Mapping of Rural Health Services during Covid-19 Pandemic in Central Java, Indonesia: Rethinking Remoteness

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Abstract. Covid-19 pandemic, since 2019 in global world and 2020 in Indonesia, changed human daily life and affected the provision of public services, especially health services. As Covid-19 spread through close interactions among humans, rural areas have the advantage of remoteness compared to higher-density urban areas. In the villages with relatively isolated access, the spread of Covid-19 is very low compared to the national average. This paper discusses how remoteness has become two sides of the coin during pandemic by examining at the data of health services in three rural areas in Provinsi Jawa Tengah, Indonesia. Data collected by in-depth interviews showed that although remoteness became a key factor in delaying the spread of Covid-19, it also became a key factor in the deterioration of advanced health services in non-covid diseases throughout the pandemic. These findings confirmed the vulnerability of basic services in rural areas, even on Java Island as a center of growth in Indonesia. Using causal network analysis, the discussion revealed that the vulnerability stem from the territorial approach in health service provision making rural areas less resilient during pandemic. This paper concludes that while remoteness provides a barrier in retaining the spread of pandemic disease, it also worsens the medical treatment capacity in non-pandemic diseases in rural areas. Covid-19 pandemic raises the need of specific arrangement public health services in remote rural areas.

Keywords: pandemic, rural health, remoteness, Central Java

1. Introduction

The Covid-19 pandemic has brought about changes in the order of human life that was never imagined before as it is transmitted through close contacts among humans. The evidence shows that this pandemic is not only related to the public health sector, restrictions on activities at various scales have changed the patterns of interaction and movement of people globally. Various perspectives taken from many researchers show that the spread and impact of this pandemic is determined by many things, including social class [1], the availability of health services and public health conditions before the pandemic [2], population status and main economic activity [3], and urban/rural and slum levels [4]. Although various campaigns regarding preventive measures to limit close contact between humans have been carried out, the transmission of Covid-19 globally and in Indonesia is still at an alarming pace even after more than a year of the disease being detected.

Rural areas known for their low intensity of built-up areas actually have low Covid-19 susceptibility characteristics. Rural areas’ daily living has easiness to access the natural environment and maintaining social distancing [5]. Some recent researches have noted the benefit of rural remoteness in pandemic. Krenz and Strulik [6] pointed out that bad road infrastructure reduced...
infection, while Petrov et al. [7] and Diarra et al. [8] highlighted natural isolation and quarantines as the main factor of low Covid19 infection in rural areas. But, lesson from the late 2009 Influenza Pandemic noted that the intimacy in indigenous communities has also become a factor toward higher hospitalization rate [9]. In Covid19 era, less available resources of healthcare is also a main challenges for rural areas in pandemic [5]. Long waiting time due to inadequate health service and large geographical distance, worsened the access and the utilization of primary health care [10].

The characteristics of basic health services that emphasize first contact care [11] were significantly disrupted during the pandemic and affected three other basic characteristics, namely continuity, comprehensiveness, and coordinated action. Mobility restriction interrupted continuity of primary services and long-distance telehealth reduced the ability to diagnose. The patient's inability to explain the symptoms led a decline in comprehensiveness. Eventually, continuity and coordination among health officers in handling the cases was on the downhill throughout the pandemic. As a coping strategy for the ongoing pandemic, health services have developed long-distance services in the form of online care (technology-based services in the network) and telecare (telephone-based services). In general, this service has advantages in terms of time and cost effectiveness, access to more diverse services without complicated administrative processes, and service efficiency due to on-demand [12]. However, some weaknesses also arise from this strategy, such as minimal patient condition assessment, inaccurate self-diagnosis, low technological adaptability, and a regulatory system that is not fully ready to adopt health services in networks and telephones [13,14].

The concept of remoteness fit the exploration of causal relationship between rurality and the spread of pandemic. Remoteness came from geographical perspectives which covers the concept of distance from urban centers [15], access to information as an economic resources [16], and accessibility to economic activities [17]. Remoteness has always been close to the concepts of rural areas. During pandemic, the concept of remoteness is widely used to describe a far less interaction among areas lead to a better spread rate of the disease. Meanwhile, isolated rural areas also experience two main impacts from mobility restrictions, namely a significant reduction in the availability of health services due to limited access to technology and communication networks, as well as an increase in health service delays due to a decrease in the ability to coordinate services between health facilities for advanced services.

