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Regional Differences in COVID-19 Vaccination Coverage in Indonesia

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A B S T R A C T

Background: COVID-19 cases are still high in Indonesia. As of September 26, 2021, there have been almost 4.21 million cases reported, with over half a million active cases, and almost 141 thousand people lost their lives. Several measures have been conducted, including social restrictions, mask mandates in public places, and vaccination. However, the vaccination rate varies by province and area. This study aims to assess the vaccination coverage in Indonesia by geographical location.

Methods: We abstracted publicly available data from https://vaksin.kemkes.go.id/#/vaccines provided by the Ministry of Health. The numbers of vaccinated individuals and target population for vaccination were abstracted to calculate the first and second-dose vaccination rates. Data were analyzed using STATA to categorize and classify vaccination rates. A vaccination coverage map was generated through STATA. The difference in difference approach was used to ascertain differences in vaccination coverage comparing Java-Bali to other islands in Indonesia.

Results: As of September 17, 2021, over 77 million people in Indonesia have received the first dose of vaccination, and more than 44 million have completed the second dose of vaccination. This corresponds to 37.40% coverage for the first vaccination and 21.29% coverage for the second vaccination. The vaccination rate ranges from 17.34% to 124,2% for the first dose, and 10.52% to 90.5% for the second dose of vaccination. Two provinces (DKI Jakarta and Bali) have more than 90% vaccination coverage for the first dose, with over 60% of the fully vaccinated target population. For the second dose of vaccination, differences by province were also observed. Only 8 provinces have coverage of above 20% for full-dose vaccination, while the remaining 26 provinces were still below 20%. The difference in difference analyses showed the association between islands with the coverage of vaccination in Indonesia, with Java-Bali having a significantly higher and faster increase in vaccination coverage compared to other islands in Indonesia ($p < 0.05$).

Conclusions: We found differences in vaccination coverage between regions and provinces in Indonesia. This might be due to differences in distribution, acceptance, and priorities due to COVID-19 cases and risk in each area. An increase in distribution and vaccine acceptance across the provinces in Indonesia is needed to ensure equal vaccine coverage in Indonesia.

Keywords: COVID-19, Vaccination, Vaccine Coverage

1. Introduction

Indonesia has been severely hit by Coronavirus disease in 2019 (COVID-19). As of September 26, 2021, there were 4,209,403 confirmed cases and 141,585 deaths due to COVID-19, making Indonesia the new epicenter of COVID-19 in Asia (JHU, 2021). The Indonesian government has conducted strong measures to stop COVID-19 spread, including vaccination campaigns. However, until recently, only 21.87% of Indonesians have been fully vaccinated, and approximately 38.35% have received the first dose (Kementrian Kesehatan Republik Indonesia, 2021b). The government policy is to vaccinate population groups in the following order: health workers; public service officers; and vulnerable communities (Fuady et al., 2021). However, the vaccination rate in Indonesia varies by province and area. Several factors might influence the differences in vaccination coverage, including the geographical location of Indonesia which caused challenges in the provision of healthcare, including vaccination throughout the archipelago.

Additionally, in Indonesia, vaccination hesitancy is increasing, particularly due to European reports of rare but serious complications of AstraZeneca and the Johnson & Johnson vaccine. Banning these vaccines from the vaccination campaigns in Europe has resulted in rumors and misinformation, mainly spread via traditional and social

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media in Indonesia (Kementrian Kesehatan Republik Indonesia, 2021a). There is a serious concern that the combination of misinformation about the vaccination against COVID-19 and differences in distribution towards vaccination may lead to very low levels of vaccination acceptance and coverage in Indonesia. This study aims to assess differences in vaccination coverage in Indonesia by provinces and regions. The findings from this study can be the basis to tailor implementation strategies for vaccination including education and advocacy to improve willingness and acceptance of vaccination.

