academy (DEA) engine (https://dea.uii.ac.id/) developed by Media Kernel Indonesia [20]. Drone Emprit is a big data system that serves to capture and monitor conversations on social media and online platforms. We analyzed the frequency and the trend of selected keywords related to COVID-19: "#NewNormal", and "New Normal". DEA provides various features including the Twitter crawl, training, and learning, analytics, reporting, demography analysis, etc. [21,22].

2.2. Data collection and processing

We gathered Twitter conversations from May 21, 2020, at 12.00 AM until June 18, 2020, at 11:59 PM Western Indonesia Time (GMT+7). DEA system uses the Application Program Interface (API) service from the Twitter platform to gather conversations in real-time using the streaming method [23]. The Twitter developer provides Twitter Search API to obtain near-real-time access to a collection of recent tweets published in the past 7 days filtering via a specific query [21,22]. We restricted tweets to "Indonesian language" and "New Normal" keywords as our monitoring subject and assigned them to DEA search API to gather the requested tweets. DEA Big Data Architecture Framework (Fig. 1) collecting data from Twitter Streaming and Twitter Crawl and processing into the server index based on the SOLR system [21].

2.3. Data analysis

All processed tweets (including mention, retweet, and reply) were plotted using cumulative search volume to explore public perception towards "New Normal". DEA engine then identified the public attention using word frequency and sentiment analysis (positive, negative, or neutral) and predominant of tweets using emotion analysis based on Plutchik's Wheel of Emotions (joy, fear, anticipation, anger, disgust, sadness, surprise, and trust). DEA sentiment analysis built using a machine learning approach through a supervised learning process and then analyzed using probabilistic classifiers [21,22,24]. This classifier will determine whether the
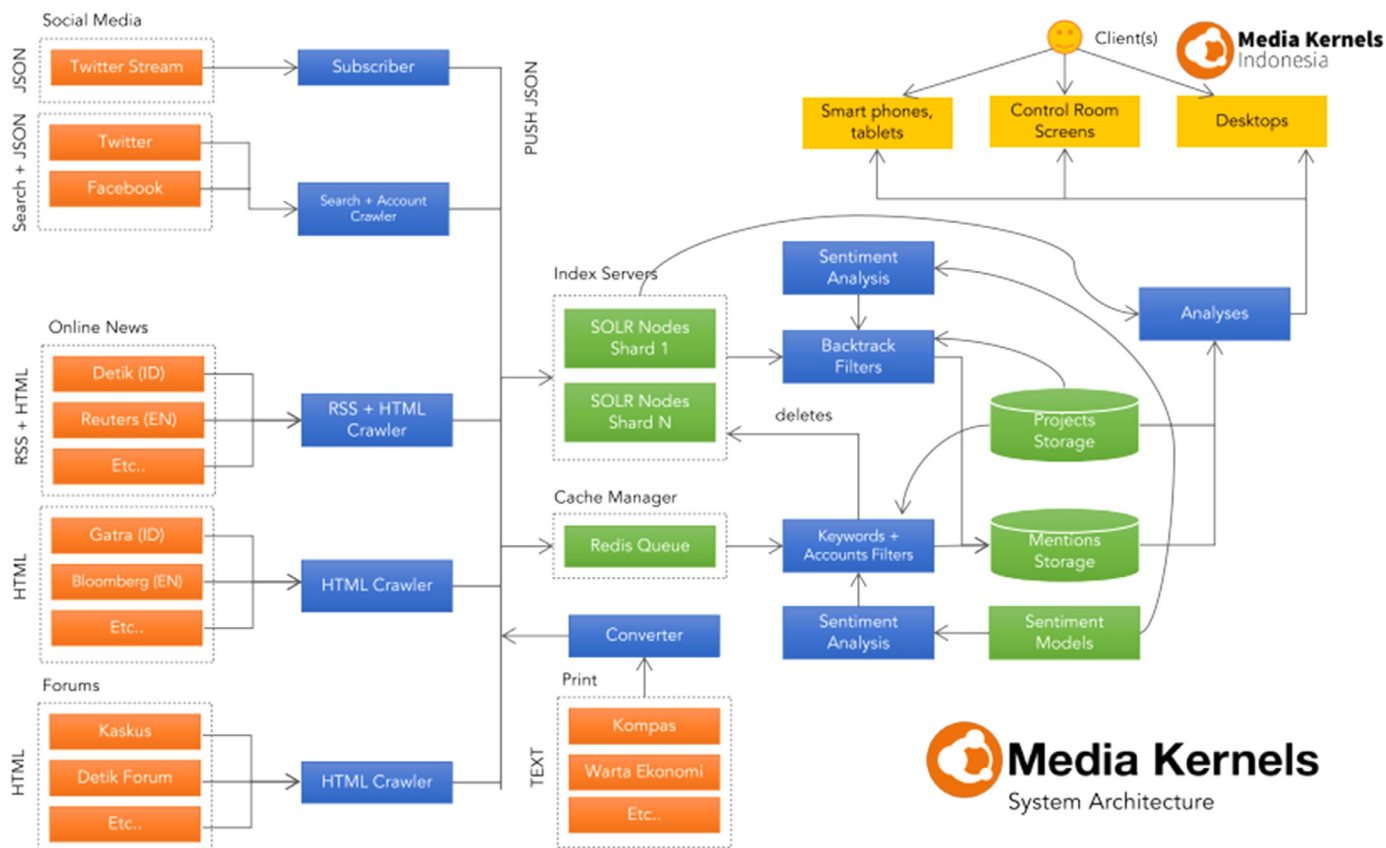
Fig. 1. Drone Emprit Academy (DEA) big data architecture.

