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Jurnal Ilmu Pemerintahan

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OTORITAS

JIP

VOL. XIII

NO. 3

PP. 364-541

December 2023

P-ISSN 2088-3706

E-ISSN 2502-9320



Department of Government Studies
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Jurnal Ilmu Pemerintahan

Volume 13 • Number 3 • 2023

OTORITAS : Jurnal Ilmu Pemerintahan

Published by the Department of Government Studies,
Faculty of Social and Political Sciences, Muhammadiyah University of Makassar

For further information, please visit: <https://journal.unismuh.ac.id/otoritas>

ISSN: 2088-3706 (Print) | 2502-9320 (Online) | DOI : 10.26618

First published in April 2011

Please send all articles, essays, reviews, and documents to:

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COVID-19 pandemic and population density problem in Indonesia: transmigration policy as an alternative program

Arifin Saleh^{1*)}, Rizal Khadafi², Achmad Nurmandi³, Mujahiddin⁴, Agung Saputra⁵, Soritua Ritonga⁶, Sigit Hardiyanto⁷

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Abstract

The objective of this study is to examine the associations between levels of population density and the transmission of COVID-19 in Indonesia. Descriptive analysis is employed to determine the data distribution of the response variable (dependent variable Y) as well as the independent variables X_1 and X_2 . Therefore, inferential analysis is a quantitative technique that involves examining a sample in order to draw conclusions about a larger population. The present investigation has revealed a statistically significant positive connection ($r = 0.954$) between the incidence of COVID-19 patients and population density in Indonesia. The Model Summary provides the R value (Correlation Coefficient) of 0.959, indicating a strong positive correlation between the variables. Additionally, the multiple correlation coefficient r (Multiple R) is 0.920, which represents the determination index or the proportion of the influence of X on Y. Therefore, it can be asserted that 92% of COVID-19 cases are driven by population density and the number of individuals experiencing employment terminations, whilst the remaining 8% is affected by additional factors. The regression equation can be constructed from the Coefficients table in the following manner: The equation can be expressed as $Y = 5327.46 + 84.174X_1 - 0.170X_2$. The calculation of the Standard Error of the Estimate (SE) yields a value of 8151.076 or 8151. The standardized coefficient (Beta) of 1.381 represents the extent of association between the number of COVID-19 infection cases and population density.

Keywords: Covid-19, population density, transmigration policy

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Introduction

The COVID-19 pandemic has exerted a major impact upon the global economy, leading to projected losses that are anticipated to reach US\$12 trillion by the culmination of the year 2021. According to the report COVID-19 has driven 40 to 60 million individuals into circumstances of severe economic distress. Not solely concerning economic adversities, moreover, within the domain of education, the circumstances engendered by the effects of COVID-19 have resulted in an impact on nearly 1.2 billion students due to the enforcement of school closure policies. The subsequent challenge lies in the exacerbation of circumstances for urban communities residing in slums due to the ramifications of COVID-19, along with the compounded hardships faced by internally displaced individuals (IDPs). This is particularly pertinent as approximately one-third of the global IDP population resides

within the ten countries most vulnerable to the socio-economic implications of COVID-19's impact (undp.org, 2021). Moreover, 1.6 billion informal workers are forecasted to experience a reduction of 60 percent in their income. The United Nations Development Program (UNDP) also provides an estimate indicating that approximately 265 million individuals residing in countries with low incomes are facing the risk of a food crisis. The tourism sector was also significantly impacted, with potential losses reaching to 850 million and 1.1 billion US dollars (undp.org, 2021).

