RESEARCH ARTICLE

Increase in public interest concerning alternative medicine during the COVID-19 pandemic in Indonesia: a Google Trends study [version 1; peer review: 2 approved with reservations]

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v1 **First published:** 06 Oct 2020, **9**:1201
https://doi.org/10.12688/f1000research.25525.1
Latest published: 06 Oct 2020, **9**:1201
https://doi.org/10.12688/f1000research.25525.1

Abstract

Background: The COVID-19 pandemic has triggered individuals to increase their healthy behaviour in order to prevent transmission, including improving their immunity potentially through the use of alternative medicines. This study aimed to examine public interest on alternative medicine during the COVID-19 pandemic using Google Trends in Indonesia.

Methods: Employing a quantitative study, the Spearman rank test was used to analyze the correlation between Google Relative Search Volume (RSV) of various search terms, within the categories of alternative medicine, herbal medicine and practical activity, with COVID-19 cases. In addition, time lag correlation was also investigated.

Results: Public interest toward alternative medicine during COVID-19 pandemic in Indonesia is dramatically escalating. All search term categories (alternative medicine, medical herbal, and alternative medicine activities) were positively associated with COVID-19 cases ($p<0.05$). The terms '*ginger*' ($r=0.6376$), '*curcumin*' ($r=0.6550$) and '*planting ginger*' (0.6713) had the strongest correlation. Furthermore, time lag correlation between COVID-19 and Google RSV was also positively significant ($p<0.05$).

Conclusion: Public interest concerning alternative medicine related terms dramatically increased after the first COVID-19 confirmed case was reported in Indonesia. Time lag correlation showed good performance using weekly data. The Indonesian Government will play an important role to provide and monitor information related to alternative medicine in order for the population to receive the maximum benefit.

Open Peer Review

Reviewer Status ? ?

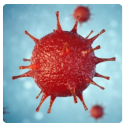
	Invited Reviewers	
	1	**2**
version 1 06 Oct 2020	? report	? report

1. **Lanjing Zhang**, Rutgers University, Newark, USA

2. **Seyed Mohammad Ayyoubzadeh**, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran

Any reports and responses or comments on the article can be found at the end of the article.

Keywords
COVID-19, alternative medicine, pandemic, search activity



This article is included in the Disease Outbreaks gateway.

This article is included in the Coronavirus collection.

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Author roles: Rokhmah D: Conceptualization, Data Curation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Project Administration, Resources, Supervision, Validation, Writing – Original Draft Preparation, Writing – Review & Editing; **Ali K**: Conceptualization, Data Curation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Software, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Putri SMD**: Data Curation, Formal Analysis, Funding Acquisition, Methodology, Project Administration, Validation, Visualization, Writing – Original Draft Preparation; **Khoiron K**: Formal Analysis, Methodology, Project Administration, Validation

Competing interests: No competing interests were disclosed.

Grant information: This study was sponsored by Indonesian Endowment Fund for Education (LPDP).

How to cite this article: Rokhmah D, Ali K, Putri SMD and Khoiron K. **Increase in public interest concerning alternative medicine during the COVID-19 pandemic in Indonesia: a Google Trends study [version 1; peer review: 2 approved with reservations]** F1000Research 2020, **9**:1201 https://doi.org/10.12688/f1000research.25525.1

First published: 06 Oct 2020, **9**:1201 https://doi.org/10.12688/f1000research.25525.1

Introduction

The COVID-19 pandemic is a massive health crisis worldwide. Within seven months, it has affected 216 countries, and more than 11 million population have been infected by the SARS-COV-2 virus, which causes COVID-19[1]. In Indonesia, COVID-19 transmission has been reported in all provinces, with 68,226 confirmed cases recorded by July 8th 2020[2]. The World Health Organization (WHO) noted that Indonesia is the third country with largest number of cases in South East Asia[3]. Therefore, appropriate action is urgently needed to halt COVID-19 transmission among the public.