classification technique will be using Naïve Bayes (Adaptive Multiple Model) method or Maximum Entropy to classify a word as positive, negative, or neutral [23]. However, the performance evaluation of the DEA classifiers shows Naïve Bayes outperforms all other classifiers with an accuracy of 90.26% [24]. We also performed a social network analysis to create a visual map of the Twitter conversations.

3. Results

3.1. Trend analysis

We collected 284,216 tweets from 137,057 active users with 2.21 interaction rates during the study period. These tweets consist of 88,677 mentions (31.20%), 31,452 replies (11.07%), and 164,087 retweets (57.73%). Fig. 2 illustrates the daily number of newly confirmed cases in Indonesia and the daily number of Twitter mentions on the "New Normal". We can see the public attention on the "new normal" can be divided into three important stages. The first stage (before May 24) represents low public attention and started after the government announced the plan to implement the first phase of the "New Normal" for industry and service sectors.

The second stage (May 24 to June 6) shows an increase of public attention after the Ministry of Health (MoH), Republic of Indonesia published the COVID-19 health protocols, focusing on workplace situations regardless of whether the curve had flattened, or if the affected population are ready. The number of tweets continued to grow dramatically with a peak of 38,223 tweets by May 29. After this period, public attention started to decrease gradually. However, the trend becomes unstable when the government has officially announced the implementation of the "New Normal" on June 5. Stage three (June 7 to June 18) demonstrates an increase

of public attention after the government mentioned their plan to reopen shopping malls by June 8. Moreover, within the same time frame, the number of daily new confirmed cases of COVID-19 also increased and reached its peak in the country with 1,042 cases on June 9 with 17,472 tweets and 1,241 cases on June 10 with 22,019 tweets [3]. Overall, we can conclude that government actions and disease transmission can affect public attention on Twitter.

3.2. Sentiment analysis of "new normal" implementation

From the sentiment analysis, we found 52% of the tweets have a "positive" sentiment. This signifies that the people had a positive outlook towards "New Normal". However, 41% of tweets indicated has "negative" statements and only 8% indicated "neutral" statements. The result from the sentiment trend also consistent with the tweet trends (Fig. 3).