Derived from the earlier elucidated data from UNDP, it becomes intriguing to delve into the correlation between population density and COVID-19 infection in Indonesia, particularly considering the enduring association between population density and urban communities residing in densely inhabited settlements, including slums. This fact adds to the interest, as Indonesia is positioned as the fourth most densely populated country in the world, boasting an approximate total population of 277 million. This constitutes 3.45 percent of the global populace, characterized by a density of 153 individuals per square kilometer (397 individuals per square mile), of which 59.1 percent reside in urban areas (worldometers.info, 2023). As of July 27, 2021, Indonesia has attained the position of being the nation with the highest daily rates of infection and mortality globally. The largest number of cases was identified within the DKI of Jakarta Province, which stands as the most densely populated province in Indonesia. This was subsequently followed by West Java, Central Java, East Java, Kalimantan, DI Yogyakarta, and Banten Province (covid19.go.id, 2021). Six out of the seven provinces are included in the ranks of the ten provinces with the highest population density among the total of 34 provinces in Indonesia (BPS, 2014).

The existing circumstances of the COVID-19 pandemic in Indonesia during the period enabled this study to corroborate previous findings regarding the impact of population density on the transmission of the virus. The relationship between population density and its correlation with the dissemination of COVID-19 has been found in numerous countries across the globe, including Algeria (Kadi & Khelifaoui, 2020), India (Arif & Sengupta, 2021; Bhadra et al., 2020; Gupta et al., 2020), and the Amerika Serikat (Hamidi et al., 2020). In analyzing the situation in Indonesia, regarding the correlation between demographic indicators and the accessibility of healthcare services with COVID-19 outcomes across provinces in the nation, it was determined that the number of confirmed cases and the trajectory of case growth showed significant correlations with demographic metrics, particularly in relation to the distribution of age groups (Wirawan & Januraga, 2021). Hence, the primary objective of this study is to bridge the void existing in previous research pertaining to the interrelation between population density and the extent of COVID-19 virus transmission.

Moreover, this study seeks to ascertain alternative policy remedies aimed at proactively addressing analogous occurrences in the future. The alternative resolutions pertain to the relocation of individuals from densely inhabited communities to regions with lower population density, employing a strategy encompassing human resource development and regional growth. This approach, within the context of Indonesia, is recognized as transmigration, a concept that has been in use from the period of Dutch colonial rule up to the present day. In the era of Dutch colonization, this phrase denoted the action of transferring individuals from the densely populated island of Java to other islands characterized by lower population densities. This movement was primarily aimed at engaging them in agricultural activities involving crops such as rubber, tobacco, tea, coffee, cloves, and sugarcane (Elmhirst, 2000; Meyer & Macandrews, 1978). Following the attainment

of independence, the Indonesian administration persistently sustained this initiative, furthering the relocation of individuals from Java, particularly those hailing from destitute, arid regions with limited educational attainments. This effort aimed to relocate them away from Java and involve them in the agricultural sector (Tardent, 1982). In contrast to the colonial rule of the Dutch government, the Indonesian authorities extended participants of this program with entitlements encompassing housing ownership, land allocation, provisions of seeds and fertilizers, guidance and instruction in their newly designated destinations. These sites were demarcated by the government as transmigration zones (Tjondronegoro, 1983).

Population density refers to the condition wherein a specific geographic area accommodates a substantial number of individuals, surpassing the area's capacity to adequately provide space for settlement in accordance with the population's requirements. The COVID-19 pandemic crisis has revealed a noteworthy association between population density and infection as well as mortality rates. In the context of Turkey, the influential elements in the transmission of the virus were identified as population density and wind patterns (Coşkun et al., 2021). There exists a strong correlation between population density and pandemic magnitude, as evidenced by fatality rate data indicating that regions with lower population density tend to impede the spread of pandemics (Bray et al., 2020; Li et al., 2018). In the context of India, the findings of the analysis revealed a positive link between COVID-19 infection and death rates in response to population density (Bhadra et al., 2020).

There is a positive correlation between population density and the likelihood of SARS-CoV-2 transmission in urban areas. This potentiality arises from the heightened degree of human interaction within densely populated communities, which exhibits a notable association with rates of illness (Irandoust et al., 2023; Moosa & Khatatbeh, 2021; Yin et al., 2021). Furthermore, the extent of interpersonal interaction is not the sole determinant of the rapid transmission of the virus in highly populated regions; the specific viral variation also exhibits a favorable correlation with this phenomenon (Md Iderus et al., 2022). The observed rapid transmission rate is subsequently associated with an elevated mortality rate resulting from the infection (Bhadra et al., 2021).

