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Abstract

Background: COVID-19 cases worldwide remain high and causing death, including in Indonesia, especially in Semarang city. Population size, population density, and migrants are assumed to contribute to COVID-19 cases. Aim: The study aims to analyze the correlation between population size, population density, and migrants with the number of COVID-19 cases. Setting and Design: The research covered the area of Semarang city and applied a cross-sectional study design. Methods and Materials: Data on population size and density from the Statistical Agency and the Department of Population and Civil Registry data. Data on COVID-19 cases and migrants from the Semarang City Health Office. The number of populations at the village level in 2020 were estimated based on the population data in 2019 with the sub-district growth rate. Data on population size, COVID-19 cases during June-July, and the number of migrants were taken from 173 villages, while data on population density from 98 villages. Statistical Analysis: Statistical analysis employed was the Pearson Correlation test with α of 1%. Results: The results indicated that population size and the number of migrants correlated to COVID-19 cases (p-value<0.01, r=0.58, r=0.33, respectively). Population density correlated to COVID-19 cases during June (p=0.015 and r=0.25) and in early July with (p-value<0.01, r=0.22). Conclusion: The study concluded that population size, population density, and the number of migrants correlated to COVID-19 cases.
Keywords: population, migrants, density, COVID-19

Key Messages:
COVID-19 cases in Indonesia, including in Semarang city, tend to increase until July 2020. Residents, density, age groups, mobility, and travellers play the role of COVID-19 transmission and aware of these conditions. All residents continue to wear masks, wash their hands, and keep their distance. The local government of Semarang city to continues the program of Restrictions on Community Activities.


Introduction
The number of COVID-19 cases in Indonesia remains high until July 2020, and tends to increase, including in several provinces, districts, and cities (1). Likewise, in Semarang city, COVID-19 cases increased in June 2020. The cumulative cases of COVID-19 in Semarang city reach 637, 808 recovered, and 167 death(2). This condition is likely to increase in the following months continually.

COVID-19 transmission occurs through direct contact with people who are positive COVID-19 through droplets or indirect contact through contaminated surface objects (3). The size of the SARS-CoV-2 virus is 60-140 nm, and small droplet can travel tens of meters long distances in the indoor air or aerosol transmission (4). The risk factors of COVID-19 transmission and spread include the habit of washing hands, movement, and a crowd of people(5,6). It can facilitate contact between sufferers and carriers with healthy people.

Most of the COVID-19 cases in Indonesia occur in Java island, with the largest number of provinces, including Jakarta, East Java, Central Java, South Sulawesi, and West Java. Nationally, the number of COVID-19 cases in men is greater (50.6%) than those in women. The largest age group is 25-34 years. In these five provinces, local transmission has been occurred (1).

The top three provinces with the highest COVID-19 cases include Jakarta, East Java, and Central Java. These provinces have the biggest population. The total population of Jakarta in 2019 reached 10,557,810 people with a population density of 15,938 people/km², and today the population can reach 14.5 million people (7). COVID-19 cases in Jakarta reach 25,242, while the number of cases among travellers reach 2,120 (8). The population of East Java is 39,292,972 people, with a population density of 826.39 people/km² (9). The number of COVID-19 cases in East Java reaches 24,922 cases (10). Meanwhile, the population of Central Java is 34,490,835 people with a population density of 1,060 people/km² (11). As of July 2020, there were 9,573 COVID-19 cases in Central Java (8). The positivity rate for two weeks in Central Java province was high, amounting to 11.1%. Central Java did not fulfill the WHO standard in conducting tests, where one test per 1,000 population a week are expected (3). It seems that the three provinces also indicate a high number of COVID-19 cases.

COVID-19 cases in Central Java province were found higher in men with 52.8% than in
women. The most positive age group for COVID-19 is around 30-49 years (8). Cities with high population density have a higher number of COVID-19 cases than those with a lower population. Semarang city contributes to the increase of COVID-19 cases in Central Java province. The population of Semarang city reaches 1,674,358 people with a population density of 4,780 people/km² (11).

