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The National Health Insurance and Infant Mortality: A Study from Indonesia

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Abstract
This study examines the relationship between Indonesia's National Health Insurance program (Jaminan Kesehatan Nasional/JKN) and infant mortality. Using data from the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia/SKI), the analysis applies Propensity Score Matching (PSM) to address potential selection bias. After controlling for a range of health-related, demographic, and socioeconomic variables, the results show that participation in the National Health Insurance program is positively and significantly associated with higher perinatal survival, indicating lower infant mortality. However, the heterogeneity analysis highlights important distributional differences. A positive, statistically significant association is observed only among households in the low and middle-income groups, suggesting that the benefits of JKN are not evenly distributed across income levels. Moreover, when examined by geographic region, the significant association between JKN utilization and improved perinatal survival is found only in Java and Sumatra. This study provides updated national evidence on the association between JKN utilization and infant mortality using the latest survey data.
Keywords: Infant mortality, National Health Insurance, Propensity Score Matching

Abstrak
Penelitian ini mengkaji hubungan antara program Jaminan Kesehatan Nasional (JKN) di Indonesia dan angka kematian bayi. Dengan menggunakan data dari Survei Kesehatan Indonesia (SKI) tahun 2023, penelitian ini menerapkan metode Propensity Score Matching (PSM) untuk mengatasi potensi selection bias. Setelah mengontrol berbagai variabel kesehatan, demografi, dan sosial ekonomi, hasil penelitian menunjukkan bahwa partisipasi dalam program Jaminan Kesehatan Nasional berhubungan positif dan signifikan dengan meningkatnya perinatal survival, yang mengindikasikan penurunan angka kematian bayi. Namun, analisis heterogenitas menunjukkan adanya perbedaan

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distribusi. Hubungan positif yang signifikan secara statistik ditemukan pada rumah tangga dengan kelompok pendapatan rendah dan menengah, namun tidak pada pendapatan tinggi, yang menunjukkan bahwa manfaat JKN belum terdistribusi secara merata di seluruh tingkat pendapatan. Selain itu, ketika ditinjau berdasarkan wilayah geografis, hubungan signifikan antara pemanfaatan JKN dan perinatal survival hanya ditemukan di wilayah Jawa dan Sumatra. Penelitian ini memberikan bukti terbaru mengenai hubungan antara partisipasi JKN dan kematian bayi dengan menggunakan data survei terbaru.
Kata Kunci: Jaminan Kesehatan Nasional, Kematian Bayi, Propensity Score Matching

INTRODUCTION

Several studies have identified the relationship between government health insurance and infant mortality. Aiyar and Sunder (2024) found that India's large-scale national health insurance program, Rashtriya Swasthya Bima Yojana (RSBY), improved mothers' access to healthcare services and reduced infant mortality by 6% and under-five mortality by 5%. These impacts were largely concentrated among poor households in urban areas. Schoeps et al. (2015) examined the effects of community-based health insurance on under-five mortality in Nouna, Burkina Faso. Based on an analysis of 33,500 children, the risk of death was 46% lower among children enrolled in community-based health insurance compared to those not enrolled. Dow and Schmeer (2003) investigated the relationship between insurance expansion and infant mortality in Costa Rica. Costa Rica adopted a national health insurance scheme that expanded children's insurance coverage from 42 percent in 1973 to 73 percent in 1984. The study showed that higher insurance coverage was strongly associated with reductions in infant and child mortality rates at the city level.

Aquino et al. (2009) evaluated the relationship between Brazil's Family Health Program (FHP) insurance and infant mortality at the municipal level, collecting data on FHP coverage and infant mortality rates across 771 Brazilian municipalities from 1996 to 2004. The study found a statistically significant negative association between FHP coverage and infant mortality, indicating that the FHP contributed to reductions in infant mortality. The findings suggest that the FHP played an important role in lowering municipal-level infant mortality rates in Brazil between 1996 and 2004. Goodman (2017) showed that the U.S. government's Medicaid program reduced infant and child mortality during the 1960s and 1970s. Before Medicaid, U.S. states exhibited similar trends in infant and child mortality. After the program's introduction, health insurance utilization increased, and infant and child mortality declined significantly in high-Medicaid-eligibility states. Among non-Caucasian infants enrolled in Medicaid, mortality decreased by 20 percent.

