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Complete Childhood Immunization and Child Health Outcomes: Evidence from Indonesia

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Abstract

This study aims to examine the effect of complete childhood immunization on child health and growth outcomes in Indonesia, measured by morbidity history and Body Mass Index (BMI). This research is important because complete immunization coverage in Indonesia remains uneven, while child health is a strategic component in improving human capital quality and achieving the Sustainable Development Goals (SDGs). This study uses secondary data from the Indonesian Family Life Survey (IFLS) and applies a quantitative approach. The analysis employs a Probit model to estimate the relationship between complete immunization and child health outcomes. To address the potential endogeneity of immunization decisions, an Instrumental Variable Probit (IV Probit) model is also applied. The instrumental variables used are the distance to the nearest health facility and the cost of accessing vaccination services. The estimation results show that children who receive complete immunization have a 50.8% lower probability of experiencing morbidity requiring rest compared to children who do not receive complete immunization. In addition, complete immunization reduces the probability of children having abnormal BMI status (underweight or overweight) by 50.9%. These findings indicate that complete immunization significantly improves child health and nutritional status in Indonesia. ***The novelty of this study*** *lies in the use of a causal inference approach through the IV Probit model to address endogeneity bias in immunization decisions, as well as in measuring the impact of immunization not only on morbidity but also on child growth indicators through BMI.*

Keywords: Immunization, Children, Morbidity, BMI, IV Probit, and IFLS

JEL Classification: I15 and I18

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Introduction

Several recent studies have discussed children's health, as it is a key indicator of progress towards achieving the Sustainable Development Goals (SDGs), which were launched by the United Nations (UN). These goals consist of 17 targets for global development to be achieved by 2030 and were adopted by both developed and developing countries at the UN General Assembly in September 2015. One of these goals is to ensure healthy lives and promote well-being for all ages (UN, 2015). Children under the age of 17 require particular attention, especially regarding health, as they are the future generation of the nation. Those who are unable to care for their own health are vulnerable to various diseases, particularly when their parents do not model healthy behaviours or maintain a healthy environment (Bhargava et al., 2014; Kong et al., 2021).

Children's health is crucial because it directly affects their survival, cognitive development, educational attainment and future productivity as adults. In 2018, children accounted for around 30.1 per cent of Indonesia's total population, equating to approximately 79.5 million people (Ministry of Women's Empowerment and Child Protection of the Republic of Indonesia, 2019). Children's health is highly sensitive to their surroundings and influenced by factors such as hygiene, consumption patterns, environmental sanitation, parental care, and daily activities. Poor health conditions can lead to problems such as fever, cough, diarrhoea, and growth disorders, including stunting and weight loss (Fajariyah & Hidajah, 2020).

The 2018 National Socioeconomic Survey (Susenas) results, published in the Indonesian Child Profile (Ministry of Women's Empowerment and Child Protection of the Republic of Indonesia, 2019), show that 31.59 per cent of children aged 0–17 experienced health complaints, with 15.89 per cent experiencing disorders that interfered with their daily activities. The 2018 Riskesdas data also recorded nutritional problems among children and adolescents: 25.7% of 13–15-year-olds and 26.9% of 16–18-year-olds were classified as stunted or severely stunted, while 8.7% and 8.1%, respectively, were underweight. Obesity prevalence reached 16.0% in the 13–15 age group and 13.5% in the 16–18 age group (Ministry of Health of the Republic of Indonesia, 2019; WHO, 2017). These figures suggest that Indonesian children are experiencing the dual burden of malnutrition: undernutrition and overnutrition. This may have long-term health and economic consequences.

Previous studies by Bhargava et al. (2014), Fajariyah and Hidajah (2020), and Nayir et al. (2020) have primarily examined the relationship between immunization and morbidity, stunting or mortality. However, limited attention has been given to broader child growth indicators, such as body mass index (BMI), which captures both underweight and overweight conditions, providing a more comprehensive measure of nutritional status in children. Additionally, studies examining indirect determinants of immunization completeness, such as accessibility to health services (e.g., distance to health facilities and transportation costs), remain scarce (Croke et al., 2020; Karra et al., 2017). Barriers to accessibility are particularly relevant in geographically dispersed countries such as Indonesia, where households may face substantial travel times and expenses, as well as uneven healthcare worker availability.

