

## TRACING DIAGNOSIS COVID-19 ANALYSIS ON GOOGLE BY COVID-19 CASES IN INDONESIA

**Gabriela Eliza Fabrianne Tamba, Rizma Adlia Syakurah\***

Faculty of Public Health, Universitas Sriwijaya, Jl. Palembang-Prabumulih KM 32 Ogan Ilir, 30662, Indonesia

### ABSTRACT

COVID-19 transmission can be controlled through RT-PCR and RDT-Ag diagnostic tests, yet neither test performs well. This has encouraged people to search information for the COVID-19 pandemic response and exposure fears on Google. Therefore, this study analyzes the correlation between COVID-19 diagnosis tracing on Google and new COVID-19 cases in Indonesia. An explanatory mixed method study design was used. A quantitative study was done using time-lag correlation between the keywords, namely "Antigen", "Swab" dan "PCR" based on Google Trends™ (<https://trend.google.com/trends>) from 13 July 2020 to November 2021. The search peaks for diagnosis and their geographical distribution were described qualitatively. There is a correlation between COVID-19 diagnosis searches on the keywords Swab ( $r = 0.787$ ,  $p\text{-value} = 0.000$ ) and Antigen ( $r = 0.378$ ,  $p\text{-value} = 0.003$ ) with COVID-19 new positive cases. The cumulative number of daily tests is also correlated with COVID-19 diagnosis searches ( $r = 0.617$ ,  $p\text{-value} = 0.000$  (PCR keywords) and  $r = -0.337$ ,  $p\text{-value} = 0.003$  (Keywords Swab)). There was also a correlation between searches for COVID-19-related keywords PCR, Swab, and Antigen and the frequency of daily PCR and Antigen tests ( $p\text{-value} < 0.005$ ). Google Trend has the potential as a monitoring tool for people's diagnosis behavior. Further study of Google Trends is required to strengthen the potential of Google Trends for monitoring COVID-19 cases in Indonesia.

**Keywords:** google trends, COVID-19, diagnosis enforcement, polymerase chain reaction, antigen

### ABSTRAK

Penemuan kasus COVID-19 melalui tes diagnostik berdasarkan RT-PCR dan antigen dapat membantu pengendalian penularan COVID-19. Namun, kedua tes tersebut tidak memberikan hasil yang optimal. Hal ini mendorong masyarakat mencari informasi tentang respons pandemi COVID-19 dan kecemasan paparan di Google. Oleh karena itu, penelitian ini bertujuan untuk menganalisis hubungan antara penelusuran diagnosis COVID-19 di Google dengan kasus baru COVID-19. Penelitian ini menggunakan desain mixed method dengan pendekatan explanatory sequential. Studi kuantitatif dilakukan dengan menggunakan korelasi time-lag antara kata kunci yaitu "Antigen", "Swab" dan "PCR" berdasarkan Google Trends™ (<https://trend.google.com/trends>) dari 13 Juli 2020 hingga November 2021. Puncak pencarian untuk diagnosis dan distribusi geografisnya dijelaskan secara kualitatif. Terdapat korelasi antara penelusuran terkait penegakan diagnosis COVID-19 pada keywords Swab ( $r = 0,787$ ,  $p\text{-value} = 0,000$ ) dan Antigen ( $r = 0,378$ ,  $p\text{-value} = 0,003$ ) dengan jumlah kasus positif baru COVID-19. Selain itu, terdapat korelasi antara penelusuran terkait penegakan diagnosis COVID-19 dengan jumlah tes harian kumulatif ( $r = 0,617$ ,  $p\text{-value} = 0,000$  (keywords PCR) dan  $r = -0,337$ ,  $p\text{-value} = 0,003$  (keywords Swab)). Korelasi juga ditemui antara penelusuran terkait penegakan diagnosis COVID-19 pada keywords PCR, Swab, dan Antigen dengan jumlah tes harian PCR dan Antigen ( $p\text{-value} < 0,005$ ). Google trend berpotensi sebagai alat monitor perilaku masyarakat terkait penegakan diagnosa. Diharapkan terdapat pengkajian lebih lanjut terhadap google trends guna memperkuat potensi google trend dalam memonitor kasus COVID-19 di Indonesia.

**Kata kunci:** google trend, COVID-19, penegakan diagnosa, polymerase chain reaction, antigen

---

\* Correspondence Address: Rizma Adlia Syakurah, Faculty of Public Health, Universitas Sriwijaya, Jl. Palembang-Prabumulih KM 32 Ogan Ilir, 30662, Indonesia, E-mail: [rizma.syakurah@gmail.com](mailto:rizma.syakurah@gmail.com)

***Received : February 8, 2023 Accepted : March 31, 2023 Published: April 6, 2023***

---

## **Introduction**

The COVID-19 pandemic had infected more than 200 countries in the world with more than 3 million positive confirmed cases. In Indonesia, the total cases of COVID-19 reached 2,228,938 million with 25,830 million new cases, and 59,534 deaths.<sup>1</sup> The high number of COVID-19 cases indicated that the disease was spreading rapidly, then a strategy was needed to reduce the spread of COVID-19.

