



Google Trends Potential for Detecting a Large-scale Mental Health Issue: A Study during Pandemic in Indonesia

Urfa Khairatun Hisan^{1*}, Muhammad Miftahul Amri², Dwi Sulisworo³, Indah Rahmawati¹, Tarisa Afira Pramesti¹

¹ Fakultas Kedokteran, Universitas Ahmad Dahlan, Indonesia

² Fakultas Teknologi Industri, Universitas Ahmad Dahlan, Indonesia

³ Fakultas Keguruan dan Ilmu Pendidikan, Universitas Ahmad Dahlan, Indonesia

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ABSTRACT

Background: Attempts have been made to overcome COVID-19. However, one problem remains present: mass-mental health issues. Numerous studies have shown increased mental problems during the pandemic. The feasibility of using search engine trends and online sentiment analysis as an additional surveillance tool to detect large populations' problems has been explored. Objective: We examined Google Trends' potential to detect early symptoms of mass-mental issues. Methods: This study is conducted on the Indonesian population. We investigate Bahasa Indonesia words related to signs of mental disorders: 'merasa sendiri', 'khawatir', 'mudah marah', 'pemarah', 'cemas', and 'takut'. Each keyword means 'loneliness', 'afraid', 'easy to get angry', 'short-tempered', 'anxious', and 'fear'. The search range is set between February 2020–2022. The assumptions are that people tend to self-diagnose by online searching with keywords that match their condition, find solutions on the internet due to the limited offline interactions during the pandemic, and find information online before going to professionals. Results: It is observed that the search frequency on Google search engine follows the COVID-19 infection trends in Indonesia. It does suggest that with the increase in the COVID-19 infection rate, the search frequency of keywords associated with signs of mental issues also increased. Following the improved pandemic conditions, the search frequency of those keywords is also reduced. Conclusion: This work has demonstrated Google Trends' potential as an adjuvant surveillance tool to detect mass-mental health issues. It should be noted that these tools should be used only to provide insight into the populations' conditions rather than as the main indicators.

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Kata kunci:

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**) corresponding author*

dr. Urfa Khairatun Hisan, S.Ked

Fakultas Kedokteran, Universitas Ahmad Dahlan, Indonesia
Kampus 4 Universitas Ahmad Dahlan,
Jalan Kolektor Ring Road Selatan,
Tamanan Banguntapan, Bantul, DIY
55166, Indonesia

ABSTRAK

Latar Belakang: Berbagai upaya telah dilakukan untuk mengatasi COVID-19. Namun, terdapat satu masalah yang tetap bertahan: isu kesehatan mental massal. Sejumlah penelitian menunjukkan peningkatan masalah mental selama pandemi. Akhir-akhir ini, kelayakan menggunakan tren mesin pencari dan analisis sentimen daring sebagai alat surveilans tambahan untuk mendeteksi masalah populasi massal semakin sering dieksplorasi. Tujuan Penelitian: Kami menginvestigasi potensi Google Trends untuk mendeteksi gejala awal masalah mental massal. Metode: Studi ini dilakukan pada populasi Indonesia. Kami menginvestigasi kata-kata Bahasa Indonesia yang berhubungan dengan tanda-tanda gangguan kesehatan jiwa: 'merasa sendiri', 'khawatir', 'mudah marah', 'pemarah', 'cemas', dan 'takut'. Setiap kata kunci berarti 'loneliness', 'afraid', 'easy to get angry', 'short-tempered', 'anxious', dan 'fear' dalam Bahasa Inggris. Rentang pencarian ditetapkan antara Februari 2020–2022. Asumsinya, masyarakat cenderung melakukan *self-diagnosis*

