Social Determinants of Health and Their Influence on Preterm Birth in Rural Indonesian Communities

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A B S T R A C T

Introduction: Preterm birth (PTB), defined as birth before 37 completed weeks of gestation, is a major contributor to neonatal mortality and morbidity globally, with a disproportionate burden in low-resource settings like rural Indonesia. This study aimed to investigate the influence of social determinants of health (SDOH) on PTB in rural Indonesian communities. **Methods:** A retrospective cohort study was conducted using data from the Indonesian Maternal and Perinatal Health Survey (IMPHS) 2018-2021. A total of 15,480 women residing in rural areas with singleton pregnancies were included. SDOH variables examined included maternal education, socioeconomic status (SES), access to healthcare, and geographical remoteness. Multivariable logistic regression analysis was performed to assess the association between SDOH and PTB, adjusting for potential confounders. **Results:** The prevalence of PTB in the study population was 12.3%. Lower maternal education, lower SES, limited access to healthcare, and residing in remote areas were significantly associated with increased odds of PTB. Women with no formal education had 2.1 times higher odds of PTB compared to those with higher education (adjusted odds ratio [aOR] 2.1, 95% CI 1.8-2.5). Similarly, women in the lowest SES quintile had 1.8 times higher odds of PTB compared to the highest quintile (aOR 1.8, 95% CI 1.5-2.2). **Conclusion:** SDOH significantly influence PTB in rural Indonesian communities. Addressing these social inequities through targeted interventions, such as improving access to education, healthcare, and economic opportunities, is crucial for reducing the burden of PTB and improving maternal and child health outcomes.

1. Introduction

Preterm birth (PTB), defined as birth before 37 completed weeks of gestation, is a critical global health concern and a leading cause of neonatal mortality and morbidity worldwide. PTB is responsible for an estimated one million neonatal deaths annually, and infants born preterm face a significantly increased risk of a range of severe health complications. These complications include respiratory distress syndrome, intraventricular hemorrhage, necrotizing enterocolitis, and long-term neurodevelopmental disabilities, which can have a lasting impact on the health and well-being of these children. While PTB is a global issue, its burden is not evenly distributed. Low- and middle-income countries (LMICs) bear a disproportionate share of the problem, accounting for more than 80%

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of all preterm births worldwide. Within these countries, the risk of PTB is further exacerbated in rural communities, which often face significant challenges in accessing essential healthcare services and resources. Indonesia, a vast and diverse archipelago located in Southeast Asia, is a prime example of a country grappling with a high burden of PTB. With a population of over 270 million people, Indonesia has one of the highest rates of PTB in the region, exceeding the global average. The prevalence of PTB in Indonesia is estimated to be around 10-12%, and it is a major contributor to the country's high neonatal mortality rate.[1-3]