In the context of Indonesia, it has been observed that density, alongside population density, has emerged as a viable indication for assessing the transmission of the COVID-19 virus (Purwono & Wibisono, 2023). There is a high probability that the detection of the COVID-19 viral transmission rate among impoverished individuals residing in densely populated settlements is insufficient (Wahid & Setyono, 2022). An additional determinant influencing the extent of viral transmission, apart from population density, is the element of altitude. This phenomenon arises from the wide range of geographical circumstances present in Indonesia, which exhibit significant diversity (Widya Hary et al., 2022). In conjunction with geographical considerations, densely populated locations are subject to additional social factors that exert a notable impact on the risk of transmission. These factors include heightened workplace and places of worship interaction (Choiruddin et al., 2023).

Generally, extant research indicates a positive correlation between population density and COVID-19 mortality rates, whereby countries with larger population densities tend to exhibit higher mortality rates in comparison to their rural counterparts. The high death rates observed in densely populated places can be attributed to the increased amount of interpersonal contact, which consequently amplifies the potential for disease transmission (Sy et al., 2021), both population size and population density have been found to be reliable indicators of the total number of infection cases at the district level (D. Wong & Li, 2020).

Nevertheless, alternative research has yielded contrasting results to the aforementioned studies, positing that population density may not have a substantial impact on the transmission of COVID-19 when stringent lockdown measures are in place (Carozzi, 2020; Lima et al., 2021; Sun et al., 2020). Nevertheless, it is widely acknowledged that the implementation of a lockdown policy serves as a short-term strategy aimed at mitigating the transmission of the virus, rather than a sustainable approach to managing individuals' socio-economic circumstances.

Population density refers to the spatial distribution of individuals within a given geographic area. In the context of this study, the utilization of population density data aims to quantify demographic characteristics, evaluate connections with ecosystems and human well-being, and enhance overall quality of life (nationalgeographic.org, 2023). The COVID-19 under consideration refers to the medical condition known as Coronavirus illness, which is classified as a contagious ailment resulting from the SARS-CoV-2 virus (who.int, 2023). Therefore, in this study, population density and COVID-19 are construed as a relationship between the clustering of individuals in a specific geographic area and the extent of infection with communicable diseases resulting from the SARS-CoV-2 virus.

The matter of fair development has posed a persistent challenge since the era of Dutch colonialism and subsequent to Indonesia's attainment of independence. The Indonesian government, following independence, perpetuated the colonial authority's objective of establishing Java as the focal point of governance and economic activities (Aspinall, 2007). During the early stages of Indonesia's independence, this issue incited numerous uprisings in various regions, encompassing both movements advocating for complete autonomy and those seeking to rectify perceived centralization in government policies (McVey, 2014; Soebardi, 1983).

The matter of fair development is intricately linked to the presence of socio-economic inequality within the context of Indonesia (Houweling et al., 2006). In the context of Indonesia, several key issues pertaining to inequality arise within the nation's economic development trajectory. The income disparity among households is evidenced by the upward trend of the Gini coefficient. Furthermore, there exists a disparity in the rate of progress among several economic sectors, namely agriculture, mining, manufacturing, and services. Additionally, there is a notable discrepancy in development levels among different regions (Muhammad Fidaus, 2016; Van & Földvári, 2016). The presence of development disparities among areas in Indonesia can be mostly attributed to factors such as insufficient human capital, inadequate governance, challenging geographical accessibility, and complications related to property acquisition (Iek & Blesia, 2019; Tadjoeidin, 2019). Historically, the Indonesian government has implemented transmigration initiatives as a means to address the disparities in human resource development and regional inequalities within the country (Tirtosudarmo, 1990).