2. Methods

We abstracted data from the publicly available data on COVID-19 vaccination which can be accessed through https://vaksin.kemkes.go.id/#/vaccines. The numbers of vaccinated individuals and target population for vaccination were abstracted to calculate the vaccination rate for the first dose and second dose of vaccine. Data were analyzed using STATA to categorize and classify vaccination rates. Map for vaccine coverage was generated through STATA. Analysis was conducted in two periods: August and September 2021 to show not only coverage of vaccination but also the progress of vaccination coverage in Indonesia by different provinces and areas. To compare the changes in vaccination rollout between the regions, use the Difference in Difference (DiD) approach in linear regression. The DiD approach allowed adjustment for the maturation effect (changes in outcome due to time, from July to September 2021), while simultaneously adjusting for differences of vaccination coverage in baseline (July 2021).

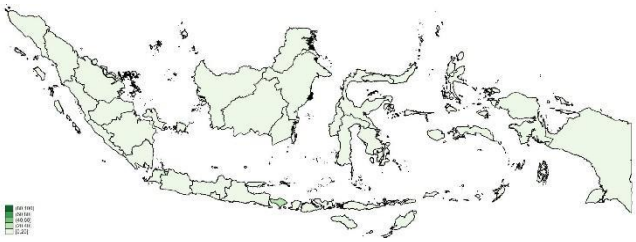
3. Results

We analyzed the vaccination rate in Indonesia between two periods: July 26 and September 17, 2021. As of July 26, 2021, over 45 million people (21.74% of the target population) have received the first dose of vaccination, and more than 18 million (8.96% of the target population) have completed the second dose of vaccination. The vaccination rate ranges from 9.1% to 88.4% for the first dose, and 4.4-26.8% for the second dose of vaccination. Two provinces (DKI Jakarta and Bali) have over 80% vaccination coverage for the first dose, with 20% of the fully vaccinated target population. Twenty-nine provinces had lower than 25% coverage of first dose vaccination. For the second dose of vaccination, differences by province were also observed (Figure 1). Twenty-seven provinces have lower than 10% coverage, and only two provinces have more than 20% coverage.

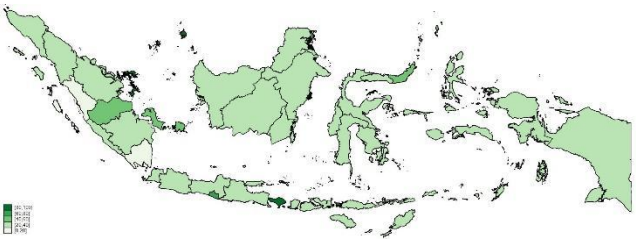
Meanwhile, on September 17, 2021, the number of people receiving the first dose of vaccination has increased to over 77 million people (37.40% of the target population), and more than 44 million (21.29% of the target population) have completed the second dose of vaccination. The vaccination rate ranges from 17.34% to 124,2% for the first dose, and 10.52%-90.5% for the second dose of vaccination. Two provinces (DKI Jakarta and Bali) have over 90% vaccination coverage for 1st dose, with over 60% of the fully vaccinated target population. For the second dose of vaccination, differences by province were also observed. The coverage of vaccination is depicted by the map shown in Figure 1.

Figure 1: Vaccination Coverage in Indonesia by provinces

1a. First Dose Vaccination July 2021



1b. Second Dose Vaccination July 2021



1c. First Dose Vaccination mid-September 2021

1d. Second Dose Vaccination mid-September 2021

Notes:

Proportion of vaccination coverage were classified as follow: <20%, 20-39.9%, 40-59.9%, 60-79.9%, and 80%

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When analyzed using the Difference in Difference (DiD) approach to compare vaccination coverage between the different islands in Indonesia, differences in baseline coverage as well as increases in vaccination rate for both the first dose and second dose were observed (Table 1).