In the context of Indonesia, over the past several years, it has made progress in reducing infant mortality rate. According to the 2017 Indonesia Demographic and Health Survey (SDKI), the infant mortality rate declined from 32 deaths per 1,000 live births in 2012 to 24 deaths per 1,000 live births in 2017 (Statistics Indonesia, 2018), and further to 18 deaths per 1,000 live births in 2023 (Ministry of Health, 2024). Nevertheless, Indonesia still ranks as the country with the third-highest infant mortality in the Southeast Asian

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region. (Ministry of Health, 2024). Various socio-economic factors influence infant mortality in Indonesia. Maternal education plays an important role; mothers with higher levels of education tend to adopt health-supportive behaviors, which are associated with better infant health outcomes. In addition, household income affects access to nutritious food, clean water, and quality health services, all of which are crucial factors for infant survival (Titaley et al., 2010).

In the meantime, the National Health Insurance (JKN) is a large-scale national health reform program aimed at achieving Universal Health Coverage (UHC) in Indonesia. Officially launched on January 2014, the JKN is administered by the Social Security Agency for Health (BPJS Kesehatan), a public legal entity established under Law Number 24 of 2011 on Social Security Agency. The program is designed to ensure access to quality and affordable health services for all Indonesian residents (Ministry of Health, 2020). Regarding maternal and infant health, the JKN plays an important role in financing antenatal care, delivery, postnatal services, and neonatal care. Before the JKN, many pregnant women were reluctant to access health services due to financial barriers (Suryahadi et al., 2021). With the financial protection provided by the JKN, these barriers can be significantly reduced. Research shows that broader JKN coverage is positively correlated with increased utilization of antenatal care services, childbirth in health facilities, and reduced maternal and neonatal complications (Suryahadi et al., 2021).

Rahayu et al. (2020) indicate that the JKN has contributed to an increase in deliveries at health facilities, which is expected to lower infant mortality rates. On the other hand, factors such as health infrastructure, service capacity, as well as education and public awareness also play a significant role in determining the success of the JKN in reducing infant mortality (Wiseman et al., 2018). The success of a government health insurance program depends not only on coverage but also on the quality and equitable access to healthcare services (Marten et al., 2014). This indicates that the relationship between national health insurance programs and health indicators, including infant mortality, is highly dependent on country-specific conditions, including structural and socio-economic factors. The effectiveness of a government health insurance program in reducing infant mortality also depends on service quality, the readiness of the health system, and equity in the distribution of services across regions (Kruk et al., 2018; Boerma et al., 2014). Thus, disparities in the availability of facilities and healthcare personnel across regions become one of the key variables that may influence the relationship between the JKN and infant mortality.

Although several studies have evaluated the impact of social protection on health on infant mortality, there remains a significant gap in the literature that specifically focuses on analyzing the relationship between the JKN and infant mortality in Indonesia. Most previous studies have emphasized the link between JKN utilization and health service utilization, such as the increase in facility-based deliveries or antenatal visits (Erlangga et al., 2019; Rahayu et al., 2020). However, the direct and quantitative relationship between participation in JKN and reductions in infant mortality has not yet been examined. In addition, some existing studies use macro or aggregate data at the district or municipal level, which do not fully capture variations at the household or individual level. Individual-level data allow for more targeted analysis in identifying vulnerable groups and more specific determinants (Wagstaff & Neelsen, 2020). The limited

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exploration of variables such as antenatal care utilization, socio-economic factors, and regional disparities as covariates in the relationship between JKN and infant mortality highlights the need for further research.

Taking these factors into account, this study seeks to fill the research gap by conducting a quantitative, microdata-based, individual-level analysis using the most recent data on the relationship between the National Health Insurance and infant mortality in Indonesia. This study will also consider health-related variables, socio-economic conditions, and regional disparities as factors that may strengthen or weaken the relationship between JKN and infant mortality. It is expected that this study will provide empirical contributions to the evaluation of the JKN program and enrich academic discourse on health policy in Indonesia.