Effenberger *et al.*[4] noted that the high virulence of SARS-COV-2 contributes to the super-spread of COVID-19. In addition, the large number of asymptomatic cases catalyze the intensity of the transmission among population. Currently, no vaccine has been developed for COVID-19. The pandemic has triggered a large-scale behavior change among the global population to protect their health[5]. This may include an increase of public interest concerning alternative medicine.

Alternative medicine in Indonesia is called *Jamu* and is well-known. It is commonly composed by herbal medicines, such as ginger and curcumin, which are extracted and added to water to be drinkable. Both ingredients and other methods of *Jamu* are accessible and available to the general population of Indonesia. *Jamu* is commonly used to preserve immunity. Therefore, this study aimed to examine public interest concerning alternative medicines in Indonesia during the COVID-19 pandemic. Time lag scenarios were also investigated.

Methods

This was a quantitative study using secondary data from Indonesia. The data was obtained from Google Trends using Google Relative Search Volume (RSV) and COVID-19 case data. Google RSV presents information on how many terms have been searched at a particular time using the Google search engine, i.e. the data provides information about public interest towards a particular term[6]. A high RSV (maximum 100 points) indicates high public interest; while the lowest (0 points) shows an absence of public interest[7]. In this study, COVID-19 cases were defined as laboratory-confirmed cases positive for SARS-COV-2 virus as reported by the Indonesian Government. The data were retrieved from January 1st 2019 to June 6th 2020 weekly (total of 74 weeks; 2019: weeks 1–52, 2020: weeks 53–74).

Data sources

Data for confirmed cases of COVID-19 nationwide were collected from the Indonesian Ministry of Health (MoH), where COVID-19 cases are reported daily (https://www.kemkes.go.id/article/view/20031900002/Dashboard-Data-KasusCOVID-19-di-Indonesia.html).

Google RSV data for Indonesia were collected from Google Trends (www.trends.google.com) with web search as default option[8]. Search terms were divided into three categories with subterms in each of the categories as follows: 1) alternative medicine (‘*Jamu*’ [alternative medicine]; 2) herbal medicine (‘*tanaman obat*’ [herbal medicine], ‘*jahe*’ [ginger], ‘*kunyit*’ [curcumin]); and 3) alternative medicine activities (‘*cara membuat jamu*’ [how to make jamu], ‘*membuat jamu*’ [make jamu], ‘*menanam tanaman obat*’ [planting herbal medicines], ‘*menanam jahe*’ [planting ginger], ‘*menanam kunyit*’ [planting curcumin]).

The first category ‘*Jamu*’ was employed to recognize public interest toward alternative medicine during the pandemic in Indonesia; as stated before ‘*Jamu*’ is traditional alternative medicine in Indonesia used for maintaining and improving immunity. The second category (herbal medicine) was used to understand public interest on the types of medical plants being used. According to Salim and Munadi[9], the production of ginger and curcumin in Indonesia was the highest compared to other medicinal plants, where the consumption trend during 2011–2015 increased by 21.95% and 5.92%, respectively. Moreover, the Statistics Office of Indonesia recorded that the total harvest of ginger and curcumin on 2018 is the largest in Indonesia[10]. Therefore, search terms of ‘*jahe*’ [ginger] and ‘*kunyit*’ [curcumin] was selected in the second category. The third category (alternative medicine activities) collected information about public interest toward performing *Jamu* and planting herbal medicines.

Data analysis

This study followed the methodology of previous studies[7,11]. After checking and cleaning the data, there was no missing data noted. The data was stored in Microsoft Excel 2010, and then transferred to STATA v13 (College Station, TX, USA) for analysis. Google RSV data was available weekly, and therefore COVID-19 case data was also analyzed weekly.