One strategy that could be implemented to reduce the spread of COVID-19 was to find cases through the implementation of diagnostic tests. However, the diagnostic tests performed using both RT-PCR and Antigen did not produce optimal results. As of September 2021, tests for COVID-19 in Indonesia had still not reached the 1:1000 population as recommended by WHO. At the end of January 2021, the positivity rate or ratio of positive cases in Indonesia had also reached 28.8%. Meanwhile, the decline in the positivity rate in Indonesia occurred in mid-March and the end of June, which ranged from 9% to 20% and the proportion of positive tests began to decrease to 12.1% in August.<sup>2</sup> In early September, the percentage of positivity rate decreased to 8.42%, but Indonesia had not yet reached the minimum limit set by WHO, which is 5%.<sup>3</sup> In February 2021, death cases had decreased but increased again in April 2021. The peak of death cases in Indonesia occurred from July 2021 to September 2021 with the highest number of deaths on July 27 2021, namely 2069 cases.

The decline in the positivity rate and the death rate for COVID-19 cases in Indonesia had not been optimal, indicating that the transmission rate for COVID-19 cases in Indonesia was still high. This has raised concerns stemming from ignorance in responding to the COVID-19 pandemic and fears of being exposed to the COVID-19 virus which had resulted in people trying to find information related to COVID-19, especially related to the diagnosis of COVID-19 through search engines. This information later formed data trends that could be accessed through Google Trends™ where these data trends were said to have potential as digital surveillance which was used as a reference for making policies related to COVID-19 with the aim of controlling COVID-19 cases. In this study, tracing the community regarding the diagnosis of COVID-19 by new cases of COVID-19 that had never been studied before. Therefore, researchers were interested in analyzing community trends in seeking information regarding the diagnosis of COVID-19 and its relationship to new cases of COVID-19.

## Methods

A mixed method design in the terms of a sequential explanatory approach was used. Quantitative study was conducted using time-lagged correlation between keywords namely “Antigen”, “Swab” and “PCR” based on Google Trends™ (<https://trend.google.com/trends>) from 13th July 2020 to November 2021. Pause the time between search activity and an increase in COVID-19 cases was symbolized as Lag (+) for after the specified day and Lag (-) for before the specified day. The results of the correlation test were interpreted through the correlation coefficient (r), 1 for the positive correlation coefficient and -1 for the negative correlation coefficient (table 1).<sup>4</sup>

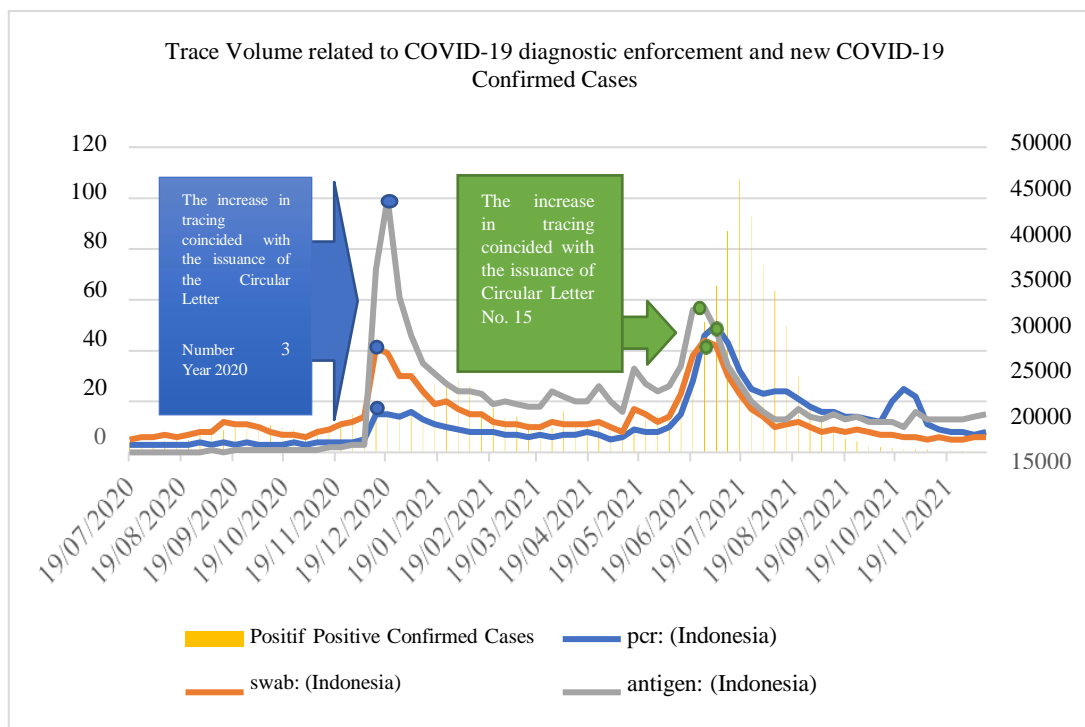
**Tabel 1. The Interpretation of the Correlation Coefficient**

Coefficient Intervals (R Value)	Interpretation
0,00-0,199	Very low
0,20-0,399	Low
0,40-0,599	Medium
0,60-0,799	Strong
0,80-1,000	Very strong

While a qualitative study was carried out on queries and peaks related to diagnosis (key words “PCR”, “Swab”, and “Antigen”) and their geographical distribution. Search frequency was displayed on a scale of 0-100 with 0 being very low transmission and 100 being very high browsing frequency. This research was approved by the Ethics Committee of the Faculty of Public Health, Sriwijaya University Number: 350/UN9.FKM/TU.KKE/2021.

## Results

Based on the search results for the keywords "Antigen", "Swab" and "PCR" showed an increase in searches related to the three keywords used. The increase in keyword searches occurred on December 19th 2020, then there was a decrease in keyword searches, but there was an increase again around June to July 2021. This is in line with several validity periods of decrees/circulars and/or instructions issued to control cases of COVID-19 in Indonesia (figure 1).