METHODOLOGY

The analysis in this study estimates the relationship between the National Health Insurance and infant mortality in Indonesia using Propensity Score Matching. Propensity Score Matching (PSM) is a quasi-experimental method used to reduce selection bias in observational studies. Its purpose is to create equivalence between the treatment group and the control group based on the probability of receiving the treatment, known as the propensity score, with the following formula:

$$e(X) = P(T = 1 \mid X) \quad (1)$$

$e(X)$ is the propensity score, P is the probability of any individual receiving treatment based on the characteristic, T = 1 is any individual receiving the treatment, while X is the vector of characteristics or covariate variables. Meanwhile, the Average Treatment Effect on the Treated (ATT) is estimated using the following formula:

$$ATT = \frac{1}{NT} \sum_{i \in T=1} \left(Yi - \sum_{j \in C\,(i)} WijYj\right) \quad (2)$$

NT means number of treated units, Yi means observed outcome of treated unit i, $c(i)$ means set of matched control(s) for treated unit i, Wij means weights assigned to control units (e.g., 1 if nearest neighbor, or proportional if multiple matches). In the meantime, the Propensity Score Matching formula for this study is as follows:

$$ln\left(\frac{P(T_i = 1|X_i)}{1-P(T_i = 1|X_i)}\right) = \alpha + \beta_1 AntenatalCare_i + \beta_2 KIABook_i + \beta_3 IronTablet_i + \beta_4 Complication_i + \beta_5 OwnHouse_i + \beta_6 HouseSize_i + \beta_7 Education_i \quad (3)$$

$P(T_i = 1|X_i)$ is the probability that mother i utilizes JKN for delivery (the propensity score), $ln\left(\frac{P(T_i = 1|X_i)}{1-P(T_i = 1|X_I)}\right)$ is the natural logarithm of the odds (logit) of JKN utilization, α is the intercept value, $AntenatalCare$ is antenatal care by health professionals, $KIABook$ is ownership of the Maternal and Child Health Book, $IronTablet$ is consumption of iron folic acid tablets during pregnancy, $Complication$ is pregnancy complications, $OwnHouse$ is home ownership status, $HouseSize$ is dwelling size in square meters (continuous variable), $Education$ is mother's education level.

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Propensity Score Matching was introduced by Rosenbaum and Rubin (1983) as a method for estimating the effect of an intervention (treatment effect) by balancing the distributions of covariates between the treatment and control groups. The Average Treatment Effect on the Treated (ATT) is more commonly used in PSM because it reflects the impact of the treatment on the group actually exposed to it (Caliendo & Kopeinig, 2008). The PSM has been widely applied to evaluate government insurance programs, maternal interventions, and community-based health services. Johar et al. (2018), for example, used PSM to assess the relationship between health insurance ownership and the utilization of delivery services. In Indonesia, this method is highly relevant for analyzing the effectiveness of JKN, given the non-random nature of participation and the presence of various covariates such as health conditions, socioeconomic status, and education.

This study employs data from the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia/SKI), namely a survey conducted by the Ministry of Health in collaboration with Statistics Indonesia (Badan Pusat Statistik/BPS). The 2023 SKI serves as the main data source because it is the most recent government health survey, providing comprehensive information on the health sector at the household and individual levels. Hence, the unit of observation for this study is at the individual level, specifically mothers who have given birth or experienced miscarriage between 2018 and 2023 when the SKI 2023 interviews were conducted. The study uses cross-sectional data, as no recent panel data on health, particularly infant mortality at the individual level, are available after the implementation of the National Health Insurance program in 2014. This study uses Stata to estimate the aforementioned models.

Several studies find that infant mortality is influenced by various medical, socioeconomic, environmental, and healthcare access factors (Lawn et al., 2005). One of the main determinants is antenatal care (ANC), as adequate ANC visits allow early detection of complications and timely medical interventions (Titaley et al., 2010). Failure to attend ANC increases the risk of preterm birth, low birth weight, and infant death (Wang et al., 2017). In addition, pregnancy complications such as preeclampsia, antepartum hemorrhage, infections, and placental disorders can disrupt oxygen and nutrient supply to the fetus, thereby increasing the risk of infant mortality (Say et al., 2014). Iron deficiency during pregnancy also plays a significant role by increasing the likelihood of preterm birth and low birth weight (Rahman et al., 2016).

