Evaluating COVID-19 Transmission Prevention Measures in Public Rental Flats (Rusunawa)

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ABSTRACT

Surabaya is an urbanized area with one of the highest numbers of confirmed COVID-19 cases in Indonesia. With Surabaya's healthcare system on the brink of collapse, housing is crucial in extending healthcare facilities. Therefore, adequate housing is the most prioritized prerequisite for people to cope with the transmission rate of the virus. Unfortunately, public rental flats (rusunawa) are among the most vulnerable housing types due to their high density, lack of adequate facilities, and low environmental quality. This paper presents a two-stage investigation to uncover Coronavirus transmission prevention strategies in dense urban settlements, namely in rusunawa. First, the research observes transmission prevention strategies and measures employed by rusunawa residents and managers. Second, the investigation concludes by evaluating the effectiveness of the identified strategies and measures using cross-tabulation analysis. Data for this research was collected using questionnaires distributed among rusunawa residents and managers. Results indicate that effective prevention strategies differ across vulnerability groups. Thus, research findings can potentially help stakeholders and decision-makers enhance their approach to preventing Coronavirus transmission. Not only that, but research findings can also help inform and anticipate future outbreaks.

Keywords: built environment, coronavirus transmission prevention, public health, public housing, public rental flat

INTRODUCTION

Between July and September 2020, Surabaya had the highest number of COVID-related deaths in Indonesia (Sulistyawati, 2020; Taher, 2020). In August 2021, Surabaya recorded 59,307 confirmed cases of COVID-19 (Satgas COVID-19 Kota Surabaya, 2021). Immense pressure on the healthcare system. In light of these events, it is becoming increasingly difficult to ignore the importance of a safe built environment and effective transmission prevention strategy. The World Health Organisation (WHO) issued several protocols and policies to curb the transmission of COVID-19. Based on the guidance, the Surabaya city administration has also issued restrictions to curb the coronavirus spread, including Surabaya Mayor Regulation number 28 of 2020 which contains guidelines for health protocols that need to be applied in various places, such as in public facilities, using public transportation, to apartments and flats. Then the social restriction stipulated through the Surabaya Mayor Regulation Number 16 of 2020, reduces the intensity of community activities outside the home and as an appeal for the community to stay at home. The implementation of the health protocol then increases the urgency of a comfortable and safe living environment. A house shelters its residents and helps protect other people − as a place for self-isolation/quarantine. With Surabaya's healthcare system on the brink of collapse, housing is crucial in extending

healthcare facilities. Therefore, adequate housing is the most prioritized prerequisite for people to cope with the transmission rate of the virus.

Public rental flats (rusunawa) were built to accommodate low-income families. A study on public housing livability revealed that rusunawa is moderately livable, citing living unit conditions, space adequacy, air circulation, security, fire protection, power infrastructure quality, and access to clean water, as the key determinants of rusunawa livability (Vialita & Rahmawati, 2019).

The Well-being and Public Health recommendations for healthy, safe, and sustainable housing are framed into the following key points: 1. Visible and accessible green elements and spaces; 2. Flexibility, adaptability, sharing, crowding of living spaces, and compliant functions located in the buildings; 3. Re-appropriation of the basic principles and archetypes of sustainable architecture, thermal comfort, and Indoor Air Quality (IAQ); 4. Water consumption and Wastewater Management; 5. Urban Solid Waste Management; 6. Housing automation and electromagnetic fields; 7. Indoor building and finishing materials (D'alessandro et al., 2020). This is a challenge for the rusunawa across Surabaya as they are dense settlements, often with communal facilities. Together utilization of spaces allows overcrowding and accelerates the transmission of COVID-19 (AHURI, 2020). In addition, overcrowding the rusunawa is not a safe place for isolation and social distancing as an effort to prevent the spread of COVID-19 (Dietz, et al & Wymelenberg, 2019).

There are 22 rusunawa spread across the city of Surabaya. The Rusunawa have different physical, social, and economic characteristics. These differences in characteristics affect the level of vulnerability of the rusunawa to COVID-19. Rusunawa located in downtown areas with higher ease of access to public facilities has an average case accumulation of 50% higher than rusunawa located in suburban areas with more remote access to public facilities (Sulistyawati, 2020). Rusunawa situated in dense urban areas may also experience reduced airflow (inadequate ventilation) (Indrani, 2010). Space inadequacy leads to adaptations. Occupants adjust their living space to improve dwelling space quality (Zuhri, Ghozali & Subiyantoro, 2018).