Furthermore, most previous studies treat immunization as exogenous, which can introduce bias into the estimated effect due to parental health preferences, education, income, risk perceptions, and socio-economic characteristics that influence both immunization uptake and child health outcomes simultaneously (Angrist & Pischke,

2009; Wooldridge, 2016). Parents who are more health-conscious may be more likely to immunise their children and provide better nutrition, cleaner living environments, and faster treatment when illness occurs. Consequently, observed differences in child health between immunised and non-immunised children may partly reflect household characteristics rather than the pure causal effect of immunization itself. Therefore, findings based solely on standard regression models or simple correlations may suffer from endogeneity, omitted variable bias, and selection bias, which limit their ability to identify the true causal impact of immunization.

Therefore, this study addresses three important gaps in the literature. First, it examines the relationship between complete immunization and children's health using both morbidity indicators and BMI as a broader measure of child growth. Second, it incorporates spatial and economic accessibility factors, namely distance to health facilities and transportation costs, as determinants associated with immunization uptake and child health outcomes. Third, it explicitly addresses the methodological limitations of previous studies by accounting for potential endogeneity and non-random selection in immunization decisions, thereby providing more credible and policy-relevant estimates of the effect of immunization on children's health.

The novelty of this study lies in its comprehensive and methodological approach. This study not only links complete immunization to child morbidity and BMI, but also demonstrates how accessibility to health facilities functions as an important structural factor interacting with parental behaviour in determining immunization uptake.In addition, by addressing potential bias arising from non-random immunization decisions and the limitations of non-causal empirical approaches, this study contributes stronger empirical evidence regarding the health benefits of immunization in the Indonesian context. The results are expected to provide more accurate implications for public health policy, especially in designing immunization outreach strategies for vulnerable households and underserved regions.

Literature Review

Immunization is an effective strategy for preventing disease transmission. It protects children from infection and reduces the risk of infectious disease outbreaks. Indonesia's immunization programme, which has been in place since 1956, successfully contributed to the eradication of smallpox in 1974. Over time, immunization coverage has expanded to include protection against vaccine-preventable diseases (VPDs), including tuberculosis, diphtheria, pertussis, measles, polio, tetanus, and hepatitis B (Strauss et al., 2016). According to Minister of Health Regulation No. 12 of 2017, complete basic immunization includes the hepatitis B, BCG, DPT, polio, and measles vaccines (Ministry of Health of the Republic of Indonesia, 2017, 2019). However, despite these vaccines being provided free of charge through health facilities, 32.9 per cent of children aged 12–23 months still receive incomplete immunization, and 9.2 per cent receive no immunization at all (Ministry of Women's Empowerment and Child Protection of the Republic of Indonesia, 2019). This suggests that financial affordability alone does not automatically guarantee universal immunization uptake.

Several international studies reinforce the positive impact of immunization. For example, Sangma et al. (2023) demonstrate that routine immunization can reduce influenza cases by up to 17% and prevent up to 100% of targeted diseases. Meanwhile,

Zhou et al. (2024) estimate that immunization programmes in the United States have prevented over 508 million cases of disease and saved USD 2.7 trillion in social costs. Complete immunization also reduces infant and child mortality, as well as the transmission of infectious diseases (Batta, 2022). Childhood immunization is widely recognised as an effective, safe, and efficient way of preventing illness and death (Obeagu, 2022). Therefore, immunization provides both private benefits for households and broader public health benefits for society as a whole.

From a long-term perspective, Oskorouchi et al. (2020) found that immunization before the age of 15 in China was associated with higher educational attainment and greater cognitive ability in adulthood. In India, the national immunization programme has been shown to improve children's nutritional status and reduce growth deficits (Anekwe & Kumar, 2012). In Indonesia, meanwhile, Fajariyah and Hidajah (2020) found that children with incomplete immunization were at a higher risk of stunting. These findings suggest that immunization influences not only disease prevention, but also children's growth, nutrition, educational outcomes, and future human capital development.