Other important determinants include ownership and utilization of the maternal and child health (MCH) handbook, known in Indonesia as buku Kesehatan Ibu dan Anak (KIA book), which serves as both a medical record and an educational tool for pregnant women. Globally known as a home-based record, this instrument is recognized by the World Health Organization as a strategic tool to enhance maternal engagement with healthcare services (WHO, 2018). Its use has been associated with more regular ANC visits, delivery in healthcare facilities, and higher immunization coverage (Magwood et al., 2019). Maternal education is also a key factor, as better-educated mothers tend to have greater knowledge of safe infant care practices and stronger decision-making capacity in seeking medical care (Mosley & Chen, 1984). Furthermore, household socioeconomic and environmental conditions, such as housing, contribute to infection risks that can ultimately increase infant mortality (Fink et al., 2011). The detailed list of

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variables used in this study is presented in Table 1.

All categorical variables in this study are operationalized as binary dummy variables, coded as 1 if the condition is met and 0 otherwise. The only continuous variable is dwelling size (square meters), which is used in its original scale.

Table 1.
List of variables

Variables	Description
perinatal survival	Infant status at birth (1 = live birth, 0 = stillbirth or fetal death)
jkn utilization	Utilization of JKN for birth (1 = delivery funded by JKN, 0 = other sources)
antenatal care	Antenatal care by health professionals (1 = yes, 0 = no)
kia book	Ownership of the Maternal and Child Health Book (KIA) (1 = yes, 0 = no)
iron tablet	Consumption of iron–folic acid tablets during pregnancy (1 = yes, 0 = no)
complication	Prevalence of pregnancy complications (1 = yes, 0 = no)
own house	Home ownership status (1 = own, 0 = other)
house size	Dwelling size (square meters)
educ	Mother's education level (1 = completed higher education, 0 = completed senior high school or below, or never attended school)

Source: The 2023 Indonesian Health Survey (SKI)

DISCUSSION AND FINDINGS

Using 65,953 observations, the descriptive analysis of the variables included in the research model is presented in Table 2. Based on the descriptive analysis, the average perinatal survival rate in Indonesia was 0.991, with a standard deviation of 0.097. This means that around 99.1 percent of infants in the dataset survived pregnancy and birth. Regarding participation in the JKN program, the average participation rate reached 0.745, equivalent to 74.5 percent of pregnant women in the sample. This indicates that the JKN has reached the majority of the pregnant population. Nevertheless, around 25.5 percent of mothers did not use JKN to access healthcare services, indicating gaps in program access.

Table 2.
Descriptive Statistics

Variable	Obs	Percentage	Min	Max
perinatal survival	65,953	99%	0	1
jkn utilization	65,953	75%	0	1
antenatal care	65,953	95%	0	1
kia book	65,953	91%	0	1
iron tablet	65,953	91%	0	1

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complication	65,953	16%	0	1
own house	65,953	82%	0	1
house size	65,953	81 (mean)	20	500
educ	65,953	19%	0	1

Source: The 2023 Indonesian Health Survey (SKI)

Healthcare services during pregnancy also show relatively high coverage. On average, 95.5 percent of mothers received antenatal care, suggesting that most respondents accessed health monitoring during pregnancy. However, 4.5 percent of mothers did not receive antenatal care. In addition, 90.9 percent of mothers had the Maternal and Child Health (Kesehatan Ibu dan Anak/KIA) book, which serves as an educational tool and as documentation for health services. A total of 91 percent of mothers also received iron folic acid tablets, which are essential to prevent anemia during pregnancy and childbirth. Regarding complications, about 84.1 percent of pregnant women did not experience complications, while 15.9 percent did. This is a substantial share and needs serious attention, as complications can contribute to higher risks of infant mortality and unsuccessful medical interventions if not managed properly (Say et al., 2014).

The housing variable shows that 82 percent of mothers lived in their own houses. The average house size was 81 square meters, with a standard deviation of 55.374. There was a wide disparity in housing size, ranging from 20 to 500 square meters, indicating inequality in housing quality, which may correlate with healthcare access and environmental conditions supporting maternal and child health. The final important variable is maternal education, which showed that only 19.6 percent of mothers had higher education, while the majority (around 80.4 percent) had senior high school education or lower. Overall, the descriptive analysis suggests that JKN participation and maternal healthcare coverage in Indonesia are relatively high. However, some groups of mothers remain without JKN protection, and socioeconomic disparities persist in terms of housing ownership, housing size, and education level.