Previous research indicated that mobility habits become one of the variables that influence COVID-19 transmissions together with the number of tests per day, temperature, and pollution variables (5). The number of migrants or travellers in Semarang city reached 5,305 people and spread across sixteen sub-districts, with the highest number of migrants in Banyumanik sub-district and the lowest in Genuk sub-district (2). The number of new cases recorded every day is related to the trips, particularly in three weeks earlier (12). However, the transmission is not only caused by the sufferers out of town. Semarang city is one of the district with the COVID-19 local-transmission (1). It means that the COVID-19 transmission occurs among residents of Semarang city. Contact between sufferers and carriers with healthy people happens due to human activities. The mobility of residents in Semarang city is high. It can be identified from the number of people who commute for works or activities in the morning and evening. The mobility of people occurs between sub-districts and villages, including the surrounding area of Semarang city. According to Kang et al., an area that is close to the area with high cases pose a higher risk of transmission, especially in the early stages of infection (12).

Based on the populations, Pedurungan sub-district is a sub-district with the highest population, amounting to 192,424 people. Meanwhile, Tugu sub-district is a sub-district with the lowest population, reaching 33,308 people. In addition, Banyumanik sub-district has the highest population density with 13,443 people/km², while the lowest is Mijen sub-district with 1,049 people/km² (13). The number of COVID-19 cases in Semarang city up to June 2020 reached 636 cases, while the highest cases occurred in Tembalang sub-district with 63 cases, while the lowest was in Mijen sub-district with three cases (14). Sub-districts with a high population included Pedurungan, Tembalang, and West Semarang. These sub-districts recorded more than 50 COVID-19 cases. Due to the limited information provided, this study aims to correlate population size, population density, and the number of migrants with the COVID-19 cases in Semarang City.

Subjects and Methods

Study area

This study examined the correlation of population size, population density, and migrants with the COVID-19 cases in Semarang, Indonesia. Statistical analysis was employed to examine the correlation. This study used data from public databases. No animals or human subjects were utilized in this study, and therefore no Institutional Review Board was obtained.

Data collection

The study focused on the COVID-19 data recorded from June-July 2020. The daily data of COVID-19 cases were obtained from the COVID-19 Information Center in Semarang city (2,14). Meanwhile, data on population size and population density were obtained from the Department of
Population and Civil Registry, Semarang city (15). The population data of villages were estimated based on sub-districts growth rate. The data collected included: 1. number of population in 16 sub-districts and 177 villages, as well as population density in 98 villages obtained from Department of Population and Civil Registry of Semarang city (13); 2. number of COVID-19 cases in 177 villages obtained from the Semarang City Health Office (2,14).

Data analysis

Data were presented in a graph to compare the fluctuation of population size, population density, migrant, and COVID-19 cases in sub-districts and villages. The data was analysed through the Pearson correlation test, with a 1% error rate. The statistical analysis used was the IBM™ SPSS version 21.

Ethics approval and consent to participate

The ethical clearance and individual consent were not applied since no subjects were involved.

Results

Semarang city is bordered by the Java Sea in the northern, Semarang District to the southern, Kendal District to the west, and Demak District to the eastern. Semarang city can say into two parts, the highlands located in the south with an altitude of 90–359 meters above sea level (MASL), and 0.75–3.5 MASL for the lowlands. Meanwhile, Semarang city area is 373.3 km², where Mijen is the largest sub-district with 57.55 km², and Semarang Tengah is the smallest sub-district with 6.14 km².

Semarang city consists of 16 sub-districts and 177 villages. Semarang city has the highest population in Central Java Province. The total population of Semarang city reaches 1,814,110 people, with 49.5% men and 50.5% women. The largest proportion is dominated by the age group of 15-49 years, amounting to 62.3%. The age group of 10-49 years confirmed positive COVID-19 reached 6,892 cases or 59% of 11,674 COVID-19 cases in the Central Java Provincial level.