Email: urfa.hisan@med.uad.ac.id

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dengan melakukan pencarian daring dengan kata kunci yang sesuai dengan kondisinya, mencari solusi di internet karena terbatasnya interaksi luring selama pandemi, dan mencari informasi secara daring sebelum ke profesional. Hasil: Teramati bahwa frekuensi pencarian di mesin pencari Google mengikuti tren infeksi COVID-19 di Indonesia. Hal ini menunjukkan bahwa seiring dengan peningkatan tingkat infeksi COVID-19, frekuensi pencarian kata kunci yang terkait dengan tanda-tanda masalah mental juga meningkat. Mengikuti kondisi pandemi yang membaik, frekuensi pencarian kata kunci tersebut juga berkurang. Kesimpulan: Penelitian ini telah mendemonstrasikan potensi Google Trends sebagai alat surveilans tambahan untuk mendeteksi masalah kesehatan mental massal. Perlu diingat bahwa alat seperti Google Trends harus digunakan hanya untuk memberikan gambaran indikasi tentang kondisi suatu populasi alih-alih sebagai indikator utama.

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INTRODUCTION

The COVID-19 pandemic has infected over 500 million people and caused the fatality of over 6 million people worldwide (Worldometer 2022). Many studies reveal that COVID-19 has affected human beings' mental health (Hossain et al. 2020; Pfefferbaum and North 2020; Talevi et al. 2020). Several pandemic-related factors have been known to induce mental issues, including fear (Fitzpatrick, Harris, and Drawve 2020), depression (Choi, Hui, and Wan 2020), anxiety (Faisal et al. 2022), stress (Rehman et al. 2021), and burnout (Launer 2020). Former studies show that mental health issues degrade personal motivations (Sheehan, Herring, and Campbell 2018), self-efficacy (Yıldırım and Güler 2022), productivity (Rouhanizadeh and Kermanshachi 2021), and even bring suicidal thoughts (Czeisler et al. 2020). At a severe level, mental issues might harm personal health and risk their lives.

On a larger scale, mental health issues might be dangerous. It is known that COVID-19 has affected all society members without considering their gender, ethnicity, age, and religion (Kamaliasari and Nurbianta 2022; Wahyuningrum and Setiyani 2022). Therefore, they all suffer from similar mental pressure. Peer-to-peer communication is one of the key factors in coping the mental pressure (Singh et al. 2020). By sharing their feelings, those with mental health issues can comfort and support each other. Hence, mental health problems can be suppressed. However, self-isolation policies and traveling bans limit them from interacting with each other.

COVID-19 has increased suicidal occurrence. In October 2020, the suicide rate among Japanese women rose by 70% compared to the same month the previous year (Sueki and Ueda 2021). In Australia (Leske et al. 2021), the suicide rate during the pandemic between March and August 2020, especially for women, increased by 23.9%. This increase is caused by mood swings, coping with stress and anxiety due to job loss, financial problems, and breakups. Similar results are found in the US (Ettman et al. 2020) and Bangladesh (Mamun and Griffiths 2020). Suicidal thoughts usually occur in a person with severe mental health issues. Therefore, the suicidal victims may have already suffered long-term mental issues before committing suicide. These mental health problems did not receive major attention, especially from stakeholders, until mass suicide happened. Even now, the mental support from the stakeholders is still arguably insufficient.

With the rapid development of technology, the internet has spread throughout Indonesia. By 2020, 64.8% of

Indonesians had access to the internet (Mudawamah 2020). This work investigates Google Trends' potential for detecting large-scale mental health issues, especially in Indonesia. Numerous research considers Google Trends as a significant source of information to support conventional surveillance (Salathé 2018; Salathe et al. 2012). Google trends visualize how often a keyword is searched by a population at a particular time. In this study, we investigate how often keywords related to mental health are searched on Google Trends and how they relate to the level of COVID-19 infection in Indonesia. The keywords (in Bahasa Indonesia) were chosen according to symptoms of common mental disorders, such as '*merasa sendiri*', '*khawatir*', '*mudah marah*', '*pemarah*', '*cemas*', and '*takut*'. For international readers, each keyword, respectively, means 'loneliness', 'afraid', 'easy to get angry', 'short-tempered', 'anxious', and 'fear'. By conducting an investigation using Google Trends, we hope to obtain insight into the tendency of mental problems in Indonesian society, especially during the COVID-19 pandemic. Hence, we can formulate policies to mitigate mental issues before it becomes too severe.