**Figure 1. Tracing Volume Related to Enforcement of COVID-19 Diagnostics and New Confirmed Positive Cases for COVID-19**

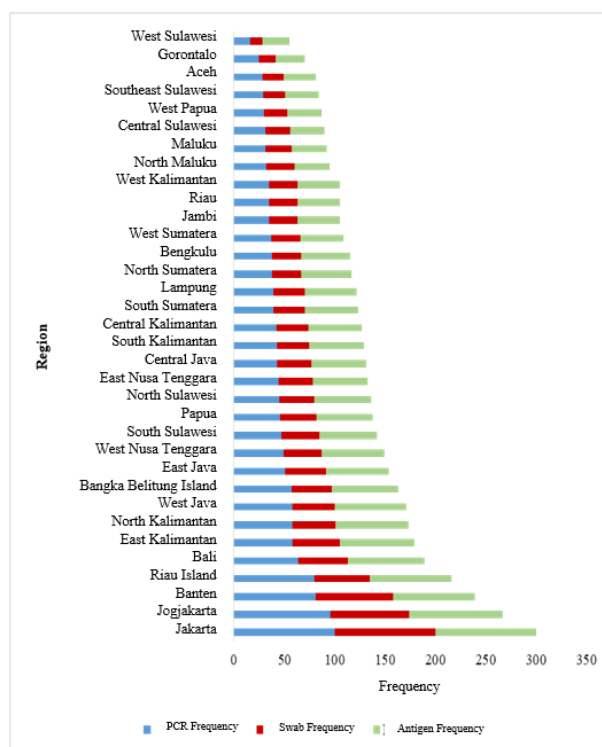
The search results in the form of search queries (table 2) showed that people who conduct searches with the keyword "PCR" in the near future also use other search terms, namely antigen, swab antigen, CT PCR, cheap, test, test, difference, bumame, results, value, antigen positive, PCR negative, nearby, in Bali, valid for several days, CT value, price, PCR test location, price period, and meaning. People who search using the keyword "Swab" also insert the word antigen, price, nearest, result, Jakarta, cost, rapid, pharmaceutical chemistry, clinic, PCR, drive thru, namely, 24 hours, Jogja, Bandung, and Bumame. In addition, people who search using the keyword "antigen" also insert the words price, nearest, cost, swab, price, pharma chemistry, Surabaya, clinic, valid, Bandung, and Jogja.

The results of the time lag correlation analysis show that there was a relationship between search volume related to the Swab keywords (p-value = 0.000) and Antigen (p-value = 0.003) and the number of confirmed positive cases of COVID-19 in Indonesia. Meanwhile, there was no relationship between search volume related to PCR keywords and the number of new positive cases of COVID-19 in Indonesia.

**Table 2. Keyword Search Related Queries**

PCR	Swab	Antigen
“antigen pcr”	“swab antigen”	“harga antigen”
“swab antigen”	“Antigen”	“antigen terdekat”
“ct pcr”	“swab antigen harga”	“biaya antigen”
“pcr dan antigen”	“test antigen”	“swab antigen harga”
“swab antigen dan pcr”	“test swab antigen”	“rapid antigen harga”
“pcr murah”	“antigen terdekat”	“tes rapid antigen”
“test antigen”	“rapid antigen”	“antigen kimia farma”
“tes antigen”	“swab antigen terdekat”	“kimia farma”
“rapid antigen”	“tes swab antigen”	“swab antigen terdekat”
“perbedaan antigen dan pcr”	“hasil swab antigen”	“harga test antigen”
“bumame pcr”	“swab antigen jakarta”	“tes swab antigen”
“hasil ct pcr”	“biaya swab antigen”	“swab pcr”
“bumame”	“rapid test antigen”	“rapid antigen terdekat”
“nilai ct pcr”	“kimia farma swab antigen”	“antigen surabaya”
“antigen positif pcr negatif”	“klinik swab antigen terdekat”	“test antigen terdekat”
“test pcr terdekat”	“klinik terdekat”	“klinik swab antigen”
“Pcr di bali”	“swab antigen surabaya”	“rapid antigen berlaku”
“pcr berlaku berapa hari”	“swab antigen dan pcr”	“antigen bandung”
“ct value pcr”	“drive thru swab antigen”	“biaya rapid antigen”
“rapid test antigen”	“swab antigen adalah”	“rapid test antigen harga”
“perbedaan swab pcr dan swab antigen”	“swab antigen 24 jam”	“harga rapid test”
“antigen atau pcr”	“antigen adalah”	“klinik terdekat”
“ct pada pcr”	“swab antigen jogja”	“klinik antigen terdekat”
“perbedaan swab antigen dan pcr”	“swab antigen bandung”	“masa berlaku antigen”
“berapa harga pcr”	“bumame”	“antigen jogja”

Search results based on region in Indonesia showed that the highest frequency of searches for the keywords PCR, swab and antigen occurred in DKI Jakarta (figure 2).



**Figure 2. Search results for PCR, Swab and Antigen keywords by region in Indonesia**

Search volume for the Swab keyword had a strong correlation 3 days before the number of new positive cases of COVID-19 (lag-3; r=0.763) and a very strong correlation 3 days after the number of positive cases of COVID-19 is confirmed (lag+3; r= 0.815). Meanwhile, search volume for the Antigen keyword had a moderate correlation 3 days before (lag-3; r=0.407) and 2 days after the number of positive cases of COVID-19 was confirmed (lag+2; r=0.423). These results indicated that an increase in search activity via Google regarding Swabs and Antigens occurred 3 days before and 2-3 days after the number of new positive cases of COVID-19 in Indonesia (table 3).