Several factors have been identified as contributing to the high rate of PTB in Indonesia. These include maternal infections, multiple pregnancies, and chronic medical conditions such as hypertension and diabetes. However, in recent years, there has been growing recognition of the crucial role that social determinants of health (SDOH) play in influencing the risk of PTB. SDOH encompass the social, economic, and environmental conditions in which people are born, grow, live, work, and age. These factors can have a profound impact on health outcomes, including maternal and child health. Several SDOH have been consistently linked to an increased risk of PTB, including lower maternal education, lower socioeconomic status (SES), limited access to healthcare, and geographical remoteness. Maternal education is a key determinant of health, as it influences health knowledge, health behaviors, and access to resources. Studies have consistently shown an inverse relationship between maternal education and PTB, with lower education levels associated with an increased risk of preterm birth. This association may be attributed to several factors, including limited awareness of pregnancy complications, inadequate prenatal care utilization, and poor nutrition. Women with lower education levels may have less knowledge about the importance of prenatal care and may be less likely to seek early and regular antenatal care. They may also be less aware of potential pregnancy complications and warning signs, leading to delays in seeking medical attention. Additionally, lower education levels may be associated with lower health literacy, making it more difficult for women to understand and follow medical advice. Socioeconomic status (SES) is another important SDOH that can significantly affect the risk of PTB. Low SES is often associated with poverty, food insecurity, and inadequate housing, which can increase stress and exposure to environmental hazards, all of which can contribute to PTB. Women living in poverty may face multiple challenges that can negatively impact their health and pregnancy outcomes. These challenges include limited access to nutritious food, clean water, and sanitation, as well as increased exposure to environmental toxins and infectious diseases. Additionally, poverty can lead to chronic stress, which has been linked to an increased risk of PTB. Access to healthcare, including prenatal care, is essential for the early detection and management of pregnancy complications that can lead to PTB. Limited access to healthcare, due to geographical remoteness, financial constraints, or cultural barriers, can hinder timely interventions and increase the risk of PTB. Prenatal care provides an opportunity for healthcare providers to monitor the health of the mother and the developing fetus, identify potential problems, and provide necessary interventions. Regular antenatal check-ups allow for the early detection and management of conditions such as pre-eclampsia, gestational diabetes, and infections, which can all increase the risk of PTB. Geographical location, particularly residing in rural areas, can also influence the risk of PTB. Rural communities often face challenges such as limited access to healthcare facilities, transportation difficulties, and a shortage of skilled healthcare providers. These factors can delay or prevent access to essential maternal care services, increasing the likelihood of PTB. In rural areas, healthcare facilities may be located far from where people live, making it difficult for pregnant women to access regular antenatal care. Transportation may be limited or unreliable, and the cost of travel can be a barrier for many women. Additionally, there may be a shortage of healthcare providers, particularly those with specialized training in maternal and child health.[4-7]

Understanding the influence of SDOH on PTB in specific contexts is crucial for developing targeted

interventions to address this public health issue. This study focuses specifically on rural Indonesian communities, where access to healthcare and other resources may be particularly limited. Indonesia's vast and diverse geography presents unique challenges in ensuring equitable access to healthcare services. The country is comprised of thousands of islands, many of which are remote and difficult to reach. Rural communities in these areas often face significant barriers in accessing healthcare, including limited infrastructure, transportation difficulties, and a shortage of healthcare providers.[8-10] This study aims to investigate the association between SDOH and PTB in rural Indonesian communities, where the burden of PTB is high and the challenges in accessing healthcare are significant.

2. Methods

This study employed a retrospective cohort design using data from the Indonesian Maternal and Perinatal Health Survey (IMPHS) conducted from 2018 to 2021. The IMPHS is a nationally representative survey that collects comprehensive data on maternal and child health, including information on pregnancy outcomes, maternal characteristics, and social determinants of health (SDOH). The survey employed a multi-stage stratified sampling design to ensure representation of various geographical regions and socioeconomic groups across Indonesia. Data were collected through face-to-face interviews with women who had given birth in the five years preceding the survey.

The study population included women aged 15-49 years residing in rural areas of Indonesia who had a singleton pregnancy during the survey period. Women with multiple pregnancies, missing data on gestational age at birth, and those with major medical conditions (e.g., pre-existing diabetes, hypertension) were excluded from the analysis. These exclusion criteria were applied to minimize the potential confounding effects of these factors on the relationship between SDOH and preterm birth (PTB). A total of 15,480 women met the inclusion criteria and were included in the final study sample.

Data were extracted from the IMPHS database, which included information on maternal demographics, socioeconomic characteristics, access to healthcare, and pregnancy outcomes. The data were collected by trained interviewers using standardized questionnaires and protocols.

The primary outcome variable was PTB, defined as birth before 37 completed weeks of gestation. Gestational age was determined based on the first day of the last menstrual period (LMP) and confirmed by ultrasound when available. Using LMP to determine gestational age is a standard practice in maternal health research, and ultrasound confirmation enhances the accuracy of the measurement.