The data was not normally distributed, so Spearman rank test was used to examine the correlation between Google RSV and COVID-19 cases. Time lag correlation between Google RSV and COVID-19 was also analyzed, where the procedure referred to Husnayain *et al.*[11] and Torres-Reyne[12]. The significance level was set at 0.05.

Results

COVID-19 cases and Google RSV

The pattern of COVID-19 case and Google RSV in Indonesia is visualized in Figure 1. Since the first confirmed COVID-19 case was reported in Indonesia on March 2nd 2020 (week 61 of this study), COVID-19 cases have been increasing in Indonesia. According to the MoH, 30,514 confirmed cases of COVID-19 were reported during 14 weeks (March 2nd–June 6th 2020); mean weekly cases were recorded as ~315 cases.

RSV of ‘*Jamu*’ [alternative medicine] from week 1 until week 60 was 40–60 points, with search activity increasing from week 61 (March 1st-7th 2020). The highest RSV score for this search term was in week 63 with 100 points (Figure 1A). The RSV of ‘*tanaman obat*’ [herbal medicine], ‘*jahe*’ [ginger], and ‘*kunyit*’ [curcumin] before the pandemic (week 1–60) was 19–49 points, with the RSV dramatically increasing from week 61 (42–79 points). The peak for all herbal medicine search terms was found in week 64 (100 points) (Figure 1B).

Figure 1. Google Relative Search Volume and COVID-19 new cases in Indonesia. COVID-19 cases compared with (**A**) 'Jamu' [alternative medicine] search term; (**B**) herbal medicine search terms ('*tanaman obat*' [herbal medicine], '*jahe*' [ginger], '*kunyit*' [curcumin]); (**C**) alternative medicine activities search terms ('*cara membuat jamu*' [how to make jamu], '*membuat jamu*' [make jamu], '*menanam tanaman obat*' [planting herbal medicines], '*menanam jahe*' [planting ginger], and '*menanam kunyit*' [planting curcumin]). Letters: A, January 30th 2020: COVID-19 declared as Public Health Emergency of International Concern; B, March 2nd 2020: first imported case was reported in Indonesia; C, March 16th 2020: social distancing declared by Indonesian Government.

A similar trend is shown for alternative medicine activities search terms (Figure 1C). Before the pandemic (week 1–60) these terms had an RSV of 0–36 points. In week 61, the RSV increases ~2 fold higher. The term '*cara membuat jamu*' [how to create jamu] and '*membuat jamu*' [create jamu] reached their peak on week 63 (100 points) and 64 (100 points), respectively. Meanwhile, the peak for '*menanam jahe*' [planting ginger] and '*menanam kunyit'* [planting curcumin] was recorded on week 65 and week 63, respectively, with 100 points. The peak for '*menanam tanaman obat*' [planting herbal medicines] reached its peak on week 63 (similar to '*cara membuat jamu*' [how to create jamu]) with the highest score of 48 points.

Statistical analysis

Table 1 displays the correlation between COVID-19 cases and Google RSV in Indonesia. All search term categories (alternative medicine, herbal medicine, and alternative medicine activities) are positively correlated with COVID-19 cases ($p<0.05$). The terms '*jahe'* [ginger] ($r=0.6376$), '*kunyit'* [curcumin] ($r=0.6550$) and '*menanam jahe*' [planting ginger] ($r=0.6713$) have the strongest correlation towards COVID-19 new cases in Indonesia. Based on a time lag scenario, the correlation between COVID-19 cases and Google RSV showed good performance with weekly data, where all search terms are significant ($p<0.05$). In the time lag scenario, a strong correlation is also found for the terms '*jahe'* [ginger], '*kunyit'* [curcumin], and '*menanam jahe*' [planting ginger] ($r>0.6$; $p<0.05$).