This project provides an important opportunity to advance the understanding of the COVID-19 prevention strategy impact in Rusunawa based on the vulnerability level. This paper presents the results of an investigation into adaptive prevention strategies employed by rusunawa residents and managers to overcome high density and limited facilities. First, we identified the COVID-19 prevention strategies in rusunawa by carrying out samples of rusunawa based on their COVID-19 vulnerability and confirmed cases in each rusunawa. After that, we analyzed which COVID-19 preventions are effective in the rusunawa based on their vulnerability to coronavirus.

RESEARCH METHODS

We divided this project into two stages. First, the investigation observed transmission prevention strategies and measures employed by rusunawa residents and managers. Then, we evaluated the effectiveness of the identified strategies and measures using cross-tabulation analysis. Therefore to determine the effectiveness of COVID-19 prevention, cross-tabulation analysis is used (Agustin, 2020; White, 2003).

In identifying the strategy to prevent the transmission of COVID-19 at the rusunawa in Surabaya, the variables used to describe the form of strategy from the physical/environmental side, the social side, namely government and rusunawa residents, and the epidemiological side in the form of case detection. The research variables were formulated from WHO prevention indicators and Surabaya Mayor Regulation number 28 of 2020 which were further refined by the findings of a literature review on COVID-19 prevention measures from the environmental, social, and epidemiological perspectives.

Table 1. Variables

Stages	Factors	Variables	Descriptions
Observing Prevention Strategies	Environment	Provision of health protocol equipment	Equipment to prevent the transmission of COVID-19
		Isolation room availability	Isolation room availability to prevent the transmission of COVID-19
	Government	Government policy	The role of the government in implementing policies to prevent the virus transmission
		Health care system	The role of the government in preparing the health care system
		Inter-sectoral cooperation	The role of the government in building cooperation with the private sector to prevent the transmission of COVID-19
	Rusunawa Residents	Residents understanding	Residents understanding of COVID-19 prevention
		Residents adaptability	Resident's adaptation during the COVID-19 pandemic
		Residents cooperation	Relations between communities collaborate to prevent the virus transmission
		Implementation of health protocols by managers	Implementation of health protocols to prevent virus transmission by managers
		Implementation of health protocols by residents	Implementation of health protocols to prevent virus transmission by residents
	Case Detection	Number of testing	Number of COVID-19 testing
		Contact tracing implementation	Tracing of close contacts of positive patients
Strategy Evaluation		Previous goals	
	COVID-19 case	number of COVID-19 case	number of COVID-19 case

Rusunawa vulnerability analysis (Adilah & Navitas, 2021) suggests there are two vulnerability categories: low vulnerability and high vulnerability. This section explains the characteristics of rusunawa in each group. Rusunawa belonging to the low vulnerability category typically have low resident density. In terms of economic characteristics, most of the rusunawa are located in non-mixed-use areas and not only located in a high-density settlement zone, but also medium-density settlement zone, low-density settlement zone, trade zone, education zone, and green open space zone. In addition, rusunawa in this category are far from public facilities (health facilities, transportation, shopping, worship, and schools).

Twelve rusunawa were revealed to be in the high vulnerability category. These rusunawa typically have high resident density. In terms of economic characteristics, most of the rusunawa are located in mixed-use areas in a high settlement zone. In addition, rusunawa

in this category are close to public facilities (health facilities, transportation, shopping, worship, and schools).

Table 2. Characteristics of Rusunawa in High Vulnerability Category

High Vulnerability		Low Vulnerability	
Rusunawa	Number of cases	Rusunawa	Number of cases
Urip Sumoharjo	71	Warugunung	68
Dupak Bangunrejo	141	Wonorejo	139
Sombo	71	Siwalankerto	108
Penjaringansari I	114	Romokalisari	13
Penjaringansari II	114	Gununganyar	56
Penjaringansari III	114	Dukuh Menanggal	41
Penjaringansari IV	114	Keputih	127
Tanah Merah I	308	Tambak Wedi	78
Tanah Merah II	308	Gunungsari	211
Randu	222	Sumurwelut	36
Grudo	118		
Pesapen	86		
Jambangan	81		
Bandarejo	251		
Indrapura	71		
Babat Jerawat	165		

1. Observing Prevention Strategies

Identification relied on primary data and secondary data analysis. For this research, we also considered the number of coronavirus cases in each. Afterward, we used Slovin's formula to determine the sample size.

$$n = \frac{N}{1+Ne^2}$$ …(1)

Where :

N :

Ne^2 :

Using Slovin's formula, we determined the number of respondents needed for the research. We calculate the sample of all of the rusunawa residents in Surabaya, then we distribute the sample proportionally to the chosen rusunawa in each category. The following table presents the number of respondents in each rusunawa.