Relations Between the JKN and Perinatal Survival Using Propensity Score Matching

To estimate the relationship between the JKN and perinatal survival, the analysis used the Propensity Score Matching (PSM) method to balance the distribution of covariates between the treatment group (JKN users) and the control group (non-JKN users). This approach ensures that the observed outcomes are more likely to result from the treatment rather than from differences in individual characteristics. In this estimation, the applied PSM method was nearest-neighbor matching with a single closest match (1-to-1 matching). The control variables used in the matching process were those previously described, namely antenatal care, possession of the KIA book, consumption of iron supplementation tablets (TTD), complications during pregnancy, and socioeconomic indicators such as home ownership, house size and mother's education level.

Table 3.
Estimation Results of the Relationship between the JKN and Perinatal Survival Using Propensity Score Matching

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Variable	Number of Obs	Diff.	Std error	t-stat	Sig
Perinatal Survival	65,953	0.0040	0.0010	4.00	***

Source: The Authors' Calculation

Notes: Significance level *** p < 0.01, ** p < 0.05, * p < 0.1

As presented in Table 3, based on the results of the Propensity Score Matching analysis of the JKN utlilization and perinatal survival, a positive and significant association was found between JKN utilization and the probability of perinatal survival. The results were statistically significant at the 1% level ($p < 0.01$), with a calculated t-statistic of 4.00. The statistical results indicate that individuals who participated in the JKN had approximately 0.4% higher perinatal survival compared to individuals with similar characteristics who did not use JKN. This association was derived from propensity score calculations that accounted for various variables, including antenatal care, possession of the KIA book, consumption of iron supplementation tablets (TTD), pregnancy complications, and socioeconomic factors such as home ownership and mother's education level. These findings indicate that participation in JKN is statistically positively associated with perinatal survival. Although the magnitude of the effect appears relatively small in absolute terms, in the context of public health, even a modest increase in the probability of perinatal survival has important implications for reducing infant mortality. At a large population scale such as Indonesia, even small improvements in survival can translate into a substantial number of infant lives saved.

According to data from the Ministry of Health (2024), there were 4,073,295 births and 74,745 infant deaths in Indonesia in 2023. If participation in the JKN program increases infant survival by 0.4% as estimated, with the current infant mortality rate at around 18.35 per 1,000 births, the JKN utilization has the potential to reduce the rate to approximately 14.35 per 1,000 births (a decline of 4 infant deaths per 1,000 births), assuming the effect applies uniformly across the population. This could save approximately 16,293 infants each year.

Robustness Check of the Estimated Relationship Between the JKN and Perinatal Survival Using Kernel Matching

As a continuation of the estimation analysis of the relationship between the JKN and perinatal survival, a robustness check was conducted using Kernel Matching method. Slightly different from the PSM, Kernel Matching uses all units in the control group, with weighting (bandwidth) based on the proximity of their propensity scores. The objective remains the same, namely to balance the distribution of covariates between the treatment group (JKN users) and the control group (non-JKN users), so that differences in the observed outcomes can be interpreted as the effect of JKN utilization rather than differences in individual characteristics. In this estimation, the control variables used for the matching process include factors previously described, such as the use of healthcare services during pregnancy (antenatal care visits), ownership of the KIA book, consumption of iron supplement tablets (TTD), and pregnancy complications. In addition, socioeconomic indicators were also included, such as home ownership, house size, and maternal education level.

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Table 4.
Robustness Check Results of the Estimated Relationship Between the the JKN and Perinatal Survival Using Kernel Matching

Variable	Number of Obs	Treated (Used)	Controls (Used)	Diff.	Std error	t-stat	Sig
Perinatal survival	65,953	48,902	16,802	0.0039	0.0009	4.33	***

Source: The Authors' Calculation
Notes: Significance level *** p < 0.01, ** p < 0.05, * p < 0.1

Based on Kernel Matching estimation, the JKN remains positively and significantly associated with perinatal survival, as presented in Table 4. This estimation was carried out as part of a robustness check to test the consistency of the main findings using a matching approach distinct from the nearest-neighbor PSM. The total number of observations in this analysis was 65,953, comprising 49,107 individuals in the treatment group (JKN participants) and 16,846 in the control group (non-participants). From the control group, 16,802 observations were successfully matched, while 44 were not used because they fell outside the bandwidth. From the treatment group, 48,902 were successfully matched with control units, while 205 were excluded for the same reason.