**Table 3. The Correlation between Keyword Search Volume Related to Number of New Positive Cases of COVID-19**

Keyword Search Volume	Dependent Variables											
	Number of Positive Cases of COVID-19											
	Lag -3			Lag -2			Lag -1			Lag 0		
	r	P	N	r	P	N	r	P	N	r	P	N
<b>PCR</b>	0,039	0,763	61	0,047	0,719	61	0,034	0,797	61	0,000	0,999	61
<b>Swab</b>	0,763**	0,000	61	0,753**	0,000	61	0,763**	0,000	61	0,787**	0,000	61
<b>Antigen</b>	0,407**	0,001	61	0,396**	0,002	61	0,378**	0,003	61	0,378**	0,003	61
	Lag +1			Lag +2			Lag +3					
	r	P	N	r	P	N	r	P	N			
<b>PCR</b>	-0,011	0,936	61	0,053	0,684	61	0,034	0,796	61			
<b>Swab</b>	0,779**	0,000	61	0,797**	0,000	61	0,815**	0,000	61			
<b>Antigen</b>	0,403**	0,001	61	0,423**	0,001	61	0,421**	0,001	61			

\*\* Correlation is significant at the 0.01 level (2-tailed).

r = Correlation Coefficient

P = P-value

N = the total number of keyword search results for a certain period

Analysis of the relationship between search volume related to keywords related to the number of cumulative daily tests for COVID-19 in Indonesia shows that there was a relationship between search volume related to PCR keywords (p-value = 0.000) and Swab (p-value = 0.003) with the number of cumulative daily tests in Indonesia. While there was no relationship between search volume related to Antigen keywords the cumulative daily number of tests in Indonesia.

The volume of searches for PCR keywords had a strong correlation 2 days before (lag-2 with r=0.651) and 3 days after the number of cumulative daily tests in Indonesia (lag+3 with r=0.709). While Swab keyword volume has a low negative correlation 3 days before (lag-3 with r= -0.367) and 1 day after (lag+1 with r= -0.368) the number of cumulative daily tests in Indonesia. These results indicated that the increase in search activity through Google related to PCR occurred 2 days before and 3 days after the cumulative number of daily tests in Indonesia. While the decrease in search activity through Google related to swabs occurred 3 days before and 1 day after the cumulative number of daily tests in Indonesia increased (table 4).

**Table 4. The Correlation between Keyword Search Volume Related to COVID-19 Cumulative Daily Test Number**

Keyword Search Volume	Dependent Variable Cumulative Number of Daily Tests											
	Lag -3			Lag -2			Lag -1			Lag 0		
	r	P	N	r	P	N	r	P	N	r	P	N
PCR	0,629**	0,000	61	0,651**	0,000	61	0,597**	0,000	60	0,617**	0,000	61
Swab	-0,367**	0,004	61	-0,304*	0,017	61	-0,323*	0,012	60	-0,337**	0,003	61
Antigen	0,228	0,77	61	0,269*	0,036	61	0,276*	0,033	60	0,228	0,077	61
Lag +1			Lag +2			Lag +3						
r	P	N	r	P	N	r	P	N				
PCR	0,614**	0,000	61	0,652**	0,000	61	0,709**	0,000	60			
Swab	-0,368**	0,004	61	-0,347**	0,006	61	-0,213	0,102	60			
Antigen	0,232	0,071	60	0,265*	0,039	60	0,379**	0,003	60			

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

r = Correlation Coefficient

P = P-value

N = the total number of keyword search results for a certain period

Analysis of the relationship between search volume related to keywords related to the number of daily PCR tests in Indonesia showed that there was a relationship between search volume related to PCR keywords (p-value = 0.000), Swab (p-value = 0.009), and Antigen (p-value = 0.045) by the number of daily PCR tests in Indonesia.

**Table 5. The Correlation between Keyword Search Volume Related to the Number of Daily PCR Tests in Indonesia**

Keyword Search Volume	Dependent Variable Number of Daily PCR Tests											
	Lag -3			Lag -2			Lag -1			Lag 0		
	r	P	N	r	P	N	r	P	N	r	P	N
PCR	0,580**	0,000	60	0,651**	0,000	61	0,648**	0,000	61	0,648**	0,000	61
Swab	0,293*	0,023	60	-0,304*	0,017	61	0,153	0,239	61	-0,330**	0,009	61
Antigen	0,477**	0,000	60	0,269*	0,036	61	0,355**	0,005	61	0,258*	0,045	61
Lag +1			Lag +2			Lag +3						
r	P	N	r	P	N	r	P	N				
PCR	0,466**	0,000	61	0,637**	0,000	61	0,656**	0,000	60			
Swab	0,429**	0,001	61	0,157	0,226	61	0,257*	0,048	60			
Antigen	0,436**	0,000	61	0,427**	0,001	61	0,386**	0,002	60			

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

r = Correlation Coefficient

P = P-value

N = the total number of keyword search results for a certain period

The volume of searches for PCR keywords had a strong correlation 2 days before (lag-2;

r=0.651) and 3 days after the number of daily PCR tests in Indonesia (lag+3; r=0.656). Swab search volume has a low negative correlation 2 days before (lag-2; r= -0.304) and moderate correlation 1 day after (lag+1; r=0.429) the number of daily PCR tests in Indonesia. Meanwhile, search volume for Antigen keywords had a moderate correlation 3 days before (lag-3; r=0.477) and 1 day after (lag+1; r=0.436) the number of daily PCR tests in Indonesia. These results indicate that an increase in search activity via Google related to PCR and Antigen occurred 2-3 days before and 1-3 days after the number of daily PCR tests in Indonesia (table 5).