The word transmigration is not widely employed beyond the borders of Indonesia. Transmigration, known as "*Transmigratie*" in Dutch, refers to a governmental initiative implemented by the Indonesian administration. This program aims to relocate individuals from densely populated urban areas to less inhabited rural regions within the territorial boundaries of Indonesia. The word was initially introduced by Soekarno, the inaugural President of the Republic of Indonesia, in 1927 through his publication in the newspaper *Soeloeh Indonesia*. Moreover, during the Economic Conference held in Kaliurang Yogyakarta, in conjunction with the Meeting of the Economic Strategy Committee on February 3, 1946, the inaugural Vice President of the Republic of Indonesia, Muhammad Hatta, emphasized the

significance of transmigration as a means to facilitate the advancement of industrialization beyond the island of Java (Kementerian Desa, 2015).

The commencement of Transmigration in Indonesia may be traced back to the period of colonization, specifically in 1905, when the initial relocation of 155 households from Kedu, Central Java to Gedong Tataan in Lampung Province took place. The Dutch government referred to the process as colonization rather than transmigration. Since 1965, the Malaysian government has employed a similar approach whereby individuals from low-income backgrounds are provided with housing and land for the purpose of cultivating rubber and oil palm trees. The program implemented in Malaysia does not bear the designation of transmigration. The transmigration program, exclusive to Indonesia, has been documented for approximately 100 years. Transmigration refers to a specific form of migration that is exclusive to the country of Indonesia (Kementerian Desa, 2015).

In the process, the transmigration program has many positive impacts related to human resource development and regional development in Indonesia. The positive impact is because the transmigration program can trigger economic development rapidly because there are investments made by residents, besides that transmigration also causes the presence of new public facilities and infrastructure in the fields of education, health and so on (Sukmaniar & Saputra, 2020). The primary objective of transmigration initiatives is to enhance both the quality and quantity of human settlements, while concurrently fostering regional self-sufficiency (Rinjani & Ningsih, 2021). The transmigration program in Indonesia generally yields favorable outcomes in the destination area, encompassing economic, social, and technological domains. Specifically, the program exerts a positive influence on the economic, social, and technological aspects of the receiving area. Moreover, it engenders effects on the dimensions of security, prosperity, and welfare of life within the transmigration area (Diah & Sekar, 2021).

The global ramifications of the COVID-19 pandemic have been immense, with anticipated economic losses projected to reach US\$12 trillion by the end of 2021 and millions facing severe economic distress. Beyond economic challenges, the pandemic has disrupted education for nearly 1.2 billion students due to widespread school closures. Urban communities in slums and internally displaced individuals face compounded hardships, especially in countries vulnerable to the socio-economic implications of the pandemic. Indonesia, the world's fourth most densely populated country, with 277 million people, grapples with the highest daily rates of infection and mortality as of July 2021. The correlation between population density and COVID-19 transmission becomes a critical focus, given Indonesia's urban communities residing in densely inhabited areas, including slums. This study aims to bridge the existing research gap by exploring the interrelation between population density and the extent of COVID-19 transmission in Indonesia, offering insights into the challenges faced by densely populated regions.

Furthermore, the study seeks to propose alternative policy remedies for future proactive interventions. One such remedy is rooted in Indonesia's historical transmigration program, which involved relocating individuals from densely populated areas to regions with lower population density. By leveraging this approach, incorporating human resource development and regional growth strategies, the study aims to address the challenges posed by population density. This proactive stance is essential, especially considering the observed positive correlation between population density and COVID-19 transmission rates in urban areas. As the research unfolds, it endeavors not only to shed light on the correlation but also to provide valuable policy recommendations for managing similar challenges in the future,

thereby contributing to the global discourse on pandemic preparedness and regional development.

Research Methods

The rate of COVID-19 transmission is significantly influenced by population density. This work employs analytical approaches, specifically descriptive and inferential analysis, to investigate the potential association between population density and the degree of COVID-19 transmission. Descriptive analysis is a methodological technique that centers on the collection and presentation of data in order to provide significant insights and interpretations. Descriptive analysis is employed to ascertain the data distribution of the dependent variable (Y) as well as the independent variables X_1 and X_2 . Inferential analysis is a methodological approach that involves examining a subset of data in order to draw conclusions that are applicable to the full population.