The estimation of the Average Treatment Effect on the Treated (ATT) produced a coefficient of 0.0039, or about 0.39 percent. The result was statistically significant at the 1% level ($p < 0.01$), with a calculated t-statistic of 4.33. These findings confirm a significant positive effect of JKN participation on perinatal survival. This result reinforces the main findings from the PSM method and indicates that the relationship between JKN and improved perinatal survival is stable and does not depend on the estimation technique used.

Heterogeneity In the Relationship Between the JKN and Perinatal Survival

The study further examines the heterogeneity in the relationship between JKN and perinatal survival across two dimensions: socioeconomic status and region of residence. Although the main estimation results indicate a positive and significant effect of JKN on perinatal survival, this relationship may vary across social groups. The heterogeneity analysis is conducted to determine whether differences exist across socioeconomic strata and across regions in the relationship between JKN and perinatal survival. By considering both socioeconomic status and geographic region, this study aims to provide a more comprehensive understanding of potential disparities in the implementation of the JKN program.

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The first heterogeneity analysis examines the relationship between the National Health Insurance Program (JKN) and perinatal survival across household socioeconomic status. Given the limitations of expenditure or income data in the 2023 Indonesian Health Survey (SKI), household socioeconomic status is determined using asset ownership as a proxy. This approach is consistent with the determination of socioeconomic status in SKI 2023, which also relies on asset ownership (Ministry of Health, 2024). However, it differs from the expenditure-based measurement used in the National Socio-Economic Survey (Susenas).

Socioeconomic status is inherently multidimensional. In research, direct measurement of income or expenditure is often difficult due to reporting bias or constraints in data collection. To address this, asset ownership can be used as a proxy for socioeconomic status, with durable assets such as washing machines, cars, motorcycles, refrigerators, or televisions serving as indicators of household wealth (Howe et al., 2012; Ministry of Health, 2024). To combine these variables into a representative index, a reliable statistical method is required. One commonly used method is Principal Component Analysis (Filmer & Pritchett, 2001). The PCA transforms a set of correlated variables into a single index that explains the data's variation (Filmer & Pritchett, 2001). The first principal component, which captures the greatest variation, is interpreted as the wealth index (Vyas & Kumaranayake, 2006). This approach allows researchers to assign weights to each asset objectively based on the data's statistical structure.

The PCA is widely applied in large-scale national and international surveys and has become a standard tool for cross-study comparison. Institutions such as UNICEF routinely use PCA to construct household wealth indices based on asset ownership and housing characteristics (Rutstein, 2008). In Indonesia, the 2023 Indonesian Health Survey also applied PCA to determine socioeconomic status (Ministry of Health, 2024). Using PCA, this study divides socioeconomic status into five quintiles. This division is consistent with the quintile classification adopted in SKI 2023 (Ministry of Health, 2024).

Table 5.
Estimation Results of the Relationship Between the JKN and Perinatal Survival by Socio-Economic Status

Quantiles	Variable	Number of Obs	Diff.	Std Error	t-stat	Sig
1. Lower	Perinatal survival	13,774	0.0049	0.0028	1.75	**
2. Lower-Middle	Perinatal survival	13,921	0.0046	0.0023	2.00	**
3. Middle	Perinatal survival	12,294	0.0059	0.0030	1.97	**
4. Upper Middle	Perinatal survival	13,174	0.0028	0.0026	1.08	

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5. Upper	Perinatal survival	13,190	0.0015	0.0020	0.75

Source: The Authors' Calculation
Notes: Significance level *** p < 0.01, ** p < 0.05, * p < 0.1

The analysis results in Table 5 indicate a clear disparity in the relationship between JKN and perinatal survival based on socioeconomic status. Among lower-income groups, specifically the bottom, lower-middle, and middle quintiles, participation in the JKN program is positively and significantly correlated with higher probabilities of perinatal survival. The results were statistically significant at the 5% level ($p < 0.05$). This finding highlights the important role of JKN in improving health oucome, namely lower infant mortality, among poor and vulnerable households. In contrast, for upper-middle and top-income quintiles, the relationship between JKN and infant mortality is not statistically significant.