Analysis of the relationship between search volume related to keywords related to the number of daily Antigen tests in Indonesia showed that there was a relationship between search volume related to PCR keywords (p-value = 0.002), Swab (p-value = 0.000), and Antigen (p-value = 0.000) with the number of daily antigen tests in Indonesia.

**Table 6. The Correlation between Keyword Search Volume Related to the Daily Antigen Test in Indonesia**

Keyword Search Volume	Dependent Variable Number of Daily Antigen Test											
	Lag -3			Lag -2			Lag -1			Lag 0		
	r	P	N	r	P	N	r	P	N	r	P	N
PCR	0,403*	0,037	27	0,555**	0,003	27	0,555**	0,002	28	0,556**	0,002	28
Swab	-0,792*	0,000	27	-0,770**	0,000	27	-0,835**	0,000	28	-0,808**	0,000	28
Antigen	-0,700*	0,000	27	-0,771**	0,000	27	-0,805**	0,000	28	-0,776**	0,000	28
	Lag +1			Lag +2			Lag +3					
	r	P	N	r	P	N	r	P	N			
PCR	0,567**	0,001	29	0,589**	0,001	28	0,508**	0,006	28			
Swab	-0,796*	0,000	29	-0,807**	0,000	28	-0,815**	0,000	28			
Antigen	-0,750*	0,000	29	-0,770**	0,000	28	-0,773**	0,000	28			

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

r = Correlation Coefficient

P = P-value

N = the total number of keyword search results for a certain period

Search volume for PCR keywords had a strong correlation 1 day before (lag-2; r=0.555) and 2 days after the number of daily Antigen tests in Indonesia (lag+2; r=0.589). Swab search volume has a very strong negative correlation 1 day before (lag-1; r= -0.835) and 3 days after (lag+3; r=0-0.815) the number of daily Antigen tests in Indonesia. Meanwhile, search volume for Antigen keywords has a very strong negative correlation 1 day before (lag-1; r= -0.805) and 3 days after (lag+3; r= -0.773) the number of daily Antigen tests in Indonesia. These results indicate that the



increase in search activity via Google related to PCR occurred 1 day before and 2 days after the number of daily Antigen tests in Indonesia. While the decrease in search activity via Google related to Swab and Antigen will occur 1 day before and 3 days after the number of daily Antigen tests increases (table 6).

## Discussion

The main findings of our study showed that Google trends searches for COVID-19 diagnostics such as "PCR", "Swab", and "Antigen" are influenced by government policies and public compliance. Government policies were crucial during the COVID-19 pandemic as an effort to control the spread of the virus and minimize its negative impact on society and the economy. Meanwhile compliance was also related to awareness of COVID-19. Community compliance with the policy indicated that the community understood the dangers of COVID-19.<sup>5</sup>

Studies reporting increased public interest in COVID-19 before the outbreak in several countries support the potential role of GT as a surveillance tool.<sup>6</sup> GT research in Pakistan, showed a high correlation between Google searches for COVID-19 symptoms and a diagnosis of SARS-CoV-2 infection.<sup>7</sup> Meanwhile, in several countries, such as France, Great Britain and Italy, there had been a significant increase in the dynamics of Google Trends searches related to lockdown policies.<sup>8</sup>

The peak of searches for "PCR", "Swab", and "Antigen" occurred in December and July 2021. The increase in searches coincided during the Christmas, New Year and Eid al-Adha holidays in Indonesia. This indicated the public's desire to carry out a diagnosis as a condition for long-distance travel during the holidays according to the travel health protocol for the Christmas 2020 and New Year 2021 holidays and a circular letter limiting community activities during the Eid al-Adha 1442 Hijri holiday issued by the Government. This regulation regulated the diagnostic requirements for RT-PCR or antigen rapid test for air, sea and land travelers.<sup>9,10</sup> The tradition of going home on holidays which many people do could increase mobility, so that it has an impact on increasing COVID-19 cases like the previous holiday period.<sup>11</sup>

This increase in tracing was reinforced by previous research which showed the implementation of health protocols and validation of supporting documents for mobilization, such as a COVID-19 free certificate following the applicable circular.<sup>12</sup> In addition, the researchers' findings also supported this increase in search through related queries or other keywords inserted such as price, location, and clinics that provide PCR and Antigen services. The community also inserted certain clinical brands such as Bumame and Kimia Farma which were widely trusted by the community in making the diagnosis of COVID-19. The decision to buy a product is based on factors, such as product, price, place, process or service.<sup>13,14</sup> In line with this, the investigation carried out an indication in the decision to purchase diagnostic services. During a pandemic, the

price of PCR and rapid antigen tests was also important information for the public. The existence of a significant price difference between the two, as well as the price of a diagnostic test which tend to be higher than that of other countries, indicated that people were looking for alternative diagnostic tests that are more efficient. The government then issued a policy to evaluate the current price limit for diagnostic tests.<sup>15,16</sup>

In addition, the public searched for information regarding the validity period, differences, and definitions. This showed that people were looking for information to educate themselves about COVID-19, in line with previous research.<sup>17</sup> The community also searched for the CT value results obtained after the PCR test results.<sup>18</sup> This indicated that the community had made a diagnosis and wanted to find out more from the test results obtained. The existence of Google which was easily accessible and rich in information had caused people to rely on Google as a source of health information and a reference in responding to the existence of the COVID-19 pandemic. In line with previous research, people were trying to find in-depth information about this virus on the Google search engine.<sup>19,20</sup>