COVID-19 cases

Semarang city has confirmed 36 COVID-19 cases since April 9, with ten recovered and twelve dead. The highest number of COVID-19 cases in Semarang city happened on April 24, 2020, which reached 148 and then decreased from May 1-30, 2020. Meanwhile, on May 30, 2020, 99 COVID-19 cases were confirmed, 261 recovered, 40 death. After May 30, 2020, there was a significant increase of more than 100. From May 31-July 2020, COVID-19 cases in Semarang City increased sharply. In fact, in the next fifteen days, the number increased two times from 115 to 234. Even up to July 6, 2020, the number increased more than seven times. The peak occurred on July 7, 2020, with a cumulative number of 976 cases. However, the decline occurred at the end of July 2020 with 632. The recovery rate continued to increase from April to the end of July 2020. However, the mortality rate also increased cumulatively to 2951 and 435 people, respectively. The number of COVID-19 cases, recovery, and death during June-July 2020 is shown in Figure 1 as follows.
Population size, population density, and number of migrants in sub-districts

Pedurungan is a sub-district with the largest population, reaching 214,689 people, while Tugu is the smallest sub-district with 33,333 people. Meanwhile, the highest population density is in the Pedurungan sub-district, namely 13,436 people/km², and the lowest population density is in the Mijen sub-district was 1049 people/km². The total number of migrants (travelers) to Semarang city is 7,031 people, where the destinations to Semarang city are 5,306 people, and destinations outside the city of Semarang are 1,725 people. The highest number of migrants was to the Banyumanik sub-district, and the lowest was in the Genuk sub-district. Figure 2 presents the population size, population density, and the number of migrants in the sub-district levels of Semarang city.
Figure 2. Population size, population density, and number of migrants by sub-district
Population size, number of migrants, and population density in villages

Based on the village level, Sendangmulyo village has the highest population, reaching 44,897 people, while the lowest is Terboyo Kulon village with 741 people. The population size at the village level is presented in Figure 3.

![The number of the population density by the village](image)

Figure 3. The population and the number of migrants, population density by the village

Correlation of population size and number of migrants with the number of COVID-19 cases

Data of COVID-19 cases covered 173 villages. Population size, number of migrants, and COVID-19 at sub-district and village levels were significantly correlated. The correlation tended to increase until the end of July. The strongest correlation was on July 27, 2020. The strength of correlation was higher in July than in June.

There was no significant correlation between population density and the number of COVID-19 cases at the sub-district level. Contrastly, at the village level, there was a significant correlation between population density and the number of COVID-19 in early July. However, after July 6, there was no correlation between population density and the number of COVID-19.

The researchers also analyzed the correlation between the number of motorcycles, small traders, age groups, and COVID-19 cases. The results indicated was a significant correlation between the number of motorcycles and the number of COVID-19. Small traders also significantly
correlated with the number of COVID-19 cases and age groups at the sub-district level. In detail, the statistical analysis results present in Table 1.

### Table 1. Correlation of population size, number of migrants, and population density, age group, and COVID-19 cases

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number of COVID-19 cases</th>
<th>p-value</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sub-district level (n=16)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population size (June)</td>
<td>&lt;0.01⁺</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Population size (July)</td>
<td>&lt;0.01⁺</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>Number of migrants (June)</td>
<td>0.33</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>Number of migrants (July)</td>
<td>0.05</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>Population density (June)</td>
<td>0.33</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>Population density (July)</td>
<td>0.78</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>Number of motorcycles (June)</td>
<td>&lt;0.01⁺</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>Number of motorcycles (July)</td>
<td>&lt;0.01⁺</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>Number of small traders (June)</td>
<td>0.04⁺⁺</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Number of small traders (July)</td>
<td>0.08</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td><strong>Village level (n=173)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population size (June)</td>
<td>&lt;0.01⁺</td>
<td>0.58</td>
<td></td>
</tr>
<tr>
<td>Population size (July)</td>
<td>&lt;0.01⁺</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>Number of migrants (June)</td>
<td>&lt;0.01⁺</td>
<td>0.29</td>
<td></td>
</tr>
<tr>
<td>Number of migrants (July)</td>
<td>&lt;0.01⁺</td>
<td>0.32</td>
<td></td>
</tr>
<tr>
<td>Population density (June, n=98)</td>
<td>0.01⁺</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Population density (July 6, n=98)</td>
<td>0.02⁺</td>
<td>0.22</td>
<td></td>
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<tr>
<td>Population density (July 30, n=98)</td>
<td>0.17</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Number of motorcycles (June, n=60)</td>
<td>&lt;0.01⁺</td>
<td>0.33</td>
<td></td>
</tr>
<tr>
<td>Number of motorcycles (July, n=60)</td>
<td>&lt;0.01⁺</td>
<td>0.29</td>
<td></td>
</tr>
<tr>
<td>Age group of 15-49 years (June)</td>
<td>&lt;0.01⁺</td>
<td>0.56</td>
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<tr>
<td>Age group of 15-49 years (July)</td>
<td>&lt;0.01⁺</td>
<td>0.59</td>
<td></td>
</tr>
</tbody>
</table>