Table 3. Number of Respondents in Each Rusunawa Sample

Rusunawa	Number of households	Number of respondents
Tanah Merah	390	30.6 ≈ 31
Romokalisari	495	38.4 ≈ 38
Gunungsari	268	20.8 ≈ 21
Urip Sumoharjo	120	9.42 ≈ 9
Total	1273	98.9 ≈ 99

We used descriptive statistical analysis with SPSS version 24 tool to identify prevention employed by rusunawa residents and managers. Based on its understanding, the descriptive statistical analysis aims to describe a phenomenon and the characteristics of that phenomenon (Nassaji, 2015). Meanwhile, the data that will be used in this analysis is the result of distributing questionnaires to the residents of rusunawa.

The likert questionnaire consists of three parts The first part is the residents' assessment of the COVID-19 transmission strategy that has been carried out by the residents. The second part is residents' assessment of the strategies to prevent COVID-19 transmission that have been carried out by managers. The third part is residents' assessments on the prevention of COVID-19 transmission that has been carried out by the government. Therefore, the questionnaire will be filled out by residents. (The complete questionnaire can be accessed at https://bit.ly/COVID-19inRusunawa)

The questionnaire used in this study used a Likert scale. Where the Likert scale is designed to measure a person's attitude, opinion, or perception of the situation that occurs or the hypothesis under study. The Likert scale rating category needs to accommodate all possible responses from respondents to a situation under study. Therefore, this study uses a Likert scale with a five-point scale, which consists of, Strongly Agree, Agree, Moderately Agree, Disagree, and Strongly Disagree.

Before further interpretation of the data, validity and reliability tests were conducted to determine the level of validity and consistency of the respondents' assessments. The process of testing validity and reliability testing is carried out using the SPSS tool (Indrani, 2010). If the data can be said to be valid and consistent, then the Likert value is calculated using the Weight Means Score formula (Zuhri, Ghozali & Subiyantoro, 2018). The following formula will be used:

Intervals were determined using the *Weight Means Score* approach.

$$M = \frac{\Sigma fx}{n} \qquad \qquad \text{...(2)}$$

Where :
M : Interval
f : Frequency
x : Score
∑ : Total
n : Sample size

Using this approach, we determined the following interval categories:

Table 4. Level of Assessments

Interval	Category
1.00-1.80	Very poor
1.81-2.60	Poor
2.61-3.40	Adequate
3.41-4.20	Good
4.21-5.00	Very good

$$Respondents' level\ of\ Assessment = \frac{score\ average}{5}\ x\ 100 \qquad \text{...(3)}$$

Based on this formula, respondents' level of assessment can be classified as follows

Table 5. Level of Assessments

TCR (Level of Assessment)	Category
90 - 100	Very good
80 - <90	Good
65 - <80	Adequate
55 - <65	Poor
0 - <55	Very poor

2. Strategy Evaluation

We investigate effective COVID-19 prevention using cross-tab analysis. Based on its understanding, cross-tabulation is one of the analytical techniques that can be used to determine whether there is a relationship between two or more variables. Where cross-tabulation analysis can be used for nominal, ordinal, and interval data types. and ratio.

The process of cross-tabulation analysis is carried out using SPSS. The analysis material is in the form of residents' assessments of the spread of COVID-19 prevention on the previous targets crossed with data on the number of cases. Where the crossing process is carried out between 2 variables so that each variable will be crossed with data on the number of COVID-19 cases separately. The form of prevention variable acts as an independent variable (column), while the variable number of COVID-19 cases acts as the dependent variable (row).

Thus, the hypothesis test in this analysis is as follows, Ho: There is no relationship between prevention strategy (rows) and the number of cases (columns); H1: There is a relationship between prevention strategy (rows) and the number of cases (columns). Then, the analysis of the relationship between the two variables can be strengthened by calculating the Chi-square test (Suradika, 2020). If the Chi-square count is lower than the Chi-square table, then Ho is accepted, while if the Chi-square count is higher than the Chi-square table, then Ho is rejected. Then, based on the calculation of the probability, if the probability is higher than 0.05, Ho is accepted, and vice versa.