In this study, the majority of searches occurred in the DKI Jakarta area. DKI Jakarta was the area with the highest number of COVID-19 cases (1.24 million confirmed cases) due to the dense population in the area.<sup>21,22</sup> The Jakarta area also had the most travelers at Soekarno Hatta and Halim Perdana Kusuma Airports in 2020.<sup>23</sup> This indicated that the high number of searches related to diagnosis based on region can be caused by the high number of cases and the number of trips in that region. In addition, the internet penetration factor in the region could also affect search volume.<sup>24</sup>

Even though the government's policy regarding COVID-19 diagnostics during the holidays was carried out as an effort to suppress the spread of COVID-19, the use of antigen/PCR was considered ineffective if it was used for a single examination without indications, such as indications of close contact. Negative PCR/antigen results also did not necessarily indicate that the individual was not currently infected. In addition, the examination was carried out only once without indication, so the effectiveness was weak. In addition, the possibility of illegal practices such as fake antigen or PCR letters, only provided financial benefits for the parties involved without considering the negative impact of efforts to deal with the COVID-19 pandemic, threats to public health and safety.<sup>25</sup>

The existence of a correlation between information-seeking activities related to making a diagnosis of COVID-19 and positive cases of COVID-19 indicated that people were searching for information before and after carrying out a diagnosis of COVID-19. This could be due to government policies related to efforts to prevent COVID-19 and public concern due to the increase in the number of positive cases of COVID-19, resulting in self-protective measures. In line with previous research, several government policies and self-protective measures increase community

search interest and correlate with the number of new cases of COVID-19.<sup>24,26</sup> The news of the discovery of a COVID-19 case also led to an increase in searches for "covid symptoms" and "hand sanitizer" by 52% and 35% after the first case was announced and continued until the observation time was determined.<sup>27</sup>

Enforcement of a diagnosis of COVID-19 was a preventive effort by the government to control and prevent transmission of COVID-19. This policy then encouraged public interest in exploring information related to COVID-19 which was considered a threat in order to understand it.<sup>28</sup> This was because someone who felt threatened by the existence of the disease, felt fear that caused protective behavior. Meanwhile, an increase in search for protective behavior and health knowledge was associated with an increase in the prevalence of COVID-19.<sup>29</sup>

This study also found that people considered information search keywords, such as the Swab keyword, rather than the Antigen and PCR keywords. Swab was a method for obtaining sample material by wiping certain parts of the nasopharynx and oropharynx in the COVID-19 examination. Swab terminology was used in PCR and antigen methods. This indicated that the public wants to get more information regarding the two methods and understand the diagnosis, so that the community took the right treatment in response to the COVID-19 pandemic. Someone who accessed health information online was based on the goal of preparing before the action and completing the understanding after the action. In addition, the search for health information also shaped perceptions, increase knowledge, and minimize uncertainty.<sup>30</sup>

This study also found a correlation between search volume for the keywords "PCR" and "Swab" with the cumulative number of daily tests. The effect of the time lag shows that information search was not only carried out precisely on the increase in the number of daily tests, but occurred 3 days before and after the increase in the number of daily tests occurred. In line with previous research that an increase in test-related search interest had a correlation with an increase in daily tests.<sup>31</sup> This indicated that people who carry out searches related to diagnostic enforcement had the goal of carrying out diagnostic enforcement. The COVID-19 pandemic had not only increased public awareness and driven information seeking, but also had an impact on their actions.<sup>31</sup> In addition to cumulative daily tests, this study also showed a correlation between keyword search volume and the number of daily PCR and Antigen tests. Previous research in the United States also showed that there was a correlation between online search trends and the COVID-19 testing situation in the United States.<sup>32</sup> The PCR and Antigen test was an enforcement of the COVID-19 diagnosis approved by WHO and the Indonesian government in the guidelines for the prevention and control of COVID-19.<sup>32,33</sup> There was an increase in the number of cumulative daily tests and Antigen, and a decrease in related keywords indicating an increase in public knowledge had an impact towards action. This was reinforced by previous research that there was an increase in public knowledge of 93.8% to carry out a COVID-19 diagnostic test.<sup>34</sup>

Antigen test capacity had also increased rapidly since the government issued a circular letter regarding travel that required the public to carry out a diagnostic test.<sup>35</sup> In addition, the existence of various information and keyword suggestions provided by Google based on previous search queries also influenced people's search interests and behavior.<sup>24,36</sup>

This research had a large population and compared search data by region in Indonesia. While the limitations of this study, the limitations in providing a complete description of a population because Google Trends data only related to the keywords or phrases searched for. In addition, the data obtained was also limited because Google Trends monitoring did not cover social media, TV networks or other online publications.

## **Conclusion**

Google trends searches for COVID-19 diagnostics such as "PCR", "Swab", and "Antigen" were influenced by government policies and public compliance. This was shown by the correlation between searches related to the diagnosis of COVID-19 with the keywords PCR, Swab and Antigen and the number of daily PCR and Antigen tests (P-valuee <0.005). Searches related to the diagnosis of COVID-19 with the keywords Swab and Antigen also correlated with the number of new positive cases of COVID-19. This showed that Google trend has the potential as a monitoring tool for people's behavior related to diagnosis. The government was expected to be able to utilize google trends as a reference in determining policies related to strategies for controlling COVID-19 in Indonesia.

## **Acknowledgement**

No applicable

## **Funding**

The authors stated that they had no funding for the reasearch

## **Conflict of Interest**

The authors declared that they had no conflict of interest.