There are several possible explanations for this variation in outcomes across income groups. First, households with middle and high income levels already have adequate access to healthcare services, which contributes to better health outcomes, including maternal and infant health (Aryastami & Mubasyiroh, 2023). Second, higher-income households tend to rely on private insurance, or out-of-pocket payments to access quality healthcare, including antenatal and delivery care. Their financial capacity enables them to obtain the best available services in terms of facilities, medical personnel, and comfort, without depending on government health insurance (Nababan et al., 2017). As a result, participation in JKN does not provide substantial additional benefits for perinatal survival in this group, since the type and quality of services they receive are already optimal from the outset.

The heterogeneity analysis also aims to evaluate whether disparities exist across regions in the relationship between the JKN and infant mortality. For this study, regions were divided into two categories: Java–Sumatra and non–Java–Sumatra. This categorization was based on differences in health infrastructure, population density, and the distribution of medical service facilities between the two regional groups.

In the Java and Sumatra regions, the estimation results indicate that the JKN program is positively and significantly associated with perinatal survival, as presented in Table 6. The estimation, conducted using Propensity Score Matching with the nearest-neighbor method and covering 37,775 observations, shows that the Average Treatment Effect on the Treated is 0.0039 with a standard error of 0.0013. This result demonstrates that participation in JKN increases the probability of perinatal survival by 0.39 percent in this region, and the effect is statistically significant.

Table 6.
Estimation Results of the Relationship Between the JKN and Perinatal Survival by Region

Regions	Variable	Number of Obs	Diff.	Std error	t-stat	Sig

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Java and Sumatera	Perinatal survival	37,775	0.0039	0.0013	3.00	***
Outside Java and Sumatera	Perinatal survival	28,178	-0.0003	0.0028	-0.11	

Source: The Authors' Calculation

Notes: Significance level *** p < 0.01, ** p < 0.05, * p < 0.1

In the meantime, in regions outside Java and Sumatra, the estimation results indicate that the JKN is not significantly associated with perinatal survival. The estimation was conducted using Propensity Score Matching with nearest neighbor on 28,178 observational units. The coefficient value of the Average Treatment Effect on the Treated is -0.0003 with a standard error of 0.0028. These results indicate that there is no significant difference between JKN participants and non-participants in terms of the likelihood of perinatal survival in these regions.

The non-Java and non-Sumatra regions, which include large islands such as Kalimantan, Sulawesi, Nusa Tenggara, Maluku, and Papua, generally face structural challenges in both access to and quality of health services. The Indonesia Health Profile 2021 (Ministry of Health, 2022) shows that the distribution of health facilities and medical personnel in these regions is much lower than in Java and Sumatra. Long geographic distances, limited transportation, and challenging topography make maternal and neonatal health services difficult to access. In this context, although JKN provides financial protection, the program's success still largely depends on the physical availability of health services that participants can actually reach.

The distribution of health facilities also highlights the dominance of Java and Sumatra regions. Data from the Ministry of Health (2024) indicate that of the 3,152 hospitals nationwide, more than 66 percent are located in Java and Sumatra. In contrast, Maluku and Papua together account for only 5 percent of the total number of hospitals. Furthermore, advanced facilities such as type A hospitals and major regional referral centers are concentrated in large cities in Java. As a result, patients from outside Java and Sumatra often need to be referred to other provinces or even across islands to access specialist care, further exacerbating disparities in access to health services. The availability of medical equipment is also uneven. Data from the Ministry of Health (2024) show that most advanced equipment, such as CT scans, MRIs, and modern ventilators, is concentrated in hospitals in Java and major cities in Sumatra. In contrast, many hospitals in the eastern regions lack digital radiology, molecular laboratories, or standard ICUs. In several districts in Papua and East Nusa Tenggara, community health centers still face shortages of basic sterilization tools and operational ambulances.

The results support the argument that the effectiveness of government insurance programs is highly dependent on health infrastructure readiness (Shah et al., 2025). In regions with adequate access and service capacity, programs like JKN can work more effectively because financial interventions are complemented by the availability of medical services. When JKN participants fully utilize health facilities, improvements in perinatal survival are more likely. From a policy perspective, this underscores the importance of synchronizing the expansion of social insurance coverage with equitable

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distribution and strengthening of health care systems across regions.

Overall, the results show that JKN is positively and significantly associated with the likelihood of perinatal survival in Indonesia. These estimates are consistent across both PSM and Kernel Matching, indicating that the association between JKN and perinatal survival is statistically positive and significant. The findings also reveal that the positive association between JKN and infant mortality outcomes is not evenly distributed across all groups. When analyzed by household socioeconomic status (using the asset ownership index as an income proxy), the significant impact is found only among low and middle-income groups, while no significant association is detected among high-income groups.