Table 6. Assessment Analysis Methods

Vulnerability Category	Residents' Assessment of the Prevention				
Number of cases	1	2	3	4	5
Low cases rusunawa					
High cases rusunawa					

1	=	Very poor
2	=	Poor
3	=	Adequate
4	=	Good
5	=	Very good

DATA COLLECTION

Data for this research was collected using questionnaires distributed among rusunawa residents. Most of the respondents work as housewives or become traders/private teachers who open businesses and operate in their respective flat units. Meanwhile, students do not go to school but carry out teaching and learning activities at home online. However, respondents who work as transport drivers continue to work outside the home to earn an income. Likewise, respondents who become employees still travel to work, even though the intensity is reduced or even taken off from work. The type of respondent's job affects the level of mobility and the respondent's capacity to prevent COVID-19. In addition, vehicle ownership also affects the mobility of respondents. Most of the respondents have a motorbike as a means of daily transportation.
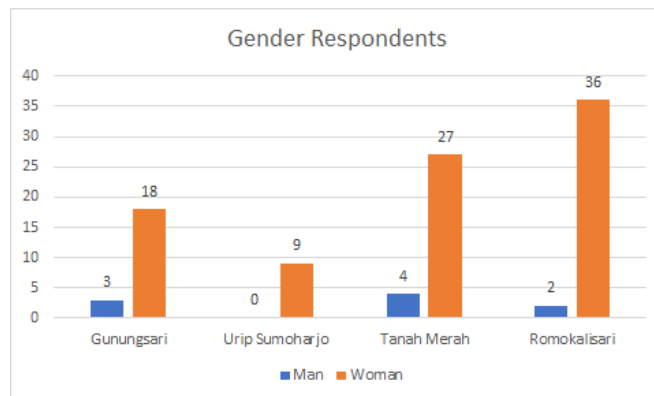

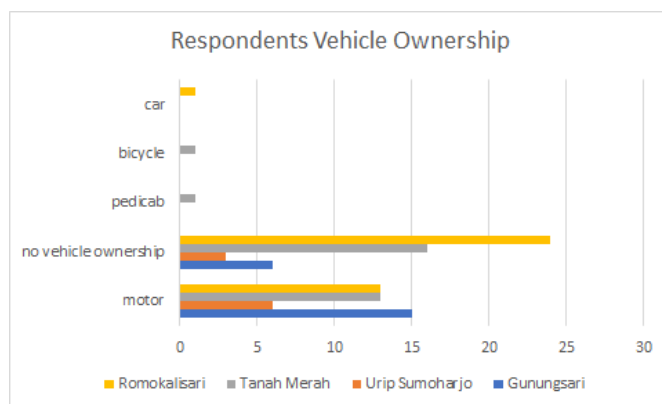**Figure 1.** Chart of Gender Respondents in Rusunawa Surabaya

Figure 2. Chart of Respondent's Vehicle Ownership in Surabaya
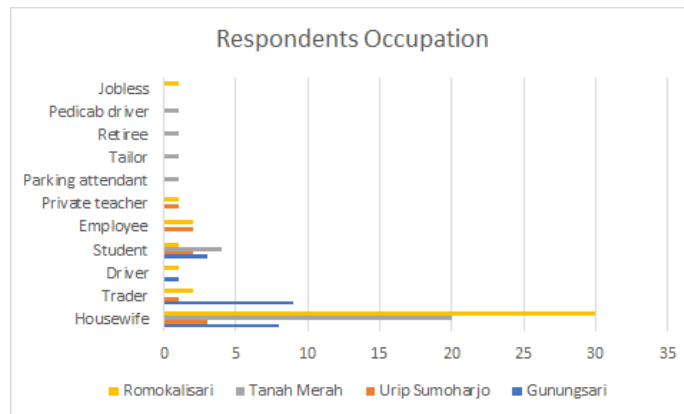
Figure 3. Chart of Respondents' Occupation in Rusunawa Surabaya

RESEARCH ANALYSIS

We proceeded to observe rusunawa with the highest and lowest number of cases in both categories. Two rusunawa in the high vulnerability category are Urip Sumoharjo with 71 confirmed cases, and Tanah Merah with 308 confirmed cases. Both rusunawa are situated in a mixed-use urban environment within a high-density residential area. However, there are differences in terms of accessibility, especially for health facilities and transportation. Where the Tanah Merah Rusunawa, which is the Rusunawa with the highest cases, has access to public facilities which are closer than Urip Sumoharjo Rusunawa, which is the Rusunawa with the lowest cases.