Common Mental Health Issues

A mental health issue can be characterized as a clinically significant impairment in an individual's cognition, emotional control, or behavior. It is frequently linked to discomfort or impairment in key areas of functioning (World Health Organization 2022a). However, mental health issues are frequently used to refer to mental illnesses. It is a more general term that includes mental illnesses, psychosocial disorders, and mental states that are associated with significant suffering, functional disability, or a serious risk of self-harm (World Health Organization 2022a).

In 2019, one out of every eight individuals, or 970 million people, had a mental condition, with anxiety and depression being the most frequent (Institute of Health Metrics and Evaluation 2022). In 2019, 301 million individuals suffered from anxiety disorders (World Health Organization 2022b). The symptoms of anxiety disorders include excessive fear and worry and accompanying behavioral problems. On an intense level, these symptoms might cause substantial discomfort or difficulty in daily life. As for depression, 280 million individuals had depression in 2019 (World Health Organization 2022b). An episode of depression lasts a minimum of two weeks and is characterized by a depressed mood (feeling down, irritated, or empty) or a lack of enjoyment or interest in activities for most of the day or even every day. Other possible symptoms include poor focus,

excessive guilt or low self-worth, hopelessness about the future, thoughts of death or suicide, restless sleep, changes in diet or weight, and unusually weary or low energy. In addition, people who are experiencing depression are more vulnerable to suicidal thoughts (World Health Organization 2022a).

Covid-19 Pandemic and Mental Health

Due to the COVID-19 pandemic, the number of persons living with anxiety and depression disorders is increased dramatically by 2020. In only one year, anxiety and major depressive disorders are estimated to have increased by 26% and 28%, respectively (World Health Organization 2022b). Evidence suggests the pandemic and associated public health and social measures (PHSMs) have sensed a rise in mental health issues globally, such as extensive anxiety and depression (See Table 1).

Table 2. Pooled effect sizes of meta-analyses with a comparison to the pre-pandemic prevalence (World Health Organization 2022b)

Variables	Studies (n)	Comparison (n)	Population	Pooled sample size	Pooled effect*	95% CI Change
Mental health problems						
Before vs. during pandemic (Robinson et al. 2022)	61	165	Mixed	55 015	0.11	0.04 to 0.17
Before vs. during pandemic (Robinson et al. 2022)		75	General		0.12	0.04 to 0.19
Before vs. March-April 2020 (Robinson et al. 2022)		98	Mixed		0.10	0.03 to 0.19
Before vs. May-July 2020 (Robinson et al. 2022)		67	Mixed		0.07	-0.02 to 0.16
Before vs. during pandemic (Robinson et al. 2022)		14	Pre-existing physical		0.25	0.07 to 0.43
Before vs. during pandemic (Robinson et al. 2022)		25	Pre-existing mental		-0.02	-0.21 to 0.18
Before vs. during pandemic (Robinson et al. 2022)		40	University students		0.13	-0.01 to 0.27
Before vs. during pandemic (Robinson et al. 2022)		38	Children/adolescents		0.11	-0.03 to 0.26
PHSM vs. no PHSM (Prati and Mancini 2021)	20		General (adult)	72 004	0.17	0.07 to 0.26
Anxiety						
Before vs. March-April 2020 (Robinson et al. 2022)		29	Mixed		0.14	-0.02 to 0.30
Before vs. May-July 2020 (Robinson et al. 2022)		23	Mixed		0.05	-0.04 to 0.14
PHSM vs. no PHSM (Prati and Mancini 2021)	10		General (adult)		0.17	0.07 to 0.27
Before vs. during pandemic (Kunzler et al. 2021)	23		General	49 746 (p) 132 145 (c)	0.40	0.15 to 0.65
Before vs. during pandemic (Kunzler et al. 2021)	13		Health care workers	5 508 (p) 22 204 (c)	-0.08	-0.66 to 0.49
Before vs. during pandemic (Kunzler et al. 2021)	6		COVID-19 patients	1 845 (p) 12 458 (c)	0.31	-0.07 to 0.69
Depression						
Before vs. March-April 2020 (Robinson et al. 2022)		32	Mixed		0.23	0.11 to 0.34
Before vs. May-July 2020 (Robinson et al. 2022)		26	Mixed		0.20	0.10 to 0.30
PHSM vs. no PHSM (Prati and Mancini 2021)	9		General (adult)		0.15	0.01 to 0.30
Before vs. during pandemic (Kunzler et al. 2021)	25		General	60 213 (p) 183 747 (c)	0.67	0.07 to 1.27
Before vs. during pandemic (Kunzler et al. 2021)	14		Health care workers	2 226 (p) 4 605 (c)	-0.16	-0.59 to 0.26
Before vs. during pandemic (Kunzler et al. 2021)	7		COVID-19 patients	1 461 (p) 21 934 (c)	0.48	-0.08 to 1.04