The present study employs statistical software (SPSS) to conduct a rigorous statistical analysis, with the primary objective of establishing the correlation between population density and the incidence of COVID-19 cases. The research utilized secondary data obtained from many sources, such as the official COVID-19 response platform (covid19.go.id), the Central Statistics Agency, and the Ministry of Health's dataset. The study aims to investigate the relationship between the dependent variable (Y), which denotes the number of COVID-19 cases recorded during the period of 2020, and the independent variables (X_1) population density and (X_2) the number of individuals who experienced layoffs in the provinces of West Java, Central Java, East Java, West Sulawesi, North Maluku, and Papua.

In the third phase, the methodology adopted involves doing density analysis using Pearson correlation. The process of data processing involves a series of sequential processes, beginning with the classification of data, followed by the editing of data, and the integration of additional supplementary data. To examine the historical utilization of the Transmigration Program by the Indonesian Government as a solution to the problem of overpopulation, this study will employ document analysis and content analysis methodologies. The topic of development disparity within Indonesia will be examined using comparable analytical methodologies.

Results and Discussion

As of July 28, 2021, the number of confirmed COVID-19 cases in Indonesia stands at 3,287,727 individuals. Among them, 2,640,676 individuals have been reported as recovered, while 88,659 individuals have unfortunately succumbed to the disease (Covid19.go.id, 2021). As a result of this, Indonesia has attained the status of being the nation with the highest daily fatality rate globally. Jakarta, the capital city of Indonesia, exhibits the highest rates of infection and death among the provinces in the country. It is succeeded by West Java, Central Java, East Java, Special Region of Yogyakarta, and Banten in terms of their respective rates. In Indonesia, there are a total of 34 provinces located on different islands. However, this study will specifically concentrate on six provinces: West Java, Central Java, East Java, West Sulawesi, North Maluku, and Papua. It is worth noting that three of these provinces serve as the primary epicenters for the transmission of COVID-19 within Indonesia.

That requires a careful approach in seeking solutions. Presenting transmigration policy as an alternative for human empowerment and regional development is an intriguing and worthwhile step. Firstly, transmigration policy can provide a solution to the issue of population density in certain regions of Indonesia. By redistributing the population to

broader and less crowded areas, it can help reduce the risk of disease spread, including COVID-19. Additionally, this policy could serve as a catalyst for regional development, alleviating pressure on infrastructure in densely populated areas.

However, it is crucial to consider the social, economic, and environmental impacts of this transmigration policy. Thoughtful planning, comprehensive support, and engagement with local communities will be key to the successful implementation of such a policy. Moreover, it is essential to ensure that transmigration does not lead to inequality or social conflicts in the receiving regions. In the context of the COVID-19 pandemic, transmigration policy must also be aligned with strict health protocols to avoid virus transmission during the transition process. With a careful and coordinated approach, this policy could be one of the strategic elements in responding to the challenges faced by Indonesia in addressing the impacts of the pandemic and population density issues.

Table 1. Infection Rate in Java Island Indonesia

No.	Province	Infection Rate	Population Density
1.	DKI Jakarta	758505	15900
2.	West Java	582027	1394
3.	Central Java	363148	1058
4.	East Java	286594	831
5.	Banten	107045	1338
6	DI Yogyakarta	110177	1227

Source: Covid-19.go.id; Central Bureau of Statistics

According to statistics data from 2020, the island of Java, which serves as the epicenter of the COVID-19 spread in Indonesia, is home to a population of approximately 151.59 million individuals. This figure accounts for approximately 56.10 percent of the overall population of Indonesia. With a population of 58.56 million individuals, Sumatra Island occupies the second position, accounting for 21.68 percent of the total population. Sulawesi Island has the third position in terms of population distribution, accounting for 7.36 percent. Following closely is Kalimantan Island with a rate of 6.15 percent. The Bali-Nusa Tenggara region and the Maluku-Papua region occupy the fourth and fifth positions, respectively, with population distribution rates of 5.54 and 3.17 percent (Badan Pusat Statistik, 2021). The statistical data shown above indicates a correlation between the transmission of COVID-19 in Indonesia and population density. In order to validate this assertion, it is important to use statistical analysis in order to provide more precise and reliable data.