A more detailed analysis of the emotion of public attention illustrated in Fig. 4 indicates that the majority of the emotions analyzed from 17,513 tweet posts were relied on "trust" (53.77%). Following the "trust" emotion was the "anticipation" emotion (14.82%) which illustrated that people were looking forward to experiencing the "New Normal" concept. Meanwhile, people were also surprised (8.62%) that the Indonesian government progressed to the "New Normal" concept despite a fluctuating number of cases. Similarly, people also expressed a joyous emotion, associated with 9.01% of the tweets. Emotion as if fear, anger, disgust, and sadness were the least common emotions identified in the public attention with a percentage portion less than 15%, which means people are looking forward to this "New Normal" concept.
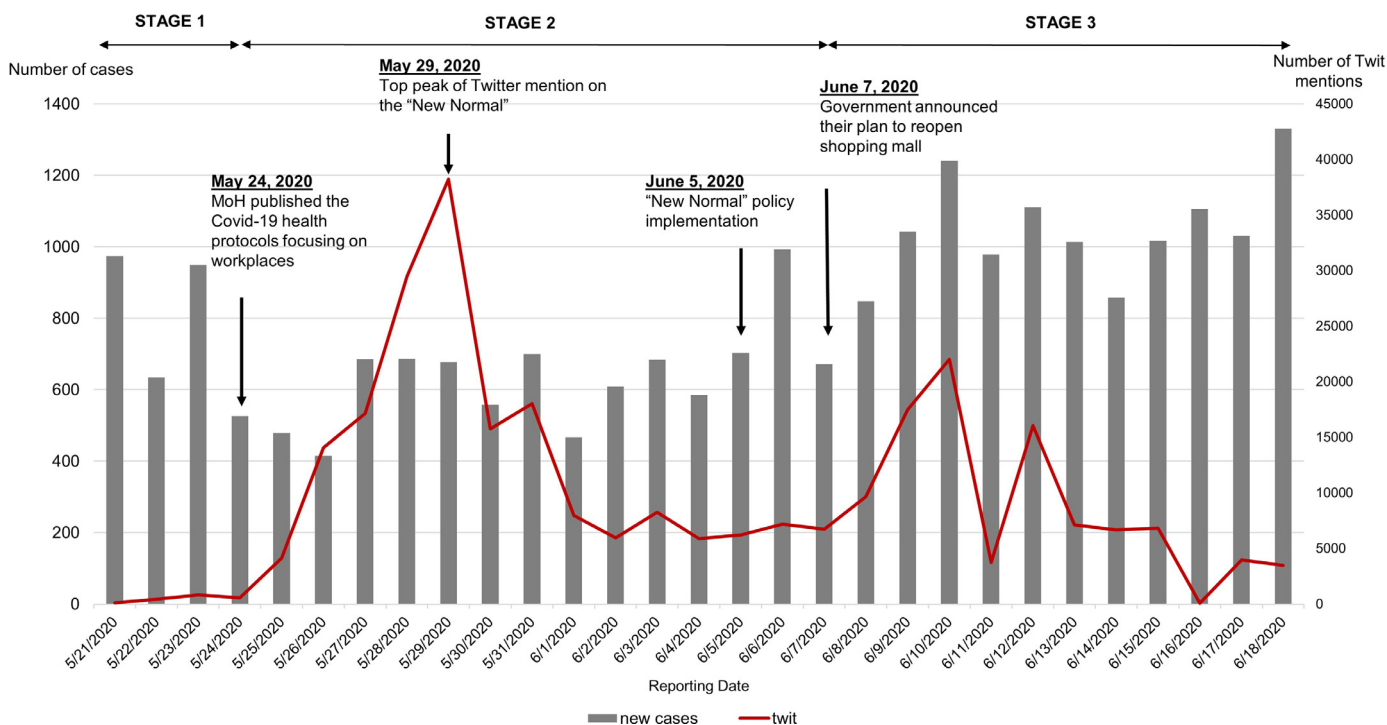
Fig. 2. Daily numbers of newly confirmed cases in Indonesia and daily numbers of Twitter mentions related to the "New Normal".
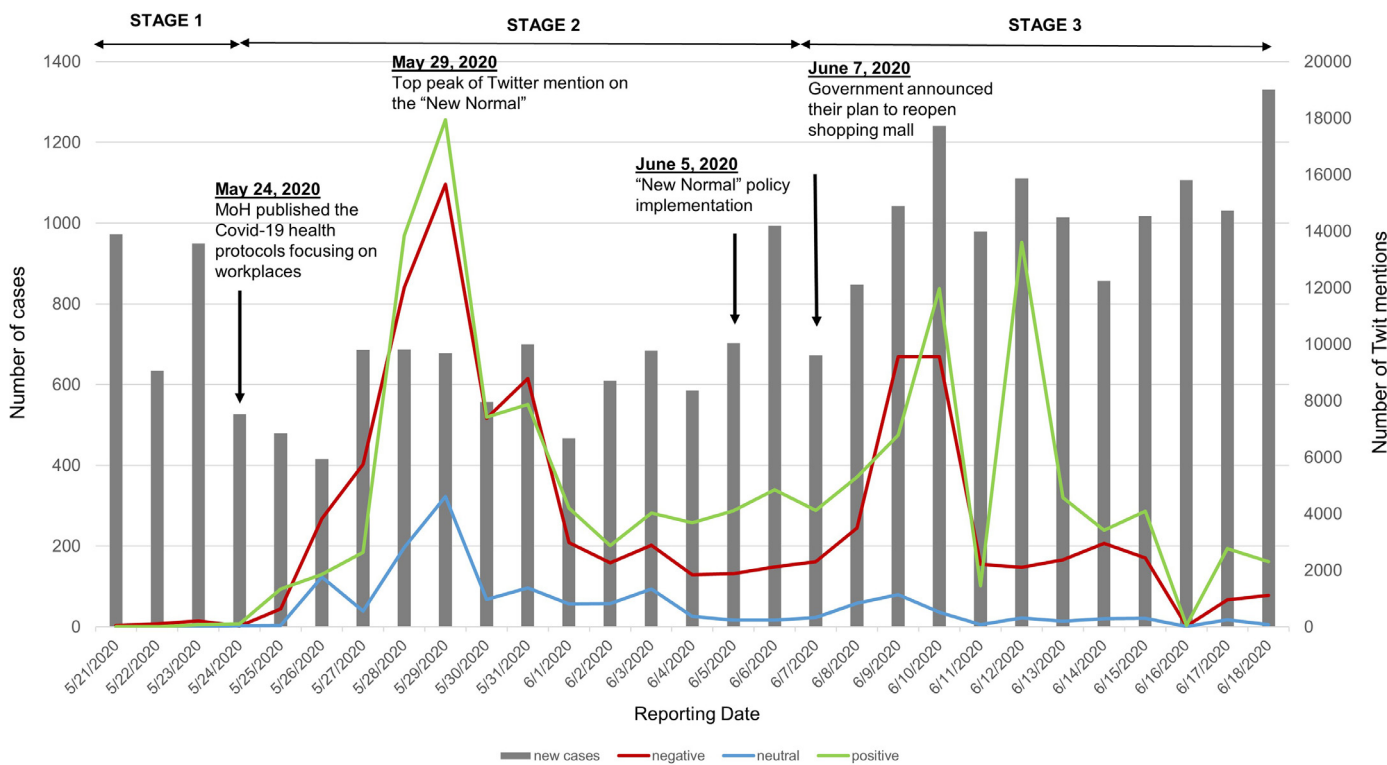