* Pooled effect = SMC (Robinson et al. 2022), Hedges' g (Prati and Mancini 2021), or SMD (Kunzler et al. 2021); (p) = pandemic participant; (c) = control participant. **Bold** represents significant effects. PHSM = Public health and social measure.

People living with pre-existing mental disorders are also at greater risk of severe illness and death from COVID-19 and should be considered a risk group upon diagnosis of infection (World Health Organization 2022b). Additionally, the long-term pandemic and related economic downturn may have an adverse effect on mental health and the suicide rate. Overall statistics showed that early in the epidemic, suicide rates did not rise in the majority of countries. However, there were signs that young individuals were at higher risk (World Health Organization 2022b). Only a small percentage of those who had mental health issues obtained therapy prior to the COVID-19 outbreak. The discrimination and stigma related to mental illness may make it even harder for people who are at risk to get the right health care at the right time. The gap in mental health treatment has, however, grown wider, according to studies, and outpatient mental health care has been severely affected (World Health Organization 2022b).

Prior Research using Google Trends

In recent years, digital footprints have emerged as viable data sources for health-related reasons. Digital epidemiology is a new science that examines illness and health trends in a community using digital traces. Many former studies suggested that Google Trends data might be used to supplement established monitoring techniques. Google Trends may be helpful in Indonesia, given the country's increasing internet adoption rate of 54.7% and, among them, a high Google usage rate (98%). The topic of digital epidemiology offers a promising alternative to aid traditional surveillance systems as Internet penetration increases, along with rising mobile phone usage and the growing artificial intelligence of machine learning (Salathe et al. 2012).

In Indonesia, many researchers consider Google Trends as their source of data. For example, studies (Anggraeni and Aristiani 2016; Husnayain, Fuad, and Lazuardi 2019; Syamsuddin et al. 2020) analyze Google Trends data and dengue incidence. A study by Limilia & Pratamawaty (2020) (Limilia and Pratamawaty 2020) investigates Google Trends and information-seeking trends of COVID-19 in Indonesia. In reference (Nindrea et al. 2020; Usman and Nindrea 2020), the authors study the Google Trends potential for COVID-19 surveillance and alternative information source. In addition, by analyzing Google Trends, a study by Rokhmah et al. (2020) (Rokhmah et al. 2020) finds an increase in public interest concerning alternative medicine during the COVID-19 pandemic in Indonesia. Then, the study by Halford et al. (2020) (Halford, Lake, and Gould 2020) analyzes Google searches for suicide and suicide risk factors in the early stages of the COVID-19 pandemic. Further, while the study by Husnayain et al. (2021) (Husnayain et al. 2021) investigates the prediction of daily new cases and mortality rate of COVID-19 using search engine query, the study by Husnayain et al. (2020) (Husnayain, Fuad, and Su 2020) explores the applications of Google Trends for risk communication in infectious disease management in Taiwan.