The main exposure variables were SDOH, including; Maternal education: Categorized as no formal education, primary education, secondary education, and higher education. Maternal education is a key indicator of socioeconomic status and health literacy, both of which can influence health behaviors and access to resources; Socioeconomic status (SES): Assessed using an asset-based wealth index derived from household ownership of durable goods, housing characteristics, and access to basic amenities. The wealth index was divided into quintiles, with the lowest quintile representing the poorest and the highest quintile representing the wealthiest. This approach to measuring SES is commonly used in health surveys, particularly in settings where income data may be unreliable; Access to healthcare: Measured by the number of antenatal care (ANC) visits during pregnancy. Women were categorized as having adequate ANC (4 or more visits) or inadequate ANC (less than 4 visits) based on the World Health Organization (WHO) recommendations. Adequate ANC is essential for monitoring maternal and fetal health, identifying potential complications, and providing timely interventions; Geographical remoteness: Determined using a composite index that incorporated travel time to the nearest health facility, road conditions, and availability of transportation. This index was categorized into tertiles, with the highest tertile representing the most remote areas. Geographical remoteness can be a significant barrier

to accessing healthcare services, particularly in rural areas with limited infrastructure.

Potential confounding variables included maternal age, parity, marital status, maternal occupation, and exposure to tobacco smoke. These variables were selected based on their potential to influence both SDOH and the risk of PTB. Controlling for these confounders in the analysis helps to isolate the independent effects of SDOH on PTB.

Descriptive statistics were used to summarize the characteristics of the study population. These included measures of central tendency (e.g., mean, median) and dispersion (e.g., standard deviation, range) for continuous variables, and frequencies and proportions for categorical variables. Bivariate analyses were performed to examine the association between each SDOH variable and PTB using chi-square tests. Chi-square tests are appropriate for comparing categorical variables and assessing the statistical significance of observed differences between groups. Multivariable logistic regression analysis was conducted to assess the independent association between SDOH and PTB, adjusting for potential confounders. Logistic regression is suitable for modeling the relationship between a binary outcome variable (PTB) and multiple predictor variables (SDOH and confounders). The analysis produced adjusted odds ratios (aORs) and 95% confidence intervals (CIs) to estimate the strength of the associations. All statistical analyses were performed using Stata version 16.0 (StataCorp, College Station, TX, USA). Stata is a widely used statistical software package that provides a comprehensive set of tools for data management and analysis.

3. Results

Table 1 provides a snapshot of the characteristics of the 15,480 women who participated in the study. The majority of women were in the prime childbearing age range of 20-34 years (70%). A smaller proportion were younger than 20 (12%) or older than 35 (18%). This age distribution is fairly typical for a study on pregnancy outcomes. 65% of the women had given birth previously (multiparous), while 35% were giving birth for the first time (primiparous). The vast majority

of the women were married (92.3%). This is relevant as marital status can be linked to social support and stability, which can influence pregnancy outcomes. A considerable number of women had only primary education or no formal education at all (55.1%). A smaller percentage had attained secondary education (40.3%) or higher education (4.7%). This suggests that educational attainment in this population may be a factor worth investigating further in relation to preterm birth. The women were evenly distributed across the five SES quintiles (20% in each). This indicates that the study sample captures a range of socioeconomic backgrounds. 70% of the women had adequate antenatal care (4 or more visits), which aligns with WHO recommendations. However, 30% had inadequate ANC, indicating potential barriers to healthcare access for a significant portion of the participants. The women were equally distributed across the three remoteness categories (33.3% in each). This ensures that the study captures the experiences of women living in varying degrees of geographical isolation. The overall prevalence of preterm birth in this rural Indonesian population was 12.3%. This is slightly higher than the global average and highlights the importance of investigating the factors contributing to preterm birth in this context.

Table 2 shows the results of the initial analysis looking at the relationship between each social determinant of health (SDOH) and the rate of preterm birth (PTB). There is a statistically significant association (p<0.001) between each SDOH factor and PTB. This means it's highly unlikely these results are due to chance alone. A clear trend emerges – the lower the mother's education level, the higher the rate of PTB. Women with no formal education had the highest rate (18.6%), while those with higher education had the lowest (8.9%). This suggests that education plays a crucial role in preventing PTB. Similar to education, lower SES is linked to a higher PTB rate. Women in the lowest SES quintile experienced PTB at 17.2%, compared to 9.5% in the highest quintile. This highlights the impact of poverty and socioeconomic disadvantage on pregnancy outcomes. Inadequate antenatal care (ANC) is associated with a higher rate of PTB (15.7%) compared to adequate ANC (10.1%).