Table 1. Differences-in-Differences analyses of vaccination coverage in Indonesia

Variables	1st Dose	2nd Dose
Baseline differences	**21.61**	6.24
Time (July-September)	**10.68**	**8.49**
Time#Java-Bali	11.88	**16.61**
Constant	18.67	7.47

Note:

- *Baseline differences refer to differences between Java-Bali and other islands in Indonesia in July 2021*
- *Time refers to increases in coverage on average in Indonesia*
- *Time#Java-Bali refers to differences in increases of vaccination coverage between Java-Bali and other islands in Indonesia*
- *Constantly refers to baseline coverage of vaccination on average in Indonesia*

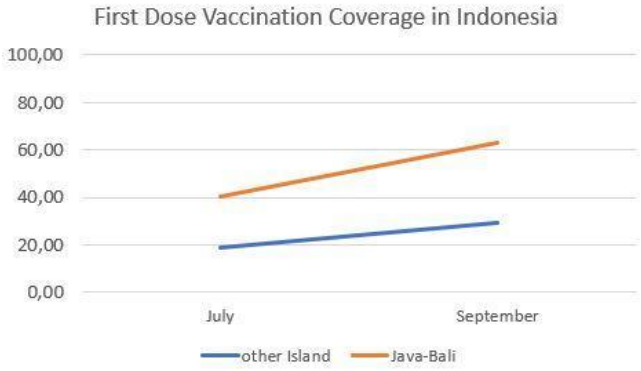
From Table 1, we can see that there were significant differences between Java-Bali and other islands in Indonesia regarding coverage of vaccination. Provinces in Java-Bali had 21.61% higher coverage of 1st vaccine compared to other islands in Indonesia. From July to September 2021, on average there was a 10.68% increase in 1st dose vaccination coverage in Indonesia. Although not statistically significant, a higher increase was observed in provinces in Java-Bali (11.88%) compared to provinces in other islands in Indonesia.

For the second dose of vaccination, a slightly different pattern was observed. Differences of vaccination coverage between Java-Bali at baseline were not significant, however, there were significant differences in terms of increase of coverage between Java-Bali and other islands in Indonesia between July-September. On average, the increase in second dose vaccination coverage was 8.49% in Indonesia, however, in Java-Bali, the increase was almost twice faster (an additional increase of 16.61%).

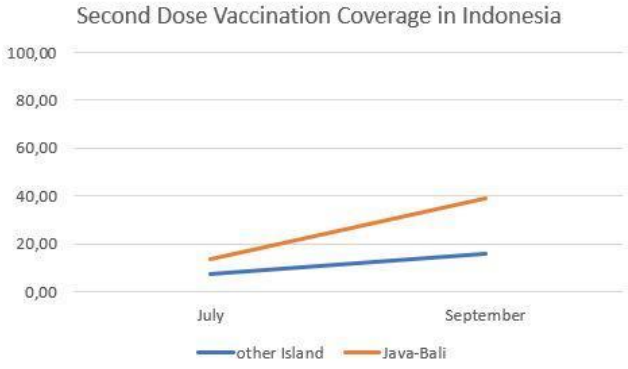
The differences-in-differences analysis approach is also depicted in Figure 2. Our analyses suggest there were differences not only in the baseline coverage of vaccination in July 2021 but also increases in vaccination coverage, shown by the widening of the gap in vaccination coverage between provinces in Java-Bali and other islands in Indonesia.

The difference in the acceleration of vaccination was more pronounced on the second dose vaccination (Figure 2). The widening of the gaps between two lines in Figure 2 depicted the differences in the acceleration of vaccination implementation between Java-Bali and other islands in Indonesia. Java-Bali had higher baseline coverage as well as faster vaccination implementation compared to other islands in Indonesia.

Figure 2: Differences-in-Differences analyses of Vaccination coverage in Indonesia



2a. First Dose Vaccination July-September 2021



2b. Second Dose Vaccination July-September 2021

4. Discussion

This study highlights the disparities in healthcare, particularly in COVID-19 vaccination in Indonesia. Significant differences by province and the islands of each province were observed for both the first and second doses of vaccination. The difference-in-difference analyses showed that in July 2021, baseline differences in vaccination coverage were observed between provinces in Java-Bali and other islands in Indonesia, particularly in the first dose of vaccination. Meanwhile, for the second dose, a significant difference was observed for the acceleration of vaccination.