METHOD

In writing this manuscript, our objective is to explore the potential of Google Trends as a surveillance source to detect a large-scale public health problem (i.e., mental health issues due to the COVID-19 pandemic), particularly in Indonesia. In addition, we also present scientific-driven arguments on the

possibility of a mass-mental health issue mitigation using the Google Trends surveillance system. The study was derived from recent high-quality systematic reviews, meta-analyses, and selected literature.

First of all, we extensively searched Scopus, IEEE, PubMed, and Google Scholar for articles describing mental health issues and public health surveillance systems. Moreover, we also included manuscripts that consider Google Trends as their source of data. These studies include the study on information-seeking behavior, dengue incidence, and many more. The following keywords were used in the search strategy: mental health, COVID-19, Pandemic, Surveillance, and Google Trends. We limit the language of search to English and Indonesian. There were no restrictions on the year of publication or research. As a result, we have gathered 25 related works. This manuscript took into account all types of research studies.

As for the next step, we obtain the data of interest from Google Trends. Then, we analyze the Google Trends data between February 2020 and February 2022. As aforementioned, we investigated six keywords associated with the signs of mental health issues. These keywords include 'merasa sendiri', 'khawatir', 'mudah marah', 'pemarah', 'cemas', and 'takut'. These keywords are in the Indonesian language (Bahasa). Bahasa was chosen since this study is conducted on the Indonesian population. We set the search range between 2 February 2020 and 2 February 2022. In deciding the search range, we consider two factors. First, the COVID-19 case in Indonesia was first reported on 2 March 2020 (Worldometer 2022). Second, the COVID-19 fatality rate has actually dropped since the last quarter of 2021. This is due to the success of the vaccination programs. It is known that the COVID-19 fatality rate is one of the main factors that many people fear. Hence, we assume that since the last quarter of 2021, the mental pressure on society due to COVID-19 has been gradually reduced despite the rapid increase in Indonesia's infection rate.

Finally, after the data is obtained, we analyze the data by comparing it with the COVID-19 infection rate in Indonesia. In addition, we also compare it with supporting theories, such as former studies on mental health issues during the pandemic.

RESULTS AND DISCUSSION

In this subsection, we comprehensively present the findings of this study. The results are presented in Figures 1-4. First of all, let us take a look at the plot of the COVID-19 infection rate and fatality rate in Figure 1.

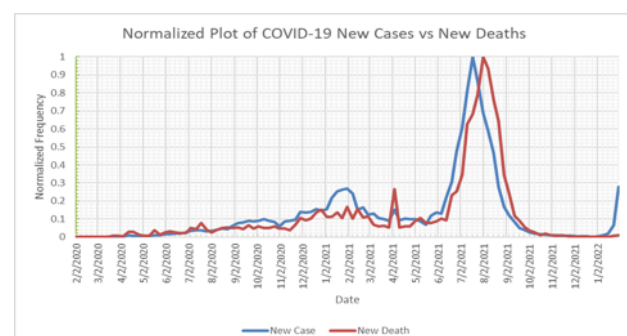


Figure 1. Normalized plot of COVID-19 new cases and new deaths in Indonesia between February 2020 - February 2022 (Worldometer 2022)

To clearly show the trendline of the two rates, we normalize each of those rates to 1. It is observed that there are at least three COVID-19 waves in Indonesia, each of which happened in February 2021, April 2021, and August 2021. It is worth mentioning that in terms of infection rate, Indonesia has actually experienced the fourth wave, which records an all-time high in the infection rate. This wave happened in February 2022. However, due to the success of the vaccination programs, the fatality rate has been reduced despite the increase in the infection rate. Hence, we exclude this period from the object of study.