Table 2. Correlation Table

Correlations				
		Number of cases of Covid-19	Density	Number of people fired
Pearson Correlation	Number of cases of Covid-19	1.000	.954	.903
	Density	.954	1.000	.972
	Number of people fired	.903	.972	1.000
Sig. (1-tailed)	Number of cases of Covid-19	.	.002	.007

	Density	.002	.	.001
	Number of people fired	.007	.001	.
N	Number of cases of Covid-19	6	6	6
	Density	6	6	6
	Number of people fired	6	6	6

Source : processed by authors

The presented Correlation Table (Table 2) demonstrates a statistically significant association between the number of COVID-19 infection cases and population density, yielding a correlation coefficient of 0.954. This coefficient signifies a positive relationship between the two variables. A positive and statistically significant link was observed between the variable representing the number of COVID-19 infection cases and the variable representing the number of employees who were laid off, with a correlation coefficient of 0.903.

Table 3. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.959 ^a	.920	.867	13624.050	2.588

a. Predictors: (Constant), Number of people fired, Density

b. Dependent Variable: Number of cases of Covid-19

The Model Summary table (Table 3) presents the R (correlation coefficient) value of 0.959, indicating a strong relationship between the variables. Additionally, the multiple correlation coefficient r (Multiple R) is reported as 0.920, which serves as a determinant index or percentage representing the extent of X's effect on Y. Therefore, it can be asserted that 92% of COVID-19 infection cases are impacted by two additional factors, specifically the degree of population density and the number of individuals facing job losses, while the remaining 8% is attributable to other variables.

Table 4. Coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5327.466	8151.076		.654	.560
	Density	84.174	42.259	1.381	1.992	.140
	Number of people fired	-.170	.268	-.439	-.633	.571

Source : processed by authors

The regression equation can be derived from the Coefficients table (Table 4) as follows: $Y = 5327.46 + 84.174X_1 + (-0.170)X_2$. The standard error of estimation (SE) is calculated to be 8151.076 or 8151. The Standardized Coefficients (Beta) value of 1.381 signifies the degree of association between the quantity of COVID-19 instances and population density. The correlation coefficient of -0.439 indicates the degree of association between the incidence of COVID-19 cases and the rate of employee layoffs.

The study conducted in urban Sanandaj, Iran provides evidence that a notable association exists between infection rates and population density per hectare, specifically in residential districts where the number of dwellings per hectare is considered. The correlation coefficient for this relationship is reported to be 0.01. This observation implies a positive correlation between the prevalence of COVID-19 infections and both population size and residential density in urban regions (Irandoost et al., 2023). Numerous prior investigations have demonstrated a positive correlation between urban areas characterized by greater population density and the propensity for SARS-CoV-2 transmission. The population density component has been recognized as a potential indicator in the transmission of SARS-CoV-2 viral infection (Martins-Filho, 2021).

Spatial regression models were employed to investigate the correlation between demographic, socio-economic, and environmental factors and the transmission of COVID-19, with a focus on variables associated with population size. Consequently, a robust association was observed between the frequencies of infection and the density of the population (Copiello & Grillenzoni, 2020). The study utilized cross-sectional data from reputable sources such as the World Bank, the Center for Health Security, and the European Center for Disease Prevention and Control. Through the application of extreme bounds analysis (EBA) and variable addition tests, the findings consistently indicated a significant positive relationship between population density and the incidence of COVID-19 cases (Moosa & Khatatbeh, 2021).