This contradictory outcomes of remoteness in times of pandemic raised a question of to what extent does remoteness beneficial to rural health services during pandemic? This paper aims to explore the relationship between remoteness and rural health in Covid19 pandemic setting using causal mechanism approach through an examination of moderatory variables. Using three cases, the results on this paper are leading to a more local knowledge on how remoteness works in rural Central Java in time of pandemic.

2. Data and Methods

2.1 Context: Referral System in Health Services in Indonesia

Health services in Indonesia use a referral system as regulated in Minister of Health Regulation No. 1/2012. The process of health services in the Referral System stipulates that health service providers are carried out in stages, according to medical needs. The Puskesmas has the authority to screen cases according to medical indications. In the Referral System, three levels of health services are identified, namely the primary (Pratama), second- and third- level health services. The first level of health services is general practitioners and dentists in primary health facilities. In certain circumstances, midwives or nurses can provide first-level health services in accordance with the provisions of other primary health services. Second-level health services are specialist health services carried out by specialist doctors or specialist dentists. The third level of health services is a sub-specialist health service.

In relation to the pandemic, this referral system becomes the context to understand the systemic impact of the pandemic on rural health services. The closest health facilities in the pre-pandemic period rigidly regulated the recipients of health services. During the pandemic, in cases related to Covid19, health facilities are faced with emergency conditions and are required to respond to every
request for services, both from their service area and from other areas. This makes the burden at each health facility potentially multiply, difficult to predict and may lead to a reduction in the service capacity of health facilities. This referral system also makes service users during the pandemic pile up in advanced health care facilities since Covid19 is a disease with rapid deterioration and requires special intervention. However, to get continuous care, patients have to pass through the primary health facilities to get a referral. Primary healthcare as the entrance then received a significant raise in the cases due to the high spread rate of Covid19.

2.2 Cases: Three Primary Health Facilities in Remote Rural Java

The paper uses three cases to examine to what extent does remoteness lead to positive effect toward Covid19 pandemic. Pustu Panggang, Pustu Krajan and Puskesmas Dadirejo are primary health facilities located in the border area of Central Java Province as can be seen in Figure 1. The nearest urban centers conducting advanced health services are more that 30 minutes travel time and covering more than 17 kms in distance in each cases. Pustu Panggang located in Kecamatan Kemalang and well-known as Kidul Woro. More than 10,000 people reside in a quite isolated enclave settlements and only one primary health care facility open six days a week from 7 am to 12 am. The second case, Pustu Krajan, a little bit closer to urban center, is 42 minutes travel using bus or car to the nearest advanced health facility located more than 22 km away. Pustu Krajan serves more than 7,000 people from two districts, open six days a week from 7 am to 12 am. The last case, Puskesmas Dadirejo is the least remote of all cases. Located 17.5 km, 30 minutes away from advanced healthcare facility, Puskesmas Dadirejo supposed to serve 2 districts with total population of more than 3,500 people. Figure 1 show location of each case and their respective advanced health care facilities.

![Figure 1. Location of Cases](image)

2.3 Methods

The paper uses qualitative approach to describe the dynamics of healthcare services in three cases. Data were collected from in-depth interviews and statistical data from local Covid19 websites, comparing healthcare services between July 2020 and January 2021. Comparison were made among three cases, using the remoteness index, spread rate, and delay time. Analysis was done using causal-mechanism instead of cause and effect. Causal mechanism focuses on how outcome (that is ‘spread rate’ and ‘delay time’) of a situation (that is ‘remoteness’) is brought into being [18]. The context of this paper is Indonesia Referral System during Covid19 pandemic. This exploratory approach suited
the objective of the paper which is to produce a local knowledge on to what extent remoteness does bring advantage to slow down the pandemic. To be specific, two sets of causal mechanisms was explored. The first causal mechanism was on the “advantage” side, exploring how remoteness produce lower spread rate in rural areas, by using the perspective of individual choice. The second causal mechanism was on the “disadvantage” side, exploring on how remoteness gave raise to delay-time in rural healthcare.