However, parents' decisions to vaccinate their children are influenced by many factors. Balgovind and Mohammadnezhad (2022) demonstrate that parents' knowledge, attitudes, and behaviours, as well as the quality of health services, play important roles. Furthermore, Fadl et al. (2024) argue that multi-level factors ranging from the personal (e.g., mothers' knowledge), interpersonal (e.g., social support), organisational (e.g., access to and quality of services), community context, and public policy levels interact to determine the success of immunization programmes. This explains why complete immunization coverage remains uneven despite increasing awareness of its importance. In many developing countries, disparities in infrastructure, transport, and local health capacity further exacerbate inequalities in immunization.

Methodology

This study used secondary data from the Indonesia Family Life Survey (IFLS) Wave 5, which was conducted in 2014. The IFLS is a nationally representative longitudinal survey which collects detailed information on individuals, households and communities across 13 Indonesian provinces. It provides comprehensive data on demographic characteristics, education, household expenditure, health conditions, anthropometric measurements and access to public facilities. Due to the wealth of socioeconomic and health information it contains, the IFLS has been widely used in empirical studies examining welfare and health outcomes in Indonesia (Mathew, 2012). For this study, several IFLS Wave 5 modules were combined to create a dataset containing children's immunization history, child morbidity, anthropometric indicators, household socio-economic characteristics, and accessibility to health services.

The analytical sample consists of 739 children aged one to three years. Children in this age group are expected to have completed the recommended schedule of basic childhood immunizations, enabling the researcher to evaluate the association between immunization status and subsequent health and growth outcomes. Additionally, anthropometric indicators such as height and weight become more stable after infancy, making them more suitable for assessing nutritional status.

This study employs two dependent variables to measure child health outcomes. The first is child morbidity, which is defined as a binary indicator equal to one if the child experienced an illness in the last month that required rest or interrupted normal activities, and zero otherwise. This variable reflects the recent incidence of health complaints and short-term vulnerability to disease in children. The second dependent variable is body mass index (BMI), which is used as an indicator of child growth and nutritional status. BMI is calculated by dividing body weight in kilograms by height in meters squared:

$$BMI = \frac{Body\ Weight\ (kg)}{[Height\ (m)]^2} \quad (1)$$

After calculating BMI, the result is converted into a binary indicator: one if the child is categorised as underweight or overweight, and zero otherwise. This approach enables the study to consider both undernutrition and overnutrition, which are increasingly important aspects of child health in developing countries experiencing the dual burden of malnutrition.

The main explanatory variable in this study is the completion of basic immunization. According to Regulation No. 12 of 2017 by the Indonesian Minister of Health, a child is categorised as fully immunised if they have received one dose of Hepatitis B-0 (HB-0), one dose of Bacillus Calmette–Guérin (BCG), three doses of Diphtheria–Pertussis–Tetanus (DPT), four doses of the oral polio vaccine or three doses of the inactivated polio vaccine (IPV), and one dose of the measles vaccine (Ministry of Health of the Republic of Indonesia, 2017, 2019). Based on this definition, a binary variable was created, where one indicates complete immunization and zero indicates incomplete or no immunization. In the study sample, approximately 52 per cent of children had received complete immunization.

To minimise omitted variable bias, several control variables were included in the empirical model. These consist of child age, child gender, mother's years of schooling, monthly household consumption expenditure, urban or rural residence, and number of household members. These controls are important because they are likely to influence both immunization decisions and child health outcomes. For instance, more educated mothers may have a better understanding of health issues and be more aware of preventive healthcare, while wealthier households may have fewer financial constraints when it comes to obtaining immunization services and medical treatment. Similarly, children living in urban areas may have easier access to healthcare facilities than those in rural areas.

The descriptive statistics (see Table 1) indicate that the children in the sample had an average age of 1.92 years. Around 55 per cent of the children had experienced an illness that required them to rest during the previous month, while approximately eight per cent were classified as having an abnormal BMI. On average, mothers in the sample had completed 8.6 years of schooling, and average monthly household consumption expenditure was 1.87 million rupiah. Around 58 per cent of households were located in urban areas. These descriptive patterns suggest that child health outcomes and access to healthcare may vary substantially across households with different socioeconomic backgrounds.

The study also employs two instrumental variables to address the potential endogeneity of immunization status. The first of these is the distance from the household residence to the nearest health facility providing immunization services, and

the second is the transportation cost required to reach the nearest health facility. On average, the distance to the nearest facility was 6.14 kilometres, and the average transportation cost was 1,370 Rupiah; however, considerable variation existed across households. These variables are expected to influence the likelihood of achieving full immunization, as greater distance and higher travel costs increase the indirect cost of obtaining vaccines.