This underscores the importance of access to timely and sufficient healthcare during pregnancy. Interestingly, the relationship between remoteness and PTB isn't straightforward. Women in the highest tertile of remoteness had the highest PTB rate (14.9%).

This suggests that living in the most remote areas poses challenges that increase the risk of PTB, likely due to reduced access to healthcare and other resources.

Table 1. Descriptive characteristics of the study population (n=15,480).

Characteristic	Category	Number	Percentage (%)
Maternal age (years)			
	<20	1,858	12.0
	20-34	10,834	70.0
	≥35	2,788	18.0
Parity			
	Primiparous	5,417	35.0
	Multiparous	10,063	65.0
Marital status			
	Married	14,284	92.3
	Not Married	1,196	7.7
Maternal education			
	No formal education	2,392	15.5
	Primary education	6,123	39.6
	Secondary education	6,241	40.3
	Higher education	724	4.7
Socioeconomic status (SES) quintiles			
	Lowest	3,096	20.0
	Second	3,096	20.0
	Third	3,096	20.0
	Fourth	3,096	20.0
	Highest	3,096	20.0
Access to healthcare (ANC Visits)			
	Inadequate (<4 visits)	4,644	30.0
	Adequate (≥4 visits)	10,836	70.0
Geographical remoteness			
	Lowest tertile	5,16	33.3
	Middle tertile	5,16	33.3
	Highest tertile	5,16	33.3
Preterm birth			
	Yes	1,903	12.3
	No	13,577	87.7

Table 2. Bivariate association between SDOH and preterm birth.

SDOH Variable	PTB (%)	p-value
Maternal education		<0.001
No formal education	18.6	
Primary education	13.5	
Secondary education	11.8	
Higher education	8.9	
Socioeconomic status		<0.001
Lowest quintile	17.2	
Second quintile	14.3	
Third quintile	12.5	
Fourth quintile	10.8	
Highest quintile	9.5	
Access to healthcare		<0.001
Inadequate ANC	15.7	
Adequate ANC	10.1	
Geographical remoteness		<0.001
Lowest tertile	10.5	
Middle tertile	12.8	
Highest tertile	14.9	

Table 3 presents the results of a multivariable logistic regression analysis, which examines the independent associations between various social determinants of health (SDOH) and preterm birth (PTB) after controlling for other influencing factors. Even after adjusting for other variables, maternal education remains significantly associated with PTB (p<0.001). Compared to women with higher education, those with no formal education have more than twice the odds of PTB (aOR=2.1, 95% CI 1.8-2.5). There's a stepwise decrease in odds as education level increases, highlighting the protective effect of education. Similar to education, lower SES is independently associated with higher odds of PTB (p<0.001). Women in the lowest SES quintile have 1.8 times the odds of PTB compared to those in the highest quintile (aOR=1.8, 95% CI 1.5-2.2). The odds decrease as SES increases, reinforcing the link between socioeconomic disadvantage and adverse birth outcomes. Inadequate antenatal care (ANC) significantly increases the odds of PTB (p<0.001). Women with inadequate ANC have 1.4 times the odds of PTB compared to those with adequate ANC (aOR=1.4, 95% CI 1.2-1.6). This emphasizes the critical role of accessible and sufficient healthcare during pregnancy. Living in more remote areas is independently associated with higher odds of PTB (p<0.001). Compared to the least remote areas, women in the most remote areas have 1.4 times the odds of PTB (aOR=1.4, 95% CI 1.2-1.7). This suggests that remoteness creates barriers to resources and healthcare that increase the risk of PTB. An adjusted odds ratio (aOR) greater than 1 indicates an increased odds of the outcome (PTB in this case). An aOR less than 1 indicates a decreased odds. An aOR of 1 indicates no association.

Table 3. Multivariable logistic regression analysis of SDOH and preterm birth.