2.4 Remoteness: Distance and Accessibility to Nearest Advanced Health Services

The concept of remoteness deals with distance and accessibility. The more distant (farther distance and longer travel time) from centers of activity in regional scale, the higher remoteness index. Accessibility deals with public transportation modes and routes to reach the remote areas. Table 1 shows the remoteness index of each case. Data were collected through measurement from Google Maps. Remoteness index were calculated using a weighted formula of those five variables. Travel distance and travel time were weighted more (‘2’) than straight-line distance (‘1’) due to their better description towards remoteness. Meanwhile, the number of public transportation modes and the number of routes were weighted equally (‘2’). The index was normalized using 0-1 scales. The higher the index (closer to 1), the higher remoteness state of the case. Data shows that Panggang has the highest remoteness along with the most population under its wing. With no public transport covering the area of case 1, reaching advanced health services needs the privilege of private transportation. As an addition, Panggang has the highest elevation among cases; it is the last settlement before reaching Mount Merapi peak.

2.5 Pandemic in Remote Areas Compared to Its Urban Centers

Covid19 hit urban center worse than rural areas. Cases in Table 2 shows that upon the same state of spread (0 to 6 cases) in mid 2020, urban areas had more than 1,500 cases in mid 2021 while rural areas only counted 351 confirmed Covid19 cases. Covid19 spread characteristic made urban busier and less independent lifestyle suffering higher active cases. Remote areas had the spread rate as low as 90% lower than urban centers in Panggang that happened to have the highest remoteness index.

2.6 Healthcare Services during Pandemic

During the pandemic, although the number of total basic healthcare services in all three cases in remote areas were not significantly raised, there is concern because health services are not something that can be postponed. With very limited basic service resources, the slightest increase in cases worsens public health conditions in remote areas. Table 3 shows that there are not many cases related to Covid19. The increase in non-Covid cases also did not increase significantly. For example, in case 2, before the pandemic there were an average of 100 cases per week increasing to 120 cases per week. The interesting thing about this is that non-covid19 cases have also increased along with increasing public awareness about the spread of Covid19. When experiencing symptoms similar to Covid-19, such as coughs and colds, people are more concerned about going to the puskesmas. This makes the burden of health care services heavier.

The average number of cases referred to advanced health facilities during the pandemic has increased due to Covid-19 cases detected at the Pustu Public Health Center. In all cases, the puskesmas only recorded it and then reported it to the advanced facility. Follow-up treatment is provided by a follow-up facility to be monitored by the local health center. The presence of active cases of Covid-19 reduces the capacity of puskesmas services during the pandemic, which shows the vulnerability of puskesmas to changes in public health conditions.

In advanced facilities, the high spread rate in the centers area created a sharp spike in the burden of advanced health care services which in turn affected the overall capacity of advanced facilities services. Handling Covid-19 with a high priority causes non-chronic diseases to temporarily
deprioritize. This is indicated by the delay time for further handling of non-covid diseases as can be seen in Table 3.

### Table 1. Remoteness of Each Cases

| Facility         | Advanced Healthcare Facility | Distance in Straight Line (km) | Travel Distance (km) | Travel Time (minute) | Mode of Public Transport | Routes to Area | Remoteness Index |
|------------------|------------------------------|--------------------------------|----------------------|----------------------|--------------------------|----------------|------------------|
| Panggang         | RSUP Soeradji                | 15.79                          | 26                   | 48                   | 0                        | 2              | 1.525            |
| Krajan           | RSUD Sukoharjo               | 17.97                          | 22.7                 | 42                   | 1                        | 3              | 1.009            |
| Dadirejo         | RSUD Purworejo               | 14.98                          | 17.5                 | 30                   | 1                        | 2              | 0.994            |

### Table 2. Comparing Urban and Rural Confirmed Covid19 Case

| Location | Urban/Rural | Mid 2020 | Mid 2021 |
|----------|-------------|----------|----------|
| Kemalang | Remote      |          | 0        |
| Klaten   | Center      |          | 0        |
| Weru     | Remote      |          | 0        |
| Sukoharjo| Center      |          | 6        |
| Bagelen  | Remote      |          | 0        |
| Purworejo| Center      |          | 0        |

### Table 3. Statistics of Cases during July 2020-January 2021

| Location | Covid19-related (total until January 2021) | Non-Covid19-related (avg. per week) | Referred Cases (avg per month) | Delay Time (max days, compared to pre-pandemic) |
|----------|--------------------------------------------|-------------------------------------|-------------------------------|-----------------------------------------------|
| Panggang | 7                                          | 70                                  | 3                             | 3                                             |
| Krajan   | 2                                          | 120                                 | 4                             | 7                                             |
| Dadirejo | 0                                          | 100                                 | 1                             | 0                                             |

3. **Results and Discussion**

The data shows that remoteness is correlated with spread rate and delay time as shown in Table 4. The higher the remoteness, the lower the spread rate. This shows that this is in line with the current literature on how the characteristics of rural areas with high remoteness can slow down the pace of the pandemic. However, two out of three cases showed a delay in non-Covid19 referrals. This delay is closely related to the pandemic based on data from in-depth interviews on cases.