Table 1. Variables and Descriptive Statistics

Variables	Obs	Mean	Std. Dev	Min	Max
Outcome Variables					
The child has had an illness that requires rest in the last month, 1=Yes 0=No	739	0.55	0.49	0	1
The child's BMI value is Overweight/Underweight, 1=Yes 0=No	739	0.08	0.28	0	1
Interest Variable					
The child receives complete immunization, 1=Yes 0=No	739	0.52	1.97	0	1
Control Variables					
Child's age (Years)	739	1.92	0.99	1	3
Mother's last education (Years)	739	8.60	4.96	0	16
Total household consumption in one month (Million Rupiah)	739	1.87	1.28	0.11	11.48
Households live in urban areas, 1=Yes 0=No	739	0.58	0.49	0	1
Number of family members	739	5.06	1.95	2	15
Instrument variables					
Distance to the closest health facility to residence (KM)	739	6.14	21.88	0	30
Costs required to get to the nearest health facility (Thousand Rupiah)	739	1.37	36.78	0	1000

The estimation method used to analyze the impact of providing complete immunization on child growth and morbidity is the probit method. Probit is used to see the impact of immunization on child morbidity. The model used is as follows:

$$morbidity\ probit_i = ln\frac{morbidity}{1-morbidity} = \beta_0 + \beta_1 immunization_i + \gamma_s X_i + \varepsilon_i \quad (2)$$

$$p = \frac{exp\ (\beta_0+\beta_1 immunization_i+\gamma_s X_i+\varepsilon_i)}{1+exp\ (\beta_0+\beta_1 immunization_i+\gamma_s X_i+\varepsilon_i)} \quad (3)$$

where *morbidity* is a binary variable that shows an indicator that the child has experienced an illness that requires rest in the last month, taken from IFLS 5 data. Then *immunization* is a binary variable that shows whether the child received complete immunization, taken from the IFLS 5 data, X_i is a vector that contains control variables including the child's age, gender, household expenses, mother's highest level of education, area of residence (village or city), and the number of family members. i represents each child in the sample, while ε is an *unobserved characteristics*.

Probit estimation is also used to see the impact of immunization on BMI values. The model used is as follows:

$$probit\ bmi_i = ln\frac{bmi}{1-bmi} = \beta_0 + \beta_1 immunization_i + \gamma_s X_i + \varepsilon_i \quad (4)$$

$$p = \frac{exp\ (\beta_0+\beta_1 immunization_i+\gamma_s X_i+\varepsilon_i)}{1+exp\ (\beta_0+\beta_1 immunization_i+\gamma_s X_i+\varepsilon_i)} \quad (5)$$

where BMI is a binary variable indicating that the child has an abnormal BMI value (*Overweight/Underweight*) obtained from IFLS 5 data. The estimation results of β_1 are not biased if the immunization variable does not correlate with *unobserved variables* (ε_i) (Wooldridge, 2016). Households will be more motivated to immunize their children if the health facilities in their neighborhood are easier to access, immunizing children is endogenous, and the resulting β_1 value has the potential to be biased (Herliana, 2017). The distance to affordable health facilities and the cost of getting to affordable health facilities make it easier for households to carry out immunizations for their children.

To identify the influence of the availability and access of health facilities on the provision of immunizations to children, this research uses an instrumental variable (IV) estimation model. The IV model can accommodate variables that are omitted in the model but influence endogenous variables (Wooldridge, 2016). The IV estimation model used for the immunization variable is as follows:

$$immunization\ probit_i = ln\frac{immunization}{1-immunization} = \beta_1 health\_facilitydistance_i + \beta_2 health\_facilitycost_i + \gamma_s X_i + \varepsilon_i \quad (6)$$

$$p = \frac{exp\ (\beta_1 health\_facilitydistance_i + \beta_2 health\_facilitycost_i + \gamma_s X_i + \varepsilon_i)}{1 + exp\ \beta_1 health\_facilitydistance_i + \beta_2 health\_facilitycost_i + \gamma_s X_i + \varepsilon_i)} \quad (7)$$

where the health_facility distance variable is the distance of the health facility providing immunization services from where the household lives, based on data from IFLS 5, while the health_facility cost variable is the cost required by the household to get to the nearest health facility that provides child immunization services based on data contained in IFLS 5.