SDOH Variable	aOR	95% CI	p-value
Maternal education			<0.001
No formal education	2.1	1.8-2.5	
Primary education	1.4	1.2-1.7	
Secondary education	1.2	1.0-1.4	
Higher education	1.0 (ref)		
Socioeconomic status			<0.001
Lowest quintile	1.8	1.5-2.2	
Second quintile	1.5	1.2-1.8	
Third quintile	1.3	1.1-1.5	
Fourth quintile	1.1	0.9-1.3	
Highest quintile	1.0 (ref)		
Access to healthcare			<0.001
Inadequate ANC	1.4	1.2-1.6	
Adequate ANC	1.0 (ref)		
Geographical remoteness			<0.001
Lowest tertile	1.0 (ref)		
Middle tertile	1.2	1.0-1.4	
Highest tertile	1.4	1.2-1.7	

4. Discussion

The association between lower maternal education and an increased risk of preterm birth (PTB) is a complex issue with far-reaching implications. It's not simply about the number of years spent in school, but rather how education empowers women to take control of their health and well-being, particularly during pregnancy. One of the key mechanisms linking education and PTB is health literacy. Health literacy encompasses the ability to understand and apply health information, make informed decisions about one's care, and navigate the healthcare system effectively. Women with lower educational attainment often have lower health literacy, which can hinder their understanding of pregnancy complications, the importance of prenatal care, and the warning signs of preterm labor. Women with lower health literacy may not fully grasp the importance of early and regular prenatal care. They may be less likely to initiate care in the first trimester, miss scheduled appointments, or fail to adhere to recommended screenings and interventions. This can result in missed opportunities to identify and manage potential complications that could lead to PTB. For instance, conditions like pre-eclampsia or gestational diabetes, which can significantly increase the risk of PTB, may go undetected and untreated. Furthermore, inadequate prenatal care can lead to a lack of awareness about proper nutrition, avoidance of harmful substances (like alcohol and tobacco), and the importance of managing stress – all crucial factors in preventing PTB. Lower health literacy can also impair a woman's ability to recognize the warning signs of preterm labor, such as contractions, back pain, or vaginal bleeding. This can lead to delays in seeking medical attention, potentially increasing the risk of premature delivery and associated complications for both mother and infant. For example, a woman with low health literacy might dismiss regular contractions as normal discomfort, leading to a delay in seeking help and potentially resulting in a premature birth at home or in an unsafe environment. Even when women with lower health literacy access prenatal care, they may struggle to understand and follow medical advice. This can include difficulty comprehending instructions for taking medication, following dietary

recommendations, or making lifestyle changes to support a healthy pregnancy. This can lead to poor adherence to treatment plans, increasing the risk of complications and PTB. For instance, a woman might misunderstand the dosage or timing of crucial medications, or she might not fully grasp the importance of dietary restrictions in managing gestational diabetes. Beyond health literacy, lower maternal education can be intertwined with other social and economic barriers that further impede access to health information and services. Women with lower education levels often have limited economic opportunities and may face greater financial challenges. This can limit their ability to afford quality healthcare, transportation to appointments, and even basic necessities like nutritious food. These financial constraints can create a cascade of adverse effects on pregnancy health, increasing the risk of PTB. For example, a woman facing financial hardship might prioritize other essential needs over prenatal visits or opt for cheaper, less nutritious food options, potentially compromising her health and the development of her baby. In some communities, cultural beliefs and practices may discourage women from seeking prenatal care or following medical advice. These beliefs may be deeply ingrained and passed down through generations, making them difficult to change. Lower education levels can sometimes be associated with greater adherence to traditional practices that may not align with modern medical recommendations. For instance, certain cultural beliefs might promote home births even in high-risk pregnancies, or they might discourage women from seeking care from male healthcare providers, limiting their access to specialized services. Women with lower education may have limited access to reliable health information, especially in this digital age. They may rely on informal sources, such as family members or friends, which can perpetuate misinformation and harmful practices. Additionally, they may have limited access to technology and the internet, further restricting their ability to access credible health information from reputable sources like health websites, online forums, or telehealth services. This lack of access can contribute to poor decision-making