Google Trends accounts for all the search frequencies regardless of whether there is a COVID-19 pandemic or not. Hence, the result that Google Trends reflect does not always associated with the pandemic incidence. Moreover, many global factors, such as wars, economic crises, and even political tension, might blur the effect of the pandemic on the search frequency. However, from February 2020-February 2022, not so many major occasions happened in Indonesia. In this period, everyone focuses on the pandemic and how to overcome it. In addition, offline activities such as school, work, and even shopping are not carried out. Therefore, we assume that the pandemic situation strongly influences the search frequency of the keywords of interest on Google Trends.

In Figure 2, we present the searching frequency trends of the terms '*merasa sendiri*', '*khawatir*', '*mudah marah*'. Note that in this figure, we normalize the searching frequency of each keyword to 1. As observed, we can see that the search trends of '*merasa sendiri*', '*khawatir*', and '*mudah marah*' are quite identical along the timeline. In early 2020, COVID-19 started to spread in Indonesia. We all know that the COVID-19 virus came unexpectedly and spread quickly. In the early 2020 period, not much is known about the nature and characteristics of this virus. There is not much information on how the virus is transmitted, how severe the fatality of this virus is, and how to prevent and treat this disease. Hence, naturally, humans feel afraid about this.

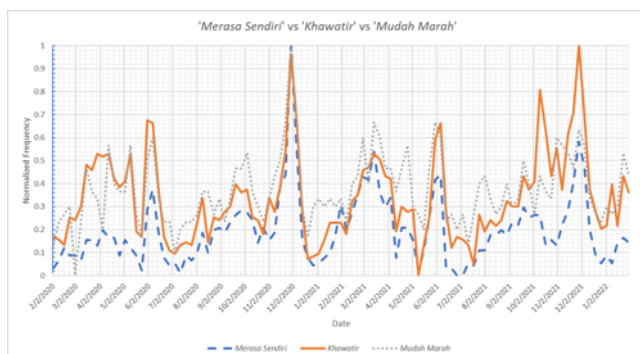


Figure 2. Normalized plot of search frequencies of '*merasa sendiri*', '*khawatir*', and '*mudah marah*' keywords in Indonesia on Google Trends between February 2020 – February 2022

In addition, the COVID-19 condition has caused governments worldwide to limit social movements. This is done so that the transmission of COVID-19 can be minimized. This condition makes many elements of society experience loneliness. In the pandemic's early phase, many people were trapped and separated from their families, including abroad workers and students. They cannot return to their hometowns due to restrictions on the inter-city transportation system. In addition, they cannot meet with

their friends and relatives because the government has set restrictions on social interaction.

Furthermore, these three keywords have experienced ups and downs several times. The increase in the frequency of keyword searches is associated with the infection wave of the COVID-19 pandemic in Indonesia. At least Indonesia experienced three waves of COVID-19 infections between 2020-2022. In the peak period of each wave, the search frequency of this keyword also increases. This means that an increase in infection rate can indirectly increase mental pressure on the community.

Similar results are presented in Figure 3. In this figure, it is observed that there is a similarity between the search frequency for the keywords '*pemarah*', '*cemas*', and '*takut*'. This is because COVID-19 makes people anxious and afraid of the possibility of being infected by the COVID-19 disease itself. There are interesting findings in the period from July 2020 to February 2022. When the search for '*pemarah*' and '*takut*' keywords decreases, the search for '*cemas*' keywords remains high. The cause of this finding is quite difficult to identify as Google Trends is unable to distinguish '*cemas*' keyword searches due to COVID-19 or other causes. Feelings of anxiety themselves can be associated with various causes, such as anxiety about the potential of being infected by the virus, anxiety about economic pressure due to COVID-19, anxiety about uncertain futures, and anxiety due to factors outside of COVID-19 such as issues of rising prices of goods, energy and economy crises, political issues, and even issues such as global tensions between Russia and Ukraine.