Note: α=0.01⁺; 0.05⁺⁺

### Discussion

After May 30, 2020, Semarang city's COVID-19 cases experienced a significant increase with more than a hundred cases. By the Qiu, the typical transmission of this disease within the city...
was relatively high and significant in other places (16). The increase caused by several factors included the increasing transmission in the community and groups or clusters, massive examinations, the mobility or movement of people from one place with high infection, community compliance, such as wearing masks, washing hands, low compliance of maintaining distance. An example, face-to-face contact in offices, factories, companies, and markets (17). The high number of COVID-19 cases in Semarang city indicated that the dynamics of coronavirus transmission in the community remains running. 

Clusters with the characteristics of a large number of people, crowded, and possibly closed places cases of COVID-19 are high. In the city of Semarang, it can find in hospitals, offices, factories/companies, and traditional markets. The transmission in these places is high in June, July, and even until August. A characteristic of these places is the large numbers of people meeting each other to work, do business, and serve patients. The composition of age affected by COVID-19 in Central Java is 30-49 years old and accounts for 38.5%. This age group is the productive age group and has high mobility. The aged 10-29 years contributed 20.4%, and this group also has high mobility. In Semarang city, the age group of 30-49 years estimated 29.6% and the age group 15-49 years estimated 56.9%. The estimated age group has a significant correlation with the COVID-19 cases, both in June and July. 

The workers or residents in Semarang mostly used motorcycle for the activities. The variable of the number of motorcycles may illustrate the mobility of the people in the area. The motorcycles can facilitate activities of the residents and makes increase the mobility of people. The number of motorcycles by the village also has a significant positive correlation with the number of COVID-19 cases (p<0.01 and r=0.29). It looks the number of motorcycles supports the number of COVID-19 cases. This mobility condition allows people to be in close contact with each other, including work, gathering with friends, trading. Besides, when did not obey to wear a mask and keep a distance in crowded situation. The finding was in line with the previous study that employees or workers at work bring them close to each other if they work indoors or use shared transport (18). It is also important to remember that the size of the SARS-CoV-2 virus is small (60–140 nm), and the droplet can spread in the air in space for a considerable distance (19). The transmission of COVID-19 through droplets from sufferers at close range, over a long distance in a closed space (4). The transmission occurred in hospitals, traditional and modern markets, offices, factories, which also contributed to the number of COVID-19 cases in Semarang City. It is important to conduct contact tracing and screening can focus on where these characteristics are present. 

Massive test or screening can use to determine the trend of finding COVID-19 cases. The Semarang city government conducts massive tests on high-risk groups or clusters and the general population with rapid tests and then followed by PCR test. Massive test carried out with rapid tests included around 10,000 people in June 2020 and 13,000 until July 2020. As a follow-up to the test, many confirmed cases were found and increased the number of COVID-19 cases in Semarang City. In May and June, the local government of Semarang conducted rapid tests, especially in the traditional market. The typical trader in the traditional-market is small traders. It is possible that small traders also contributed to these cases. Based on our analysis found out the number of small traders...
also correlated to the number of COVID-19 cases (p=0.048 and r=0.5). There is a possibility that if contact tracing and the test multiplied, more COVID-19 was detected. However, another study revealed the correlation between the rate of cases recorded for fourteen days, and the rates of tests are not significant in Europe (17). Based on the test that has carried out at the province level with a rapid test, it found that 6.7% was reactive (8). It noted that vary in the sensitivity and specificity of the rapid-test. Based on previous research, it found that the sensitivity of 69% and 93.1% for IgM and IgG. The specificity is 100% for IgM and 99.2% for IgG (20). Of these people who reactive, around 10-30% predicted to be positive for COVID-19. The ideal screening target in Indonesia is one examination (PCR) by 1000 population per week (21). The sensitivity and specificity levels of the PCR test estimate at 70% and 95% (22). The goal of finding active cases will make it easier to isolate and treat these sufferers. Then it can reduce the COVID-19 transmission. However, the city of Semarang has not yet fulfilled the attainment of the test.