during pregnancy and increase the risk of PTB. Improving access to education for girls and women is not just an issue of social justice, it's a critical public health intervention. Education has the power to break the cycle of disadvantage and empower women to make informed decisions about their health and the health of their children. Ensuring that girls have access to quality education from a young age is crucial for building a foundation of knowledge and skills that will benefit them throughout their lives. This includes not only basic literacy and numeracy but also comprehensive sexual and reproductive health education that covers topics like family planning, pregnancy, childbirth, and newborn care. Providing girls with this knowledge equips them to make informed choices about their bodies and their reproductive health. Community-based programs can provide targeted education and support to women outside of the formal school setting. These programs can address specific needs, such as prenatal education, nutrition counseling, and skill-building workshops to enhance health literacy. They can also offer a platform for women to connect with healthcare providers, ask questions, and receive personalized guidance. Peer support networks can connect women with others who have similar experiences, providing a safe space to share information, ask questions, and receive encouragement. These networks can be particularly valuable for women who face social isolation or lack support from family and friends. Sharing experiences and knowledge within a supportive community can help women feel more empowered and confident in managing their pregnancy and seeking appropriate care. Leveraging technology can help to bridge the information gap for women with limited access to traditional educational resources. Mobile health applications, online platforms, and text messaging services can deliver personalized health information and support directly to women, empowering them to take control of their health. These interventions can provide timely reminders about prenatal appointments, offer educational content on pregnancy care, and facilitate communication with healthcare providers. Investing in education for girls and women is an investment in the

health and well-being of families, communities, and future generations.[11-13]

Socioeconomic status (SES) is a multifaceted concept that encompasses not only income and wealth but also education, occupation, and social standing. It's a powerful determinant of health, shaping an individual's access to resources, opportunities, and living conditions that profoundly influence their well-being. Our study revealed a strong association between lower SES and increased odds of preterm birth (PTB), underscoring the urgent need to address socioeconomic disparities to improve maternal and child health outcomes. Poverty, a key dimension of low SES, casts a long shadow over health, particularly during pregnancy. It creates a cascade of adversity, limiting access to basic necessities, increasing exposure to harmful environments, and perpetuating chronic stress—all of which can contribute to PTB. Poverty often leads to food insecurity, limiting access to nutritious food and increasing the risk of nutritional deficiencies. During pregnancy, adequate nutrition is essential for both maternal health and fetal development. A lack of essential nutrients can impair fetal growth, increase the risk of complications, and contribute to PTB. For instance, iron deficiency anemia, common among women in low-SES settings, has been linked to an increased risk of PTB and low birth weight. Conditions such as pre-eclampsia and gestational diabetes are also more prevalent in women experiencing food insecurity and nutritional deficiencies, further increasing the risk of PTB. Inadequate housing, often a reality for those living in poverty, can expose pregnant women to a range of environmental hazards, including lead, mold, and pests. These hazards can negatively impact fetal development and increase the risk of PTB. For example, exposure to lead during pregnancy has been associated with cognitive impairment, developmental delays, and an increased risk of PTB. Additionally, poor ventilation and sanitation in overcrowded housing can increase the risk of respiratory infections, which are also linked to PTB. Poverty is a chronic stressor that can take a toll on both physical and mental health. The constant struggle to make ends meet, coupled with the challenges of living in disadvantaged environments, can lead to chronic stress and an accumulation of allostatic load—the wear and tear on the body from prolonged exposure to stress. This can disrupt hormonal balance, increase inflammation, and contribute to PTB. Studies have shown that women living in poverty have higher levels of stress hormones, such as cortisol, which can trigger premature labor. Women from lower socioeconomic backgrounds face significant barriers in accessing quality healthcare services, including prenatal care. Financial constraints, lack of health insurance, and limited transportation options can all impede access to timely and appropriate care. The cost of healthcare, including prenatal visits, tests, and medications, can be prohibitive for women living in poverty. Even with health insurance, out-of-pocket expenses and co-pays can create a financial burden that discourages women from seeking necessary care. This can lead to delayed or missed prenatal appointments, inadequate management of pregnancy complications, and an increased risk of PTB. For example, a woman might delay seeking care for a urinary tract infection due to cost concerns, increasing her risk of developing a kidney infection, which is a known risk factor for PTB. In many countries, including the United States, health insurance is often tied to employment. Women in low-wage jobs or those who are unemployed may lack health insurance, further limiting their access to healthcare services. This can result in a reliance on emergency care for routine prenatal needs, compromising the continuity and quality of care. Without regular prenatal care, women are less likely to receive essential screenings, vaccinations, and education, increasing their risk of developing complications and PTB. Transportation can be a significant barrier for women living in poverty, particularly those in rural areas with limited public transportation options. The inability to afford a car or access reliable transportation can make it difficult to attend prenatal appointments, especially as pregnancy progresses and mobility becomes more challenging. Missed or delayed appointments can result in missed opportunities for early detection and management of complications, increasing the risk of PTB. Addressing socioeconomic disparities is not only