One additional consequence of the pandemic, which predominantly affects individuals residing in densely populated regions, is the economic ramifications. The proliferation of COVID-19 has resulted in a notable downturn in economic activity, characterized by a substantial reduction in both export and import operations. This suggests that COVID-19 has had a considerable negative impact on economic conditions (Famiglietti & Leibovici, 2022). The world economy, particularly that of Indonesia, has had significant repercussions as a result of the COVID-19 pandemic. According to the data provided by the Indonesian Central Statistics Agency (BPS, 2020b), there was a decline of 1.01 percent in Indonesia's economy during the first quarter of 2020 as compared to the preceding quarter of 2019. The aforementioned state arises as a consequence of the suspension of economic operations resulting from the implementation of social and physical distancing measures, which have been mandated as a health protocol to mitigate the spread of COVID-19. The education services sector experienced the most significant economic deceleration, with a decline of 10.39 percent, followed by the government administration sector, which saw a contraction of 8.54 percent (Chairani, 2020).

Research has demonstrated that population density plays a significant role in facilitating the transmission of the COVID-19 virus. The study's findings additionally indicate that the swift transmission of the virus was observed in Indonesian towns characterized by a significant concentration of inhabitants. The transmission of the virus is accelerated in metropolitan areas due to their high population density, resulting in a more intricate distribution network. Conversely, locations with lower population density, such as rural

regions, do not experience the same phenomenon. The correlation between increased transmission rates in metropolitan locations is significantly impacted by the heightened level of human interaction, therefore rendering population density in urban regions a significant concern in relation to the dissemination of the COVID-19 virus.

The existence of a positive association between the transmission of the COVID-19 virus in urban populations and high population density is an indisputable reality (Alam, 2021; Coşkun et al., 2021; Pascoal & Rocha, 2022). This favorable link is closely associated with the significant level of interpersonal interaction observed in densely populated residential regions (Irandoost et al., 2023). Nevertheless, when subjected to stringent lockdown measures, it was observed that there was no substantial impact of high population density on the transmission dynamics of the virus (Sun et al., 2020; H. S. Wong et al., 2023). While the impact of population density on viral transmission under lockdown measures is minimal, it is important to note that lockdown itself is a transitory strategy rather than a permanent one. In essence, the constrained dissemination of the infection during the period of lockdown is likewise a transitory circumstance.

The swift dissemination of the COVID-19 virus has led to the immobilization of economic operations across diverse sectors of the population. The inherent unpredictability of the virus disrupts the smooth functioning of economic cycles and leads to enduring economic consequences. The economic uncertainty is further intensified by the implementation of lockdown measures, which are designed to mitigate the transmission of the virus. As a consequence of these circumstances, a significant number of individuals saw a reduction in their earnings and employment opportunities as a result of workforce reductions and the closure of businesses. The rise in unemployment resulting from job and income loss leads to a corresponding increase in crime rates, particularly in densely populated regions of Indonesia that mainly rely on the manufacturing industry. The government's lack of clarity regarding the prioritization of health and the economy constitutes a significant determinant in the ongoing endeavors to achieve both health and economic recovery.

This study aims to examine a range of potential strategies that might be employed to proactively address future occurrences of comparable catastrophes, with a particular focus on Indonesia and other global regions. The challenge of managing crisis situations, like as the COVID-19 pandemic, is exacerbated in densely populated urban areas that heavily rely on manufacturing and finance industries. One potential course of action that may be contemplated in addressing the circumstances of this socio-economic crisis is the revitalization of the transmigration program (Tardent, 1982). The decision to implement this program as a viable alternative aims to mitigate the high population density in a specific region that heavily relies on the manufacturing industry. Instead, the program seeks to empower a community residing in a less densely populated area, with a primary focus on agricultural, plantation, fisheries, and marine development.