Discussion

Since the first COVID-19 confirmed case was reported on March 2nd 2020 (week 61), there have been a dramatic increases in cases in Indonesia. The mean weekly cases of COVID-19 is ~315 case (Figure 1), and we noted the highest case load reported on week 74 (4741 cases). We also show in our data that COVID-19 cases in Indonesia have increased by ~305% within 14 weeks (30,514 cases; Figure 1). This indicates a super-spread of COVID-19 in Indonesia. The high population and population mobility may take an essential role in intense COVID-19 transmission[13,14].

Alternative medicine is one option for individuals to maintain and increase their immunity during the COVID-19 pandemic. In our study, we found that the search activity of alternative medicine-related terms, including herbal medicine and activities surrounding alternative medicine, was low and steady before the pandemic (weeks 1–60). This was even though a Public Health Emergency of International Concern had been declared by the WHO on January 30th 2020 (week 56). Interestingly, only after the first COVID-19 confirmed case in Indonesia was announced on week 61 did the search activity dramatically increased. Most of the search terms looked at in this study reached their peak on week 63–64, after which social distancing issue has been established in Indonesia (on March 16th 2020)[15]. The alternative medicine issue also appeared among the public around March 13th – 16th (week 63) during the pandemic. In this period, the President of Indonesia claimed that herbs can fight COVID-19, which may have increased public interest toward alternative medicine[16].

In this study, all search terms were associated positively with COVID-19 cases in Indonesia ($p<0.05$). This indicated that increasing COVID-19 cases elevated the public interest

Table 1. Correlation between Google Relative Search Volume and COVID-19 cases in Indonesia.

Search term	Weeks						
	lag -3	lag -2	lag -1	lag 0	lag 1	lag 2	lag 3
Alternative medicine							
'*Jamu'* [alternative medicine]	0.4351**	0.3858**	0.3917**	0.4028**	0.3165**	0.3113**	0.3032*
Herbal medicine							
'*tanaman obat*' [herbal medicine]	0.5231**	0.5474**	0.5648**	0.5643**	0.5839**	0.5408**	0.5330**
'*jahe'* [ginger]	0.6362**	0.6306**	0.6289**	0.6376**	0.5806**	0.5668**	0.5422**
'*kunyit*' [curcumin]	0.6096**	0.6115**	0.6238**	0.6550**	0.5974**	0.5839**	0.5623**
Alternative medicine activities							
'*cara membuat jamu*' [how to make jamu]	0.5324**	0.4589**	0.5101**	0.5127**	0.4573**	0.4410**	0.4360**
'*membuat jamu*' [make jamu]	0.5531**	0.5082**	0.5592**	0.4874**	0.4525**	0.4236**	0.4132**
'*menanam tanaman obat*' [planting herbal medicine]	0.5212**	0.5312**	0.5609**	0.5690**	0.5778**	0.5583**	0.5394**
'*menanam jahe*' [planting ginger]	0.5699**	0.5802**	0.6117**	0.6713**	0.6253**	0.6174**	0.6052**
'*menanam kunyit*' [planting curcumin]	0.2830**	0.3019*	0.3146**	0.4187**	0.4076**	0.5019**	0.4790**

*significant ($p<0.05$); **significant ($p<0.01$)

concerning alternative medicine. A similar result was also shown with the time lag scenario, where all search terms were positively associated with COVID-19 cases ($p<0.05$). This finding shows that there was an increase in search activities 1–3 weeks after nd before the increase of COVID-19 cases in Indonesia. However, a strong correlation is detected at the present time (lag 0), particularly for the herbal medicine category. This study found that correlation analysis using weekly data of Google RSV compared to COVID-19 new cases in Indonesia showed good performance, which is collaborated by previous studies[7,17–19].

The trend of Google RSV for all search terms was higher during the pandemic. This indicates increasing public interest toward alternative medicine during the pandemic in Indonesia. Wise *et al.*[20] noted that awareness of the public related to the COVID-19 pandemic is elevated due to the risk posed by the virus, and the large number of available information sources serves to reinforce their protective behavior. Galankis[21] also reported that the public tend to search for information related to health either short- or long-term during the pandemic.