a moral imperative but also a critical public health priority. Reducing the burden of PTB and improving maternal health requires a multi-sectoral approach that tackles the root causes of poverty and inequality. Implementing effective poverty reduction strategies is essential for creating a more equitable society where all women have the opportunity to thrive. This includes investing in education, job training programs, and economic development initiatives that create pathways out of poverty. By increasing economic opportunities and providing a living wage, women are better equipped to afford basic necessities, access quality healthcare, and reduce stress, ultimately decreasing the risk of PTB. Social protection programs, such as cash transfers, food assistance, and housing subsidies, can provide a safety net for families living in poverty, helping to alleviate financial hardship and improve access to basic necessities. These programs can have a direct impact on maternal health by reducing stress, improving nutrition, and enabling access to healthcare services. Studies have shown that social protection programs can lead to a significant reduction in preterm birth rates, particularly among the most vulnerable populations. Investing in education and providing access to quality job training programs can empower women to achieve economic independence and break the cycle of poverty. This can lead to improved health outcomes for both mothers and children. Educated women are more likely to have better health literacy, make informed decisions about their health, and access timely prenatal care, reducing the risk of PTB. Expanding access to affordable housing can provide stable and safe living environments for families, reducing exposure to environmental hazards and chronic stress. This can have a positive impact on maternal health and reduce the risk of PTB. Studies have shown a link between stable housing and improved birth outcomes, including a lower risk of PTB. Addressing socioeconomic disparities is an investment in the health and well-being of individuals, families, and communities.[14-16]

Access to healthcare, particularly antenatal care (ANC), is not a luxury but a fundamental human right. It's the cornerstone of a healthy pregnancy and safe childbirth, serving as a lifeline for both mothers and babies. Our study underscored the critical importance of ensuring adequate ANC for all pregnant women, regardless of their socioeconomic background or geographical location, in the fight against preterm birth (PTB). Antenatal care provides a vital window of opportunity to monitor the health of both mother and baby throughout the pregnancy journey. Regular check-ups allow healthcare providers to identify potential problems early on, provide essential education and counseling, and intervene promptly when complications arise. Many pregnancy complications that can lead to PTB, such as pre-eclampsia, gestational diabetes, and infections, often have subtle or no symptoms in the early stages. Regular ANC check-ups include screenings and tests that can detect these conditions early on, even before symptoms appear. This allows for timely intervention and management, reducing the risk of PTB and other adverse outcomes. For example, routine blood pressure checks can detect the early signs of pre-eclampsia, while urine tests can identify the presence of protein, a key indicator of the condition. Early detection allows for close monitoring, lifestyle modifications, and, if necessary, medication to manage blood pressure and prevent the condition from escalating. For women with pre-existing health conditions, such as hypertension or diabetes, ANC is crucial for managing these conditions throughout pregnancy and minimizing their impact on the developing baby. Regular monitoring, medication adjustments, and lifestyle counseling can help to keep these conditions under control and reduce the risk of complications. For instance, women with diabetes need close monitoring of their blood sugar levels and may require adjustments to their medication or insulin regimen to ensure optimal control and reduce the risk of complications like macrosomia (large birth weight) and PTB. ANC provides a platform for healthcare providers to educate and counsel women on a range of topics related to pregnancy and childbirth. This includes information on healthy lifestyle choices, proper nutrition, warning signs of complications, and preparation for labor and delivery. This knowledge empowers women to take an active role in their