Fig. 3. Daily numbers of newly confirmed cases in Indonesia and daily numbers of twitter mentions related to the "New Normal".

3.3. Tweet exposure and engagement

All tweets were mostly dominated from accounts with number of followers around 101-500. These accounts were resulted in a total of 79,898 tweets (28.11%) post by 48,059 active users with potentially reached 6.5 million users. Meanwhile, around 48,600 tweets (17.10%) post by an account with 1001-10K followers con-

tributed from 16,499 active users with potentially reach more than 20 million users.

3.4. Hashtag and social network analysis

The most common hashtags used in tweets related to COVID-19 and "New Normal" were explained in Supplementary Table 1. The
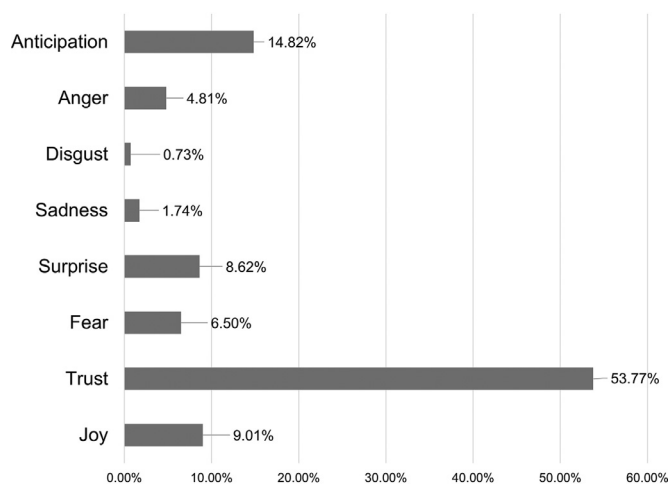
Fig. 4. Emotion analysis of tweets for the "new normal".

top three most prevalent hashtag was "#NewNormal" with 17,051 tweets, followed by "#TataKehidupanBaru" (Bahasa "NewLifestyle") with 10,980 tweets, and "#DisiplinPolaHidupBaru" (Bahasa "DisciplineOnTheNewLifestyle") with 5,200 tweets. Meanwhile, the top hashtags influenced by the "negative" sentiments were "#IndonesiaAbnormal" with only 1,848 tweets.

Fig. 5 illustrated the social network analysis using the retweet network that is connected using various nodes. The orange nodes indicated the account associated with the conversation. The network with the "negative" sentiments were illustrated with cyan links, while the magenta links showed a "positive sentiment". The social network analysis was mostly dominated by the magenta links, which means the public attention using Twitter conversation, was dominated with a "positive" statement, while the cyan links were only contributed in a small portion. Two clusters mention the issue of "New Normal". The first cluster mostly dominated by the government account using the hashtag "#TataKehidupanBaru", while the other cluster is dominated by either individual accounts or news media accounts using the "#NewNormal" hashtag. The details of each node sources can be seen in Supplementary Table 2. Meanwhile, the zoom in picture of each SNA cluster derived from DEA platform were illustrated in Supplementary Fig. 2 and Supplementary Fig. 3. From the picture, we can see that the government massive campaigns were majorly carried by the Indonesian military and police corps account as they have been deployed to enforce the implementation of the "New Normal".

4. Discussion

This study demonstrates how the trend of public attention on the "New Normal" implementation, was gradually influenced by both the government actions and the spread of the disease. Our findings were also consistent with the study conducted in China, which found that public reactions in Sina Weibo (the Chinese version of the Twitter platform) were affected by the spread of the disease and the government response during the early stage of the COVID-19 epidemic [25]. A study reporting public opinion on lockdown policy in overcoming the COVID-19 pandemic in Indonesia using Twitter-based data analysis also found a significant correlation between issues on Twitter with the public interest [26]. In this study, Twitter posts about the lockdown policy continued to increase after the government officially implemented this policy in society.

The result from the trend analysis indicates the changing trend of public attention on the "New Normal". At the beginning of the study (stage 1), public attention is still low, as people are still

focusing on stay-at-home campaigns to reduce COVID-19 transmission. However, the first entry peak points of public attention started when the government announced its plan to ease its large-scale social restrictions after the country was suffering from huge economic losses. The tweet frequency continued to increase dramatically following the strong government effort to promote COVID-19 new health protocols to support the transition to the "New Normal" along with the widespread public criticism in the media as the coronavirus cases and deaths are still rising in the country.

The trend started to decrease gradually as people began to accept government policy to adapt and live with the virus while adopting the "New Normal" protocol. Although public attention has declined gradually, the trend starts to increase again after the government mentioned their plan to reopen shopping malls. Meanwhile, at the same time, the country experienced the highest spike in COVID-19 cases for two days in a row [3]. The changing trend of people's interest in the "New Normal" indicates that people are more empathic about how the government initiative can put people at risk, as Indonesia still experiencing a fluctuating number of newly infected cases and poor public compliance on the new health protocol.

We also observed the public sentiment result and found more than half of the people had a "positive" perception towards the "New Normal". Interestingly, when we analyzed the sentiment trend, the public's sentiment tendency has shifted from "negative" to "positive" within less than 2 months. Other studies also observed a decline of "negative" sentiments but an increase in "positive" sentiments as the epidemic occured due to the increasing frequency of emotional support posted by the government account [27]. The dominant perception changed from "negative" to "positive" due to the strong government effort to promote the new health protocol [28].