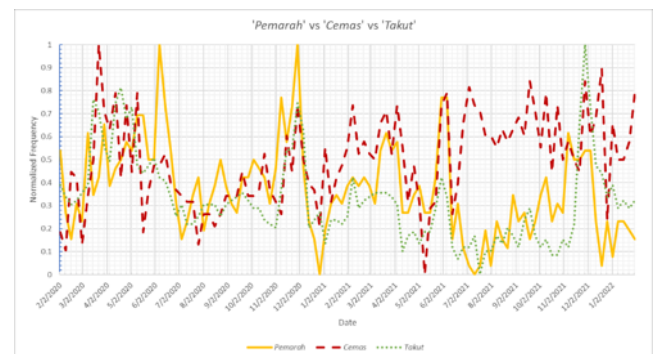


Figure 3. Normalized plot of search frequencies of '*pemarah*', '*cemas*', and '*takut*' keywords in Indonesia on Google Trends between February 2020 – February 2022

Although the six keywords have similar trends, there are significant differences between the search frequency of one keyword with another. To measure this difference, we normalized the search frequency of all six keywords simultaneously. Normalization is done in the range 1-100. As shown in Figure 4, the search frequency for the keyword '*takut*' was the highest with an average of 60.2, followed by '*cemas*' at 7.2, '*khawatir*' at 6.6, '*merasa sendiri*' at 4.0, '*pemarah*' at 2.5, and '*mudah marah*' at 1.7.

According to the findings, we can see a strong association between one keyword with others. This association is reflected in similar trends in the search frequency between keywords. Therefore, it is possible that during the same time, a person experienced more than one sign of mental health issue. While before the pandemic, an early mental health issue could be easily tackled by visiting a professional, it is rather challenging to see a professional during the pandemic.

This is because COVID-19 forces policymakers to implement social distancing to minimize the virus's spread.

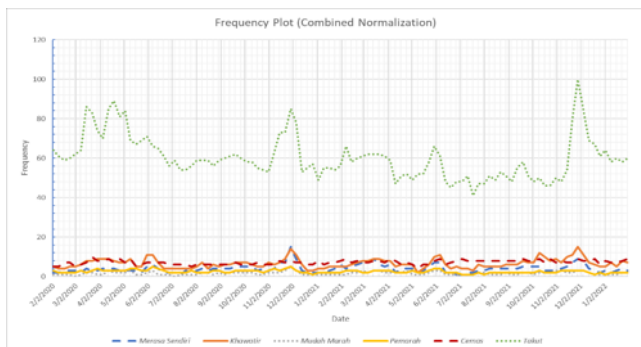


Figure 4. Search frequency plot (combined normalization) of the keywords of interest in Indonesia on Google Trends between February 2020 – February 2022.

Moreover, many professionals close their services during the pandemic. This is because some professionals are also afraid of virus infection. Further, many regions in Indonesia lack medical doctors during the pandemic peak. Hence, some psychiatrists are asked to take care of COVID-19 patients since they are also medical doctors.

This situation is worsened by the lack of intercommunication between one person to another. Under normal circumstances, people can easily meet their friends or relatives and ask them to give emotional support. During the pandemic, however, they cannot meet each other. COVID-19 affects everyone. Even if the policy allows them to meet, many people might already be occupied by themselves and their families, making providing emotional support to others their last priority. They also tend to be reluctant to meet other people outside their families due to fear of being infected by the virus.

These things make people who have no one feel lonely. This can be seen from the increase in the number of searches for the lonely keyword, which follows the trend of the frequency of other keyword searches. Then, people also easier to get angry because of various things. Some of them are dissatisfied with the government's desecuritization of the COVID-19 issue in the early phase (Chairil 2020). They are also angry with the elements of the community that do not obey the rules and make the pandemic situation worse.