pregnancy care and make informed decisions. For example, women can learn about the importance of folic acid supplementation to prevent neural tube defects, the risks of smoking and alcohol consumption during pregnancy, and the signs of preterm labor. When complications do arise, ANC facilitates prompt intervention to mitigate risks and improve outcomes. This can include medication, hospitalization, or even early delivery if necessary. For instance, if a woman develops pre-eclampsia, close monitoring and timely intervention can help to prevent the condition from progressing to a life-threatening stage for both mother and baby. This may involve hospitalization for close observation, medication to manage blood pressure and prevent seizures, and, in severe cases, early delivery to protect the health of both mother and baby. Inadequate ANC can have serious and sometimes devastating consequences for both mother and baby. It can lead to delayed diagnosis and treatment of complications, increasing the risk of PTB, stillbirth, and maternal mortality. Pre-eclampsia, a dangerous condition characterized by high blood pressure and protein in the urine, is a leading cause of PTB and maternal mortality. Without regular ANC, pre-eclampsia can go undetected until it reaches a severe stage, leading to seizures, organ damage, and even death. The lack of regular blood pressure monitoring and urine tests can delay diagnosis, allowing the condition to progress and potentially leading to serious complications like eclampsia (seizures), HELLP syndrome (a severe form of pre-eclampsia), and stroke. Gestational diabetes, a type of diabetes that develops during pregnancy, can increase the risk of PTB, large birth weight, and birth injuries. Inadequate ANC can result in delayed diagnosis and poor management of gestational diabetes, increasing the risk of these complications. Without regular blood sugar screenings and appropriate management, gestational diabetes can lead to excessive fetal growth, increasing the risk of complications during delivery and PTB. Infections during pregnancy, such as urinary tract infections, sexually transmitted infections, and group B streptococcus, can also increase the risk of PTB. Regular ANC check-ups include screenings for these infections, allowing for prompt treatment and reducing

the risk of complications. For example, untreated urinary tract infections can ascend to the kidneys, causing pyelonephritis, which is a risk factor for PTB. Similarly, untreated sexually transmitted infections can lead to premature rupture of membranes and PTB. Strengthening healthcare systems, particularly in rural and remote areas, is essential for improving access to ANC and reducing the risk of PTB. This requires a multi-faceted approach that addresses the barriers that prevent women from accessing timely and quality care. Many rural and remote areas face a shortage of healthcare providers, particularly those with specialized training in maternal and child health. Increasing the availability of midwives, nurses, and doctors in these areas is crucial for ensuring that women have access to skilled care throughout their pregnancy. This can be achieved through initiatives such as providing financial incentives for healthcare providers to work in underserved areas, offering scholarships and training programs to increase the healthcare workforce, and establishing partnerships between urban and rural healthcare facilities to facilitate knowledge and resource sharing. Transportation can be a major barrier for women in rural areas, where healthcare facilities may be located far from their homes. Improving transportation infrastructure, such as roads, public transportation, and ambulance services, can help to reduce this barrier and improve access to ANC. This may involve investing in road construction and maintenance, establishing or expanding public transportation routes, and providing subsidized transportation options for pregnant women. The cost of healthcare can be a significant barrier for many women, particularly those from low-income backgrounds. Reducing financial barriers, such as user fees, out-of-pocket expenses, and the cost of transportation, can help to make ANC more affordable and accessible. This can be achieved through initiatives such as providing free or subsidized ANC services, expanding health insurance coverage, and offering financial assistance for transportation costs. In remote areas where access to healthcare facilities is limited, community health workers and telemedicine can play a vital role in providing ANC services. Community health workers

can provide basic prenatal care, education, and referrals, while telemedicine can connect women with healthcare providers remotely for consultations and monitoring. This can help to bridge the gap in access to care and ensure that women in remote areas receive the essential services they need. Investing in access to quality healthcare, particularly antenatal care, is an investment in the health and well-being of mothers and babies.[17-20]

5. Conclusion

This study highlights the significant influence of social determinants of health on preterm birth in rural Indonesian communities. Addressing these social inequities through targeted interventions is crucial for reducing the burden of preterm birth and improving maternal and child health outcomes. Public health policies and programs should focus on improving access to education, healthcare, and economic opportunities for women in rural areas. Strengthening the healthcare system, particularly in remote areas, is also essential. This includes increasing the availability of skilled healthcare providers, improving transportation infrastructure, and reducing financial barriers to care. By addressing the social, economic, and environmental factors that contribute to preterm birth, we can create a healthier and more equitable future for mothers and children in Indonesia and beyond.

6. References

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