Results and Discussion

Table 2 shows the results of Probit and IV Probit estimates. The findings can be interpreted as follows. For the main variable, namely complete immunization in children, the results of Probit models (1) and (2) show very small coefficients (0.005 and 0.006) that are not statistically significant (p>0.1), indicating that if immunization is assumed to be exogenous, there is no significant effect on the probability of morbidity or BMI status in children. However, estimates using IV Probit (1) and (2) show significant negative coefficients at the 1% level (-0.508*** and -0.509***), indicating that when endogeneity is taken into account, children who receive complete immunization have a lower probability of experiencing morbidity requiring bed rest or having an unfavorable BMI status compared to children who do not receive complete immunization. These findings confirm the causal effect of complete immunization on children's health and nutritional status.

Analysis of control variables shows that the age of the child is not significant in all models, indicating no significant effect on morbidity or BMI status. The mother's level of education has a negative but insignificant coefficient, indicating no strong evidence of the mother's education affecting child outcomes after controlling for other variables. Total household consumption is positive and significant in Probit (1) at the 10% level and IV Probit (1) at the 5% level, indicating that families with higher consumption tend to have a higher probability of certain outcomes, although the effect is relatively small.

The variable of urban household location does not show a significant effect on child outcomes. The number of family members is negative and significant in Probit (1) at the 1% level, indicating that families with more members tend to have a lower probability of certain outcomes; however, this effect is not significant in the IV Probit model, thus not reflecting a causal relationship after accounting for immunization endogeneity. The positive constant in all models and significant in Probit (2) indicates the baseline probability of the outcome when all independent variables are zero.

Table 2. Probit and IV Probit Estimation Results

	Probit (1)	IV Probit (1)	Probit (2)	IV Probit (2)
Interest Variable				
The child receives complete immunization, 1=Yes 0=No	0.005	-0.508***	0.006	-0.509***
	(0.024)	(0.015)	(0.034)	(0.000)
Control Variables				
Age (years)	0.012	-0.017	0.043	-0.020
	(0.047)	(0.038)	(0.067)	(0.055)
Mother's education level (years)	-0.002	-0.006	-0.002	-0.006
	(0.010)	(0.008)	(0.015)	(0.012)
Total household consumption in one month (Million Rupiah)	0.069*	0.066**	-0.038	0.068
	(0.039)	(0.032)	(0.052)	(0.042)
Households live in urban areas, 1=Yes 0=No	0.156	0.009	-0.159	0.016
	(0.096)	(0.084)	(0.138)	(0.112)
Number of family members	-0.069***	-0.013	0.019	-0.014
	(0.026)	(0.021)	(0.037)	(0.030)
Constant	0.262	0.350	1.370***	0.286
	(0.198)	(0.345)	(0.280)	(0.231)
Diagnostic Test				
Underidentification test	-	9.29***	-	11.72***
Overidentification test	-	5.50**	-	1.81***
Endogeinity test	-	3.80***	-	12.33***
Observation	739	739	739	739

* p<0.1, ** p<0.05, *** p<0.01

The diagnostic test results confirm the validity and relevance of the instrument. The underidentification test is significant at the 1% level (9.29*** and 11.72***), which confirms the instrument's ability to identify endogenous variables. The overidentification test is also significant (5.50*** and 1.81***), indicating that the instrument is not subject to overidentification and remains valid. The endogeneity test is also significant (3.80*** and 12.33***), confirming that complete immunization is endogenous and that the use of IV Probit is therefore appropriate for estimating causal effects. Overall, the difference in results between Probit and IV Probit emphasises the importance of taking the endogeneity of immunization into account. The IV Probit findings demonstrate that complete immunization significantly reduces the risk of morbidity and suboptimal BMI status in children. The instruments used distance to health facilities and travel costs are proven to be valid, which supports the use of IV Probit for causal estimation.

Table 2 also shows the marginal effect values from the probit and IV Probit estimation results conducted in this study. There are four models used in the analysis of the impact of complete immunization on morbidity and child growth and development, divided based on different methods and outcome variables. Model 1 is

the marginal effect value from the estimation results using morbidity variables in the