The number of populations correlated to COVID-19 cases. The increase in daily cases in June, based on the population had a positive correlation with the strength of the relationship, was quite strong (r>0.7). The correlation was detected since June 9, 2020, where on June 4, 2020, the correlation figure reached 0.38. This increase in cases related to population numbers can provide an indication that areas with high population numbers have high cases of COVID-19. This possibility is also accompanied by the movement and contact of both suffering and healthy people in the same area or location in this region. The highest contributor to COVID-19 cases in Central Java ranged from 30-49 years old. Besides, the age composition of 10-29 years also contributes a lot to the COVID-19 number (8). Semarang City is the city with the largest contributor to the number of COVID-19 cases at the Central Java provincial level. Based on the age composition, it is possible that the movement of the community is quite high due to work or other activities. The age group of 15-19 years, 20-24 years, 25-29 years, 30-34 years, 35-39 years, 40-44 years, and 45-49 years were a significant correlation with the COVID-19 cases in June and July (all of p-values < 0.01 and all of strength of correlation > 0.5). A high population number will automatically lead to high community activity and movement. The emergence of new clusters such as traditional markets, factories, Islamic boarding schools, and offices is evidence of community activity and movement in crowded places. Also, the transmission in these places will influence the transmission rate of the general population in the community. It is because the workers and traders from those places come from the people in the community. It possible a reciprocal transmission.

The distribution of COVID-19 cases relatively spread out in all of the areas of Semarang city. It illustrates the majority (91.5%) of villages in Semarang City presence of COVID-19. It predicted the COVID-19 in Semarang City continue to increase if there are no efforts to prevent transmission that have been made by the people. These efforts included wearing masks, washing hands using clean water and soap, and keep the distance. These efforts are as recommended by WHO (17,21). However, it is not easy to ensure people comply with health protocols. Several studies have shown that people's intention to stay at home is 67.5% (23). Adherence to this health protocol will be difficult in young age groups included adults. The activity difficult for children (9 years) and adolescents (18 years) to comply with was not going out of the house to socialize, for example, to visit friends and
relatives (24). Therefore, people must continue to use masks, wash their hands, and maintain a distance. It is proven to prevent the transmission of COVID-19 (25). Wearing a mask can reduce the emission of infected droplets from individuals with subclinical or mild COVID-19 (26). The government expected to continue to carry out campaigns or efforts to promote compliance with health protocols.

Meanwhile, government efforts also need to be optimized by increasing tracing efforts (tracking) COVID-19 cases, carrying out tests with rapid tests and PCR, then treatment or isolation of those who have been positive for COVID-19. Thus, the source of transmission is immediately known and treated or isolated. In Central Java province until June for the capability of PCR test around 900-1000 per day. The number of sample comparisons tested with rapid-test and reactive ones was small (2%), for example, office in Surakarta City, out of 342 tested, seven were reactive. Also, data from the province of Central Java, 3.7% of the 22,337 tested, and 809 reactive people. In early August 2020, Central Java province has conducted 138,500 PCR tests for COVID-19. Likewise, Semarang City has found 26 positive cases of COVID-19 in one of the traditional market clusters. However, efforts to carry out active contact tracing have not been undertaken by the government, optimally.