A detailed analysis of the predominant emotion on the "New Normal", showed the emotion of "trust" was expressed by the majority of the Twitter conversation, followed by the emotion of "anticipation" and "joy". The fluctuated trend of COVID-19 cases and poor public compliance were linked with the negative emotion of "distrust" which is more frequently mentioned than the positive emotion of "trust". Meanwhile, hoping for a better situation with the new health protocol and government control measures mostly affects the emotion of "anticipation". Themes like how people react with the local government effort in preparing the new health protocol were the most common themes expressed in the emotion of "joy". Moreover, being stay at home for almost 2 months, leads to anxiety and frustration among the affected population. Therefore, with the implementation of the "New Normal", people are feeling joy and looking forward to the government action to reopen schools, offices, and other public spaces.

However, the majority of the public attention showed the emotion of "distrust" on the government initiative on the "New Normal". First, Indonesia continued to experience hundreds of new cases every day, which even spiking up to more than 1000 cases in early June. While other countries entered a "New Normal" period after reported a significant decline or even zero COVID-19 cases, Indonesia rushed the policy to reduce the economic damage. Second, people's poor compliance with physical distancing and wearing masks have created many violations of the PSBB policy. Third, lack of testing capacity and case reporting delays, which caused many suspected cases, to have died either before being tested or before receiving their lab results [1]. Easing restrictions without taking consideration of the above situation will put a greater risk of people get infected by the virus and caused the public to distrust the government prevention and control measures on the COVID-19 pandemic.
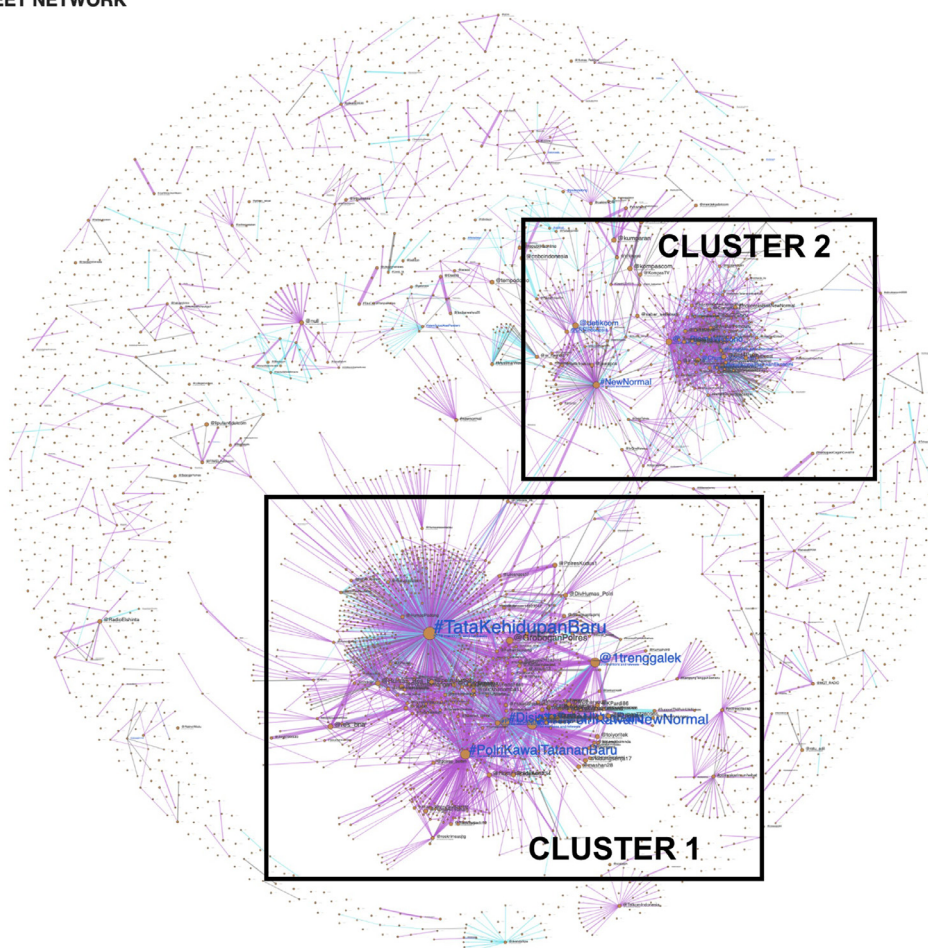
Fig. 5. Social Network Analysis using Hashtag Topic and Retweet for the "New Normal"
We inverted the original color of the figure derived from DEA platform to make it visible to the audience. The original picture from DEA platform can be seen in Supplementary Fig. 1.