Table 7. Characteristics of Rusunawa in High Vulnerability Category

Vulnerability Factor		Number of Cases	
		308 (Tanah Merah)	308 (Tanah Merah)
	Social	High-density residents	High-density residents
	Economic	Mixed-Use, High-density settlement zone	Mixed-Use, High-density settlement zone
Physical	**Health Facilities**	900m	140m
	Transportation Facilities	500m	270m
	Mosque/Worship place	140m	300m
	Shopping Facilities	550m	600m
	Schools	300m	190m

The two rusunawas chosen to represent the low vulnerability category are Romokalisari with 13 confirmed cases and Gunungsari with 211 confirmed cases. Rusunawa Romokalisari, which is the Rusunawa with the lowest cases, has more accessibility to public facilities than Rusunawa Gunungsari, which is the Rusunawa with the lowest cases. In addition, the Romokalisari rusunawa become rusunawa which represents the characteristics of most of the rusunawa in low vulnerability typology, namely non-mixed use land use and located in medium density settlements. Meanwhile, Rusunawa Gunungsari represents rusunawa with mixed-use land use and closer access to public facilities.

Table 8. Characteristics of Rusunawa in Low Vulnerability Category

Vulnerability Factor		Number of Cases	
		13 (Romokalisari)	211 (Gunungsari)
Social		High-density residents	Low-density residents
Economic		Non-Mixed-Use, Medium-density settlement zone	Mixed-Use, Trade zone
Physical	**Health Facilities**	900m	140m
	Transportation Facilities	500m	270m
	Mosque/Worship place	140m	300m
	Shopping Facilities	550m	600m
	Schools	300m	190m

1. Prevention Strategies

The identification process began by observing the sample rusunawas.

a. High Vulnerability Rusunawa

- Urip Sumoharjo

    Rusunawa Urip Sumoharjo is located on Jl. Embong Kaliasin, Tile. The building which stands on an area of 3,500 m² is managed by the Surabaya City Land and Building Management Office. Built on a collaboration between the City Government and PT Barata in 1982-1985, this flat has been renovated due to declining quality. Currently, there are 3 twin blocks, each consisting of 4 floors with a total of 120 units and an area of 21 m² per unit.

    In addition to room units, Rusunawa Urip Sumoharjo also has 1 prayer room, as well as a pavilion. However, in this rusunawa there is no health post or isolation room. Residents who are detected positive are immediately isolated in the hospital. Then in terms of infrastructure, waste management and drainage in this flat is quite good. However, water traffic jams often occur, once every 2-3 days.

    Regarding the resident's assessments, prevention measures in Urip Sumoharjo are very good (78.52 of 100). The form of prevention with the lowest score is socialization to prevent the spread of COVID-19 (64.4), rusunawa management awareness of COVID-19 health protocols (82.2), physical distance regulation by management (82.2), and contact tracing by the government (82.2).

- Tanah Merah

    Rusunawa Tanah Merah is located on Jl. Tanah Merah V, Tanah Kali Kewall, Kec. Kenjeran. The building which stands on an area of 23,060 m² is managed by the Surabaya City Land and Building Management Office. Built according to the 2007-2008 and 2008-2009 APBN, this flat consists of Rusunawa Tanah Merah I and Rusunawa Tanah Merah II, each of which consists of 4 blocks with 5 floors. The total number of units in this flat is 390 with an area per unit of 21-24 m².

    In addition to room units, Rusunawa Tanah Merah also has 2 prayer rooms, an open field, and a multipurpose room. However, in this rusunawa there is no health post or isolation room. Residents who are detected positive

are immediately isolated in the hospital. In terms of infrastructure, waste management and water availability in this flat are quite good.