## **References**

1. Ritchie H et al. Coronavirus Pandemic (COVID-19) – the data. Our World in Data, <https://ourworldindata.org/coronavirus> [2020, accessed 2 July 2021].
2. World Health Organization. WHO Indonesia Situation Report. 2021. Epub ahead of print 2021. doi: 10.1017/S0020818300011711.

3. Kementerian Kesehatan RI. Ikhtisar Mingguan Covid-19 Indonesia, 28 Agustus - 3 September 2021, [http://repository.bkpk.kemkes.go.id/4191/1/Ikhtisar Mingguan %28Weekly Report%29 COVID-19 di Indonesia Edisi 7 Periode 28-3 September 2021.pdf](http://repository.bkpk.kemkes.go.id/4191/1/Ikhtisar_Mingguan%28Weekly%20Report%29_COVID-19_di_Indonesia_Edisi_7_Periode_28-3_September_2021.pdf) (2021).
4. Sugiyono. Metode Penelitian Pendidikan Pendekatan Kuantitatif, kualitatif, dan R&D. Bandung: Alfabeta, 2010.
5. Fathimah AF, Al-Islami MF, Gustriani T, et al. Kepatuhan Masyarakat Terhadap Pemerintah Selama Pandemi: Studi Eksplorasi Dengan Pendekatan Psikologi Indigenous. *PsikobuletinBuletin Ilm Psikol.* 2021;2(1):15. <http://dx.doi.org/10.24014/pib.v2i1.11703>
6. Effenberger M, Kronbichler A, Shin J Il, et al. Association of the COVID-19 pandemic with Internet Search Volumes: A Google Trends™ Analysis. *Int J Infect Dis.* 2020;95(June): 192–197. <https://doi.org/10.1016/j.ijid.2020.04.033>
7. Ahmed S, Abid MA, de Oliveira MHS, et al. Ups and downs of COVID-19: can we predict the future? Local analysis with Google Trends for forecasting the burden of COVID-19 in Pakistan. *Electron J Int Fed Clin Chem Lab Med.* 2021;32(4):421–431; PMID: 35046760; PMCID: PMC8751396.
8. Dagher SH, Lamé G, Hubiche T, et al. The influence of media coverage and governmental policies on google queries related to COVID-19 cutaneous symptoms: Infodemiology study. *JMIR Public Heal Surveill.* 2021;7(2):1–11. doi: 10.2196/25651
9. Satuan Tugas Penanganan COVID-19. Surat Edaran No. 3 Tahun 2020 tentang Protokol Kesehatan Perjalanan Orang Selama Libur Hari Raya Natal & Menyambut Tahun Baru 2021 dalam Masa Pandemi Covid-19.
10. Satuan Tugas Penanganan COVID-19. Surat Edaran Satgas No 15 tahun 2021 Pembatasan Aktivitas Masyarakat Selama Libur Hari Raya Idul Adha 1442 Hijriah Dalam Masa Pandemi Corona Virus Disease 2019 (COVID-19), [https://covid19.go.id/p/regulasi/surat-edaran-kepala-satuan-tugas-nomor-15-tahun-2021#:~:text=Tentang Pembatasan Aktivitas Masyarakat Selama,2019 \(COVID-19\). \(2021\)](https://covid19.go.id/p/regulasi/surat-edaran-kepala-satuan-tugas-nomor-15-tahun-2021#:~:text=Tentang Pembatasan Aktivitas Masyarakat Selama,2019 (COVID-19). (2021)
11. Nadine A, Imtiyaz ZZ. Analisis Upaya Pemerintah Dalam Menangani Mudik Melalui Peraturan Menteri Perhubungan Nomor 25 Tahun 2020 Pada Masa Covid-19. *Media Iuris.* 2020;3(3): 277. doi: 10.20473/mi.v3i3.20674
12. Pujaningsih NN, Sucitawathi IGAAD. Penerapan kebijakan pembatasan kegiatan wabah Covid-19 di Kota Denpasar. *J MODERAT.* 2020;6(3):458–470. doi: 10.25157/moderat.v6i3.3537
13. Setyarko Y. Analisis Persepsi Harga, Promosi, Kualitas Pelayanan, dan Kemudahan Penggunaan Terhadap Keputusan Pembelian Produk Secara Online. *Ekon dan Manajemen,* ISSN 2252-6226. 2016;5(2):128–147. doi: 10.36080/jem.v5i2.329.