Concerning the public fear and anxiety, the government claimed that only regencies/cities located in a green zone (areas with a low rate of COVID-19) will be granted permission to implement the "New Normal" policy [4]. Moreover, the government also strongly promote the COVID-19 health protocol focusing on workplace situation to support the transition to a "New Normal" and reassure the public anxiety. This effort seems to reduce the people's distrust of government control measures and influence people's positive expectations after implementing a new health lifestyle protocol, expressing the emotion of "anticipation".

The ability of social media platforms like Twitter to measure public interest in the government's risk communication response in reducing the transmission of emerging infectious diseases could become a powerful tool to spread and disseminate information and related policies about disease prevention and protection [29]. However, if not used properly, social media can become a destructive platform for government efforts in preventing and controlling disease transmission. Our findings on the changing trend of public perception expressed by the Twitter user within a certain amount of time indicate inadequate government response to provide effective risk communication during a public health emergency. There is a need for more excessive and proactive communication on social media to address uncertainty and perceptions in the community so that it can build public trust and increase people's engagement [6].

There are some limitations attributed to our study. First, our study did not apply any geographical analysis, thus we cannot ob-

serve the diversity of the frequency of the tweets based on the most affected regions/cities in Indonesia. Even though more than 60 percent of confirmed cases in the country reported on Java Island, only 4 out of 34 provinces in Indonesia have applied the PSBB policy [4]. Therefore, public perception observed in our study was particularly affected by the local government risk communication actions in their regions. Second, we only targeted tweets in the Indonesian language, which may limit our findings to be generalized into the global emergency. Moreover, the majority of Twitter users in Indonesia are young adults and adults (18-44 years old) [30], thus it cannot represent the whole population age in Indonesia.

Furthermore, we also concern about the ethical issues of using Twitter data for research, such as collecting individual tweets without obtaining informed consent from users. The common justification is probably because Twitter contents are publicly accessible via Twitter API and the reuse of Twitter data is also permitted by Twitter's Term of Service and Privacy Policy [31,32]. Additionally, according to the Social Media Ethics Framework in The Ethics of Using Social Media Data in Research: A New Framework [31], it is very important for the researcher to ensure the anonymity of Twitter users and to protect user's sensitive personal information, including health condition, financial status, political affiliation or beliefs, racial or ethnic origin, and sexual orientation. It is also mentioned that researchers are allowed to reuse and republish Twitter data if the user are either organizational account (government ac-

count or digital media account) or public figure, thus we will not be violating the ethical conduct in Twitter-based research.

5. Conclusion

Our study demonstrated how social media (e.g. Twitter) offers the opportunity for either government and public health officers in analyzing the public attention to risk communication and epidemic control measures on COVID-19 related issue the "New Normal". Twitter can facilitate the government in delivering the appropriate message behind difficult decision-making to the public while addressing public concerns and encouraging them to adopt constructive behavior in response to the COVID-19 pandemic. In this study, we found that the majority of the tweets expressed positive sentiment towards the "New Normal" issue that linked with the emotion of "trust", "anticipation", and "joy". Meanwhile, only a few people expressed the feeling of "fear", "sadness", "disgust", and "anger". Hence, we can conclude that the issue of "New Normal" after the implementation of partial lockdown received a majority of positive perception among Indonesian people.

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Declaration of Competing Interest

The authors declare no conflicts of interest in this paper.

Acknowledgments

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.cmpb.2021.106083.

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