These things can be easily turned into a massive suicide. Some studies (Launer 2020; Sianturi and Zulaeha 2022; Tanaka and Okamoto 2021; Zalsman et al. 2020) and news (Baihaqi 2021) stated that suicide incidents increased during the pandemic. However, a lesson learned is a lesson earned. We can take lessons from what happened and formulate policies to prevent similar things from happening in the future.

Study Limitations

This study, indeed, has certain limitations. For instance, in its current state, Google Trends is unable to distinguish whether searched keywords are related to COVID-19. For instance, the frequency of people searching songs that have the word '*takut*' in it cannot be differentiated from the frequency of people who searched the same word, but due to different reasons (e.g., literally feels '*takut*'). Even when people search the word '*takut*' due to their literal feelings of

fears, the cause of their fears cannot be distinguished only by using Google Trends. Therefore, the Google Trends outcomes regarding one situation (e.g., mental issue) can no longer be accurate if other big events that triggered people to search similar words have occurred. For example, economic crises, war, natural disasters, and political threats can also trigger people to feel afraid, and hence, search the keywords mentioned in Google. Nevertheless, the findings of this study showed similar search frequency trends regarding keywords associated with mental health symptoms. The frequency fluctuations are also similar to the COVID-19 infection and severity rate. Therefore, although the findings of this study cannot be used as a 'Gold' standard for mass mental health indicators, they can still be used to gain insights regarding the overall mental health situations of one population. Moreover, during the COVID-19 peak, there were almost no big events occurred that might produce outcome bias.

Another limitation of this study is that we limited this study to Indonesia settings, and therefore, this study result cannot be generalized. Although there were other internet search engines (e.g., Bing, Yahoo!, etc.), we investigated only the Google search engine due to its popularity. Because of that, the findings of this study cannot reflect the search frequency of other search engines. Despite that, as aforementioned, in terms of frequency of use in Indonesia, Google has also topped the other search engines by a notable amount. This makes Google Trends arguably can be used to reflect the search frequency trend of the Indonesian population, at least until when this paper was written.

CONCLUSIONS AND RECOMMENDATION

The findings of this study show the potential of Google Trends to detect the early signs of large-scale mental health issues. It is validated that the search frequencies of the keywords associated with mental health symptoms increased during the pandemic. Furthermore, the frequencies of the keyword searches also follow the infection rate timeline. Considering that these mental health symptoms could lead to suicidal thoughts and that suicidal incidence increased during the pandemic, we must pay attention to this problem so that something similar does not happen in the future. We can overcome this large-scale mental health issue through early detection and proper response.

Previous studies have shown evidence that Google Trends can be used as a surveillance assistant to aid stakeholders in formulating policies suitable to solve population problems. Infectious diseases, information-seeking behavior, and even dengue incidence are among those problems. In this study, we have found that Google Trends is able to provide insights regarding the overall mental health situations of one population. However, it is worth noting that the findings should only be used as a secondary source of information to provide useful insights rather than as a 'Gold' standard for mass mental health indicators.

In addition, although the pandemic situation is getting better, COVID-19 has also brought other pressures, such as economic problems, burnout, PTSD, and depression. These factors can also be investigated further so that the negative impact of these factors can be minimized.

In the future, it is desirable to extend this research to a larger population involving multiple nations. Moreover, the potential use of Google Trends in other major issues, either

related to health events (e.g., ebola, hepatitis, etc.) or not (e.g., war, stock market, cryptocurrency, etc.), can also be investigated. Additionally, the study can also be extended by involving other major search engines such as Bing and Yahoo!. Furthermore, the resolution of the data analysis can be reduced to produce a finer result (i.e., daily analysis) that might lead to more fruitful insights. Finally, a robust algorithm that can distinguish the compounding factors of the Google Trends outcome can be formulated to ease the data analysis process and increase the study's accuracy.

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