14. Permata Sari D. Faktor-Faktor Yang Mempengaruhi Keputusan Pembelian, Kualitas Produk, Harga Kompetitif, Lokasi (Literature Review Manajemen Pemasaran). *J Ilmu Manaj Terap.* 2021;2(4):524–533. doi: 10.31933/jimt.v2i4
15. Santia T. Perbandingan Harga Tes PCR, Antigen hingga Masker Dulu dan Sekarang, Bak Bumi dan Langit! LIPUTAN6.COM, <https://www.liputan6.com/bisnis/read/4965816/perbandingan-harga-tes-pcr-antigen-hingga-masker-dulu-dan-sekarang-bak-bumi-dan-langit> [2022, accessed 26 March 2023].
16. Putri CA. Kenapa Baru Sekarang Harga Tes PCR Diturunkan? CNBC Indonesia, <https://www.cnbcindonesia.com/news/20210815180643-4-268560/kenapa-baru-sekarang-harga-tes-pcr-diturunkan> [2021, accessed 26 March 2023].
17. Bento A, Nguyen T, Wing C, et al. Information Seeking Responses to News of Local COVID-19 Cases: Evidence from Internet Search Data. *ArXiv.* 2020;Preprint. <https://doi.org/10.48550/arXiv.2004.04591>.
18. Heriagus A. CT Value Tidak Menentukan Kesembuhan Pasien Covid-19, <https://www.ui.ac.id/ct-value-tidak-menentukan-kesembuhan-pasien-covid-19/> [2021, accessed 23 May 2022].
19. Limilia P, Pratamawaty BB. Google Trends and Information Seeking Trend of COVID-19 in Indonesia Google Trends dan Tren Pencarian Informasi COVID-19 di Indonesia. *J ASPIKOM.* 2020;5(2): 188–205. doi: 10.24329/aspikom.v5i2.74
20. Liaw AE, Putri FP, Qamarani MA, et al. Minat Pencarian Informasi Selama Pandemi Covid-19 Di Indonesia: Studi Google Trends. *VisiKes J KesehatanJurnal Kesehat.* 2022;21(1): 258–267. doi: 10.33633/visikes.v21i1Supp.4184
21. Satuan Tugas Penanganan COVID-19. Peta Sebaran. covid.go.id, <https://covid19.go.id/peta-sebaran> [2021, accessed 11 April 2022].
22. Ghiffari RA. Dampak Populasi Dan Mobilitas Perkotaan Terhadap Penyebaran Pandemi Covid-19 Di Jakarta. *Tunas Geogr.* 2020;9(1): 81; doi: 10.24114/tgeo.v9i1.18622
23. BPS BPS. Statistik Transportasi Udara 2020. 2021.
24. Rizqullah MF, Syakurah RA. Public Search Interest Analysis on Indonesian COVID-19 Containment Policy. *J Kebijak Kesehat Indones JKKI.* 2020;9(3):147–153. doi: 10.22146/jkki.57541
25. Agung. Epidemiolog: Antigen atau PCR Tak Efektif Untuk Syarat Perjalanan. Universitas Gajah Mada, <https://www.ugm.ac.id/id/berita/21858-epidemiolog-antigen-atau-pcr-tak-efektif-untuk-syarat-perjalanan> [2021, accessed 26 March 2023].
26. Chandra M, Syakurah R. Potential use of personal protection online search during COVID-19 pandemic for predicting and monitoring public response. *Int J Public Heal Sci.* 2020;9(4): 406–413; doi: 10.11591/ijphs.v9i4.20547

27. Bento AI, Nguyen T, Wing C, et al. Evidence from internet search data shows information-seeking responses to news of local COVID-19 cases. *Proc Natl Acad Sci U S A*; 117. Epub ahead of print May. 2020; Preprint. doi: 10.1073/PNAS.2005335117.
28. Syafitri DU, Falasifah M, Hakim FR. Penerapan PHBS, Perilaku Pencarian Informasi, dan Kesehatan Mental Masyarakat di Awal Masa Pandemi COVID 19. *Motiv J Psikol*. 2021;4(2):98; doi: 10.31293/mv.v4i2.5586
29. Du H, Yang J, King RB, et al. COVID-19 Increases Online Searches for Emotional and Health-Related Terms. *Appl Psychol Heal Well-Being*. 2020;12(4):1039–1053; doi: 10.1111/aphw.12237
30. Zhao X, Fan J, Basnyat I, et al. Online Health Information Seeking Using “#COVID-19 Patient Seeking Help” on Weibo in Wuhan, China: Descriptive Study. *J Med Internet Res*; 22. Epub ahead of print. 2020;22(10):e22910. doi: 10.2196/22910.
31. Jun SP, Yoo HS, Lee JS. The impact of the pandemic declaration on public awareness and behavior: Focusing on COVID-19 google searches. *Technol Forecast Soc Change*. 2021; 166(May):120592; doi: 10.1016/j.techfore.2021.12059
32. World Health Organization (WHO). Antigen-detection in the diagnosis of SARS-CoV-2 infection. World Health Organization, <https://www.who.int/publications/i/item/antigen-detection-in-the-diagnosis-of-sars-cov-2infection-using-rapid-immunoassays> [2021, accessed 11 April 2022].
33. Kementerian Kesehatan Republik Indonesia. Keputusan Menteri Kesehatan Republik Indonesia Nomor HK.01.07/MenKes/413/2020 Tentang Pedoman Pencegahan dan Pengendalian Corona Virus Disease 2019 (Covid-19). Kementerian Kesehatan Republik Indonesia 2020; 207.
34. Salamah U, Kusuma DY. Diseminasi Teknologi PCR, Rapid Antigen, dan Rapid Antibodi Sebagai Upaya Edukasi Masyarakat dan Mitigasi Covid--19 di Kalurahan Serut, Gedangsari, Gunungkidul. *Pros Semin Nas Has Pengabd Kpd Masy Univ Ahmad Dahlan*. 2021;3(1):462–468.
35. CNN Indonesia. Hasil Tes Antigen Belum Masuk Pendataan Nasional. CNN Indonesia, <https://www.cnnindonesia.com/nasional/20210216141421-20-606878/hasil-tes-antigen-belum-masuk-pendataan-nasional> (2021).
36. Ramadhan MHA, Habibah U, Putri AK, et al. Minat Pencarian Masyarakat Terhadap Alat Pelindung Diri Selama Pandemi Covid-19 Di Indonesia: Analisis Google Trends. *J Kesmas (Kesehatan Masyarakat) Khatulistiwa*. 2021;8(3):122–129. doi: 10.29406/jkkm.v8i3.2580