The distribution of the COVID-19 vaccine is a challenge not only for Indonesia but also for the global population. WHO has launched the COVAX initiatives to facilitate global equity in vaccine distribution (Emanuel et al., 2021). However, inequality between countries, particularly those of high-income countries (HICs) and the low-middle income countries (LMICs) are observed (Tatar et al., 2021). This is due to the lack of availability and high demand for COVID-19 vaccines amidst the pandemic, particularly in LMICs (Torres et al., 2021).

In Indonesia, the government has procured the COVID-19 vaccine with the initial launching of vaccination in mid-February, targeting health care providers. This was followed by vaccination to high-risk populations i.e., elderly, service workers, and public servants, before having general rollout to all eligible adults in Indonesia. As of now, vaccine rollout has been underway throughout the provinces, with regional differences between the areas. There are several factors related to the disparities. First, the differences in COVID-19 cases, which are Java-Bali islands, particularly in the urban areas (Purwanto et al., 2021; Rasjid et al., 2021). This led to the prioritization of Java-Bali islands provinces in COVID-19 vaccination. Second, Indonesia's geographical conditions present challenges to achieving an equal distribution of healthcare in general, including vaccination (Fernandez et al., 2011; Hardhantyo & Chuang, 2021; Tripathi & Singh, 2017). Third, healthcare provider factors include availability and quality resources, including equipment, healthcare professionals, and infrastructure.

Despite the national level program implementation, the rollout, as well as the capacity to implement each of the programs, differ by region, as well as by individual and community characteristics. Previous studies have also reported the unequal distribution of physicians and healthcare providers in Indonesia, with scarcity in rural areas and less populated regions of Indonesia (Meliala et al., 2013). Furthermore, as an archipelagic nation, geographical conditions become a major barrier to accessing healthcare, especially, in rural and remote areas (Hull et al., 2015). The differences in healthcare availability and capacity across the different regions in Indonesia (Diana et al., 2015), present challenges in providing equal access to vaccination. Healthcare provider factors related to healthcare include availability and quality of resources, including equipment, healthcare professionals, and infrastructure (Målqvist et al., 2013).

The gap in current coverage, as well as acceleration in vaccination between the regions, requires improvement in the rollout strategy for vaccination. The inclusion of volunteer and community health workers to help in the preparation and coordination is needed (Fuady et al., 2021; Lazarus et al., 2021). The involvement of stakeholders beyond the health departments is also crucial because the vaccination process includes several steps which require not only healthcare providers. The vaccination process generally has several steps: 1) the registration, which includes checking of vaccination status through the Peduli Lindungi, an application which integrated information on COVID-19 status, including vaccination, 2) the screening, which includes anamnesis or interview on health history as well as a basic health check, 3) the vaccination process, which needs to be conducted by trained vaccinator, 4) observation, in which the vaccine receivers need to wait for at least 30 minutes to observe for adverse events, and 5) reporting of vaccine status through Peduli Lindungi application. From these five steps, at least the first and fifth steps can be conducted by non-health official volunteers.

Vaccination efforts need to be improved, to facilitate a reduction in COVID-19 cases. Previous research has reported the effectiveness of vaccines to reduce the risk for infection, severe morbidity, and mortality due to COVID-19 cases (Aldila et al., 2021; Toharudin et al., 2021). The government policy to prioritize healthcare workers who are at high-risk for infection, and the elderly who are at higher risk for severe cases are in line with the current recommendation for COVID-19 vaccination. Nevertheless, regional differences in vaccine coverage and acceleration need to be addressed. Additionally, educational campaigns to improve awareness and willingness for vaccination, and address vaccine hoax is also important (Chavarría et al., 2021; Harapan et al., 2020; Ullah et al., 2021). Hence, an increase in the availability of vaccines will be met with willingness and acceptance of vaccination.

5. Conclusion

We found differences in vaccination coverage between regions and provinces in Indonesia. The contributing factors include the differences in COVID-19 burden between regions and provinces which influence prioritization. This might be due to differences in distribution, acceptance, and priorities due to COVID-19 cases and risk in each area. An increase in distribution and vaccine acceptance across the provinces in Indonesia is needed to ensure equal vaccine coverage in Indonesia. These can be done with the inclusion of community volunteers and campaigns to increase awareness of and willingness for vaccination.

Acknowledgments

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