The Transmigration program in Indonesia is a government initiative that seeks to enhance the quality of life and well-being of the population by facilitating voluntary relocation to specific areas (Horch, 1991). The transmigration program in Indonesia, which has been in operation for an extended period, has been widely regarded as an effective strategy for addressing demographic challenges and enhancing societal well-being (Legiani et al., 2018). The ideal geographical location of Indonesia, intersected by the equator, contributes to its high soil fertility and agricultural potential. This is attributed to the region's abundant rainfall and favorable climatic conditions, which facilitate the development of

various agricultural activities (Abdulkadir et al., 2012; Kasryno, 1992; Kifli et al., 2021; Manwan et al., 1992). Similarly, the fisheries and marine sector can be explored in the context of Indonesia, which holds the distinction of being the biggest archipelago globally and possesses abundant marine and aquatic natural resources (Delimayanti et al., 2022; Sari & Muslimah, 2020; Sinansari & Priono, 2019).

One of the primary limitations of this study pertains to its restricted reach, which can be attributed to the expansive geographical expanse of Indonesia. The major urban centers in Indonesia are situated across many islands, each encompassing their respective densely populated regions. Furthermore, it is worth noting that the statistics pertaining to infection rates, fatality rates, and recovery rates, which can be accessed through the official government website (covid19.go.id), exhibit subpar quality. This is mostly due to the inconsistent and delayed data input and updates provided by local governments. Therefore, the primary objective of this research is to provide a foundation for future investigations about the association between population density levels and the transmission of COVID-19 in intricate archipelagic nations like Indonesia. This can be achieved by employing more extensive methodologies and including more thorough datasets.

This paper proposes that the Indonesian government should give careful consideration to and revitalize the transmigration program as a potential solution for addressing the issue of population density, based on the evidence presented in the relevant literature review. The existing program, which has mostly concentrated on relocating individuals from Java Island, the most densely populated island in Indonesia, to enhance their involvement in agricultural sectors outside of Java Island, should be revised to incorporate additional opportunities in the fisheries and marine sectors. In order to ensure the success of this program, it is imperative to make modifications that take into account population shifts within or between islands, as well as socio-cultural considerations, religious beliefs, and traditional practices. Hence, it is unlikely that the future will witness a recurrence of the disorderly circumstances prevalent in metropolitan populations heavily reliant on the manufacturing and financial sectors of the economy, as a consequence of the COVID-19 crisis.

Conclusion

The present study reveals a statistically significant positive association ($r = 0.954$) between the number of COVID-19 cases and population density in Indonesia, as determined using Pearson's correlation analysis. The Model Summary presents the R (Correlation Coefficient) value of 0.959, indicating a strong relationship between the variables. Additionally, the multiple correlation coefficient r (Multiple R) is 0.920, which represents the determinant index or the proportion of the influence of X on Y. Therefore, it can be asserted that 92% of COVID-19 cases exhibit a correlation with population density and the prevalence of layoffs, whereas the remaining 8% are attributable to additional factors. The Coefficients table provides the necessary information to construct a regression equation, which can be expressed as follows: $Y = 5327.46 + 84.174X_1 - 0.170X_2$. The standard error of estimation (SE) is calculated to be 8151.076 or simply 8151. The standardized coefficient (Beta) value of 1.381 signifies the extent of association between the quantity of COVID-19 instances and population density. The correlation coefficient of -0.439 indicates the degree of association between the incidence of COVID-19 cases and the occurrence of layoffs.

This study additionally identified the advantages of the transmigration program in Indonesia as a means to address the issue of population density within the country.

Furthermore, aside from facilitating the migration of individuals from densely populated regions to sparsely inhabited ones, this initiative has also demonstrated its efficacy in enhancing the well-being of program participants. The augmentation in income and welfare of program beneficiaries is derived from the provisions and empowerment initiatives facilitated by the government, encompassing entitlements to property ownership, housing, land, as well as help in the form of seeds, fertilizers, training, counseling, and various other forms of aid. In order to proactively address and mitigate the repercussions of future crises, such as the COVID-19 pandemic, the implementation of transmigration programs can serve as a viable alternative solution.

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