3.1 **Remoteness and Covid19 spread rate**

The relationship between remoteness and Covid19 spread in this research strongly support the arguments on the spread of pandemics as described in the introductory section of this paper. To explain how remoteness is related to the spread rate in the three cases in this study, an exploratory explanation uses a causal mechanism to explain how the low Covid19 spread rate compared to urban centers can occur in rural areas in Central Java. The perspective used to build a causal mechanism in this analysis is an agent-based model that explains how individual decisions related to remoteness
during a pandemic produce low spread rates in rural areas. This causal element was identified based on information from in-depth interviews in the three cases.

The first case emphasizes the distance and adequacy of internal interactions that lead to low spread rates. Primary data shows that individual decisions to reduce the rate of entry and exit from the region contributed greatly to the low spread rate. The second case emphasizes increasing public awareness in the area which makes spread prevention measures more massive in the community. Meanwhile, the third case has a pattern similar to the first case which emphasizes the adequacy of internal interactions to continue to carry on with life as usual, being an individual decision that has a large effect on the spread rate.

Based on these things, there are four causal elements that influence the low spread rate in remote rural areas, namely (1) distance from distant activity centers, (2) adequacy of internal resources, (3) good resilience to loss of external resources, (4) knowledge of the pandemic. The causal mechanism formed then connects the four causal elements in causal pathways from remoteness situations in producing an outcome in the form of a low spread rate of Covid19 as can be seen in Figure 2.

As can be seen in Fig 1. There are 3 causal mechanisms that link remoteness to causal elements as a moderator, namely high transport costs, having the ability to activate survival mode, and limited access to health services. Meanwhile, there are two causal mechanisms that link moderating elements to the outcome (low spread rate), namely decisions to reduce interactions and increase knowledge about the pandemic. The mechanism identified in this scheme is a mechanism that shows strong characteristics of rural areas, such as self-sufficiency and distant from urban centers.

3.2 Remoteness and Delay Time in non-Covid-19 Advanced Treatment

The relationship between remoteness and delay time in non-covid19 advanced treatment has been shown in Table 4. To explain how remoteness is related to delay time during the pandemic in the three cases in this study, an exploratory explanation uses a structure-based model perspective. This perspective is specifically based on the referral system for health services in Indonesia. The causal mechanism in this analysis aims to build a causal pathway that explains how remoteness during pandemic results in delays in continued health services with a referral system as a moderator.

The first and second cases mention the priority of the pandemic in the provision of health services. This is because the referral system in the health care system in Indonesia encourages the accumulation of Covid-19 pandemic patients in advanced service facilities. Therefore, resources on advanced service facilities are concentrated on handling the pandemic, leaving non-Covid19 in delayed services. In non-chronic cases, service delays are an option when dealing with resource constraints. This is no different from other studies which state that the capacity of health care facilities that changed drastically during the pandemic caused service delays for non-Covid patients [19,20]. Data from in-depth interviews also show delays in handling due to additional procedures during the pandemic. This reinforces several studies which have found that additional procedures in health care during a pandemic lead to delays in follow-up services [21,22].

Based on these things, there are two causal elements that affect the occurrence of delays in rural healthcare, namely (1) limited capacity in increasing demand very quickly, and (2) service procedures that are getting longer during the pandemic. The causal mechanism that is formed then connects the two causal elements in causal pathways to explain how remoteness produces outcomes in the form of delays in health services as can be seen in Figure 3.
4. **Conclusion**

Remoteness during a pandemic has two opposite outcomes. Remoteness in the covid19 statistics is a good shield in terms of spread rates, while in the statistics of non-Covid services it is proven to be a contributor to delays in obtaining continued services. It is interesting to observe that remoteness becomes an advantage when the outcome occurs in primary health care, however, these advantages turn into a drawback when the outcome is measured in advanced health services. The causal mechanism shows that the difference is caused by the different perspectives underlying the decision, namely individual choice and institutional structure. In advanced health care, remoteness is a factor...
that worsens delay time because of the distance that must be taken, but it is not directly causally related to the occurrence of delays. Thus, remoteness is indeed beneficial for health services during a pandemic only in rural primary health services. Once the cases have been moved to advanced health services, remoteness is no longer beneficial.

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6. References

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