Regarding the resident's assessments, prevention measures in Tanah Merah are very good (78.52 of 100). The forms of prevention with the lowest scores are rapid test checks by the government to residents (69.03), socialization of preventing the spread of COVID-19 (71.6), hand sanitizer provision in strategic locations (79.35), and contact tracing by the government (80.64).

b. Low Vulnerability Rusunawa
   - Romokalisari

Rusunawa Romokalisari is located on Jl. Romokalisari, Benowo. The building, which stands on an area of 109,137 m², is managed by the Surabaya City Land and Building Management Office. Built with the 2013-2015 State Budget, this rusunawa has 5 blocks, each consisting of 5 floors with a total of 495 units and an area of 24 m² per unit.

In addition to room units, Rusunawa Tanah Merah also has 1 prayer room and a hall in each block, an open field, a mosque, and a health post. This is what distinguishes the Rusunawa Romokalisari from other flats because there is a health post. However, residents who were detected positive were immediately isolated in the hospital. In terms of infrastructure, waste management and water availability in this flat are quite good.

Regarding the resident's assessments, prevention in Romokalisari is very good (91.88 of 100). The form of prevention with the lowest score is a socialization of the prevention of the spread of COVID-19 (74.74), rapid test examination by the government to residents (77.37), implementation of government policies (79.47), and cooperation with other sectors in preventing the spread of COVID-19 (79.47).

   - Gunungsari

Rusunawa Gunungsari is located on Jl. Gunungsari No. 7-9, Sawunggaling, Wonokromo. The building, which stands on an area of 6,799 m², is managed by the Department of Housing for Settlements and Human Settlements, East Java Province. Built with the 2010-2011 East Java Provincial Budget, this flat has 3 twin blocks, each consisting of 5 floors with a total of 268 units and an area of 34 m² per unit.

Apart from room units, Rusunawa Gunungsari also has 1 prayer room, an open field, and a pavilion. However, in this rusunawa there is no health post or isolation room. Residents who are detected positive are immediately isolated in the hospital. In terms of infrastructure, the availability of water and waste management in Rusunawa is quite good.

Regarding the resident's assessments, prevention measures in Gunungsari are good enough (78.52 of 100). The forms of prevention with the lowest scores are contacted tracing by the government (42.86), rapid test checks by the government to residents (46.67), hand sanitizer provision in strategic locations (61.9), and treatment facilities by the government to anticipate the spread of COVID-19 (61.90).

2. Strategy Evaluation
   a. High Vulnerability Rusunawa

Analysis of results from high vulnerability rusunawa samples indicate the following prevention has effect in preventing COVID-19: First, Rusunawa

management awareness and enforcement of COVID-19 health protocols (keep the hands clean, wear a mask, maintain adequate distance). Second, increasing the government's role in preventing the spread of COVID-19. The government facilitates treatment, carries out case detection (testing and contact tracing) for residents of rusunawa, and builds public-private partnerships in COVID-19 prevention. Third, the Provision of facilities to implement health protocols such as hand sanitizer provision in strategic locations.

b. Low Vulnerability Rusunawa

Analysis of results from high vulnerability rusunawa samples indicate the following prevention has effect in preventing COVID-19 First, Residents need to maintain adequate physical distance. Residents can cooperate in preventing the transmission of COVID-19 and implement PSBB (Large scale social restrictions) and maintain distance while in the rusunawa. Second, Regular rapid testing should be conducted by the government, namely towards residents displaying symptoms

CONCLUSION

Rusunawa across Surabaya have different characteristics. It affects the rusunawa vulnerability to COVID-19. This study found that to curb COVID-19 transmission, prevention plays an important role. The number of cases that arise is directly proportional to the effectiveness of a well-implemented strategy. Results indicate that effective prevention strategies differ across vulnerability groups. An effective strategy for high vulnerability rusunawa is the strategy carried out by rusunawa managers, governments, and the provision of equipment and facilities. Then, an effective strategy for low vulnerability Rusunawa is a strategy carried out by Rusunawa residents and the government. But it turns out there are over 100 confirmed cases in the low vulnerability group. Therefore, further investigation is needed to uncover factors affecting the number of cases.

The findings of this study still have shortcomings due to the data collection process, which is the strategy evaluation through rusunawa residents' perspective only. Therefore, further research is needed involving other related parties such as the Rusunawa management staff, the Rusunawa management service, and the local health office to obtain more comprehensive research results. Nevertheless, research findings can potentially help stakeholders and decision-makers enhance their approach to preventing Coronavirus transmission. Not only that, but research findings can also help inform and anticipate future outbreaks.

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