Low and middle-income households often rely on government-managed health financing for access to health services. In this context, JKN serves as the primary instrument enabling access to health care that was previously unaffordable. JKN utilization increases the likelihood of these groups accessing services, including pregnancy-related care. The program reduces financial barriers that have long been the main obstacle to accessing health services, thereby enhancing inclusion within the national health system. For higher income groups, however, the impact of JKN is not statistically significant. This can be explained by their greater tendency to use private health services outside JKN coverage and by their financial capacity to access health care without depending on government subsidies (Maulana et al., 2022). In other words, JKN does not substantially alter the health care consumption patterns of higher-income households because they already had stable access prior to the program. Many in this group prefer private facilities not covered by JKN, and even when they are formally enrolled, they often do not use JKN as their primary health care channel (Maulana et al., 2022). This explains why JKN is not significantly associated with perinatal survival in upper-middle and high-income groups.

The heterogeneity analysis across regions shows that JKN has a positive and significant association with perinatal survival in Java and Sumatra, but not in other regions. This reflects structural disparities within Indonesia's health care system. Java and Sumatra have more advanced health infrastructure, including health professionals, medical facilities, and logistics systems. With financing provided by JKN, people in these regions are better able to utilize services because they are readily available. In contrast, regions outside Java and Sumatra, such as Kalimantan, Sulawesi, Nusa Tenggara, Maluku, and Papua, face significant challenges with health infrastructure (Ministry of Health, 2024). In these areas, financial protection through JKN alone is insufficient to guarantee access to services for pregnant women and infants, as facilities remain limited or absent. The shortage of facilities, long distances, difficult geography, and limited transportation reduce access to health services. Many remote health centers lack permanent doctors, face shortages of medical equipment and medicines, and struggle to meet demand (Ministry of Health, 2024). These constraints contribute to low utilization of formal health care and delayed medical response.

This creates significant disparities in JKN effectiveness across regions. In Java and

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Sumatra, the program performs relatively well because it is supported by adequate infrastructure. Outside these islands, limitations in health infrastructure remain the primary obstacle to equitable access and service quality. Strengthening health infrastructure in regions beyond Java and Sumatra is therefore essential to ensuring that the JKN benefits the entire Indonesian population.

CONCLUSION

This study was conducted to analyze the relationship between the JKN and infant mortality in Indonesia. It applies a quantitative approach using Propensity Score Matching and Kernel Matching, as well as heterogeneity analysis based on socioeconomic status and region. The main findings are as follows. First, the results show a positive, significant relationship between JKN participation and perinatal survival in Indonesia. Second, there is a disparity in the relationship between JKN and perinatal survival across socioeconomic groups. JKN shows a positive and significant relationship with perinatal survival among individuals in households in the first, second, and third quintiles, while no significant relationship is detected in the fourth and fifth quintiles (upper middle and high income). Third, the relationship between JKN and perinatal survival also varies across regions. In Java and Sumatra, where health service infrastructure is more complete and accessible, JKN is positively and significantly associated with perinatal survival. In contrast, in regions outside Java and Sumatra, the relationship is not significant. This suggests that JKN's success likely depends not only on financing but also on the readiness and availability of a supportive health care system.

Based on these findings, several recommendations are directed to relevant stakeholders. First, Given the positive and significant relationship between JKN and perinatal survival, BPJS Kesehatan should continue expanding coverage and ensuring the sustainability of JKN participation, particularly for pregnant mothers and infants. Second, to reduce socioeconomic disparities in the benefits of JKN for perinatal survival, BPJS Kesehatan should ensure that all socioeconomic groups receive equal benefits, including by expanding participation, simplifying service procedures, and collaborating with private insurance providers. Third, regarding regional disparities, the Ministry of Health should strengthen the capacity and accessibility of health services in regions outside Java and Sumatra to reduce infant mortality. The findings suggest that in these regions, JKN utilization is not significantly associated with perinatal survival, likely indicating limited capacity and accessibility of health services. Strengthening health infrastructure is essential to ensure the benefits of the National Health Insurance Program are distributed more evenly across Indonesia.

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