The Indonesian Government plays an important role in the high public interest toward alternative medicine during the pandemic. Actions concerning monitoring and providing valid information regarding alternative medicine to the public are urgently needed. These actions should prevent misuse of medical herbal among the public. In addition, information could be used to empower communities to provide self-remedial source at a household level, such as planting herbal medicines.

Conclusion

Public interest on alternative medicine related-terms has dramatically increased during the COVID-19 pandemic in Indonesia. Search terms relating to alternative medicine, herbal medicines and activities surrounding alternative medicines correlate positively with an increase of COVID-19 cases in Indonesia. This study recommends that the Indonesian Government take an active role in informing the public about alternative medicines, and monitoring and providing valid information. This may empower households to produce medical herbs independently.

Data availability

Underlying data

COVID-19 case data available from: https://www.kemkes.go.id/article/view/20031900002/Dashboard-Data-KasusCOVID-19-di-Indonesia.html

Google Trend data available from: https://trends.google.com/. Search terms and other parameters are provided in the text.

Mendeley: Public interest on alternative medicine during pandemic in Indonesia, http://dx.doi.org/10.17632/fv7tprb24j.1[22].

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http://www.doi.org/10.17632/fv7tprb24j.1

Open Peer Review

Current Peer Review Status: ? ?

Version 1

Reviewer Report 05 February 2021

https://doi.org/10.5256/f1000research.28170.r78462

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Seyed Mohammad Ayyoubzadeh
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The paper analyzed if the public interest in alternative medicine had changed during the COVID-19 pandemic in Indonesia using Google Search data provided by Google Trends. The authors used the Spearman rank test for performing the statistical test. The result showed that the public interest in alternative medicine has increased during COVID-19.

The study has cited related literature analyzing Google Trends in COVID-19. However, It will be great if the authors could add some references about alternative medicine in the introduction section.

The study design seems appropriate, choosing a reasonable time range for the analysis and performing a suitable statistical test for the analysis.

Please remove the sentence *"Currently, no vaccine has been developed for COVID-19".*

The URL for google trends is "https://trends.google.com/" not *"www.trends.google.com"* mentioned in the data source.

I couldn't find the data from the mentioned URL: https://www.kemkes.go.id/article/view/20031900002/Dashboard-Data-KasusCOVID-19-di-Indonesia.html

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Medical Informatics, eHealth, mHealth, IoT, smartphone apps, data mining, CDSS

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 11 November 2020

https://doi.org/10.5256/f1000research.28170.r73844

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Lanjing Zhang
Department of Biological Sciences, Rutgers University, Newark, NJ, USA

This is an interesting article focused on the links between google search trend and daily incidence of COVID-19 in Indonesia. The findings appear novel since my search of the literature shows no similar works in the Pubmed. However, I have the following concerns:

Major:

1. The correlation coefficients appeared moderate (about 0.5-0.6). This low degree of correlation should be addressed. One of the approaches is to correlate the keyword with the google trend. If such a correlation is moderate (in Indonesia), the correlation coefficient become acceptable. Of course, some discussions are needed even so.

2. Literature review is less comprehensive. It could be improved by citing related articles [1,2,3] and others.

3. The authors may compare the trends of search interest in these alternative medicine terms,

whose change may have a better correlation with the COVID-19 incidence trends.

4. Do the symptoms correct with COVID-19 daily incidence? They may correlate better than these alternative medicine terms.

5. Not sure why Spearman ranked test was used. In my view, Pearson's rho may be a better choice.

Minor:

1. It will be more helpful if the authors could discuss more on how direct use of these trends could improve disease surveillance and prevention.

2. Detailed p values should be provided even they are smaller than .05.

3. The case number is probably meant daily new cases or daily incidence. Please use the more precise terms.

4. The total case number should be updated since the one in the text is published 4 months. The number may have been doubled.

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Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: clinical epidemiology, statistical methodology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.