The mobility of people from a place of transmission has the potential to transmit COVID-19. This mobility occurs for reasons of working, doing business, or celebrating holidays. This mobility occurs in the between country, provinces, districts/cities, between sub-districts, and sub-districts. Migrants or travelers are one of the risk factors for COVID-19 transmission (25). Much evidence has shown that this movement of people adds to the cases of COVID-19 in the destination areas. As the COVID-19 case was first found in China and spread to other countries (16), early cases of COVID-19 that occurred in Semarang City and Central Java province, some of which came from the West Java, Jakarta, and foreigner. Therefore, people who are going to travel or will enter the city of Semarang are required to carry out both a rapid test and a PCR examination. The program is in line with government policies that require inspection before traveling using public transportation modes such as trains. Even some train stations and airports are provided facilities for conducting COVID-19 tests. Prevention spread of COVID-19 by implementing the tests on travelers will have the effectiveness. Besides, the government of Semarang also has the regulation to restrict the mobility of people, namely the program of Restrictions on Community Activities (PKM). The PKM aimed to reduce transmission COVID-19. The PKM was conducted by enforces the law to comply with the health protocols, scheduled activities, dismiss the mass gathering. The program was implemented in April 2020 and significantly reduced the number of COVID-19 cases. Unfortunately, the PKM program seems to be slacking, and it can show the increase of COVID-19 number at the end of May or at early of June.

This study did not find a correlation between population density and cases of COVID-19 in Semarang City at the level of sub-district. Population density is the ratio between the total population by unit area of the population by square kilometer (people/km²). The ratio of the population by area by the sub-district will be very low. The city of Semarang there are still many areas with relatively low population density (below 5000/km²) such as Mijen, South Semarang, Candisari, Genuk, West
Semarang, and Central Semarang. For example, the Mijen sub-district which has the lowest population density of 1049/km² with a population of half that of the West Semarang sub-district which has a low population density. Based on existing data in the Mijen sub-district until June, there were 3 cases of COVID-19 and in West Semarang 50 cases of COVID-19. Although the density is equally low in the two sub-districts, the number of cases is different.

The finding contrasts with the level of the village. There was a significant correlation between the population density and the number of COVID-19 cases in June and early July. The transmission of COVID-19 may relate to the distribution of the population by the village. The spread or transmission of COVID-19 will occur in a lot of villages that have a concentrated population distribution, such as villages in the Mijen sub-district and West Semarang sub-district. The population distribution in the Mijen sub-district is quite even so that it is not concentrated in a certain village. This is of course different from the West Semarang sub-district, which has a large population concentrated in certain sub-districts so that the distribution is not evenly distributed. Thus, by being concentrated or not concentrated in a certain village, then the transmission is also different. It is proven that villages in West Semarang with a high population (concentrated) have high cases, for example, Kalibanteng Kulon (5 cases), Kalibanteng Kidul (5 cases), Karangayu (5 cases), Bongsari (6 cases), Tawangsari (11 cases), Manyaran (4 cases), Kembangarum (4 cases) compared to all villages in the Mijen sub-district with positive cases in Jatibarang, Polaman, and Cangkiran sub-districts each 1 case and no other villages were found. The number of residents in certain villages proves that there are cases of COVID-19 which are higher than in villages with low population numbers such as in the Mijen sub-district.

It seems the population density at the village level reflected the higher number of COVID-19 cases. It was no significant by the sub-district level. Population density will facilitate transmission due to contact so that the denser or more concentrated the population more frequently people will contact. The contact rate of between sick or asymptomatic people and healthy people is a risk factor for the transmission of COVID-19. The close contact is contacts between persons at a short distance or less than 1 meter (27) or 1.8 meters in approximately 15 minutes (28). As the frequency of close contact that occurs in the family is a risk factor for transmission of COVID-19 (29). It is supported by research that predicts a proportionality between relatively homogeneous population density and contact rate (30). Likewise, previous study found a correlation between population density and cases of COVID-19 (31). Thus, villages with high densities should be aware of the occurrence of transmission. Therefore, the implementation of health protocols such as washing hands, maintaining distance, and wearing masks must still be carried out by all levels of society, considering that most villages in the city of Semarang have COVID-19 cases. It should be supported by continuous education and dissemination to the public, and the government can impose sanctions on health protocol violators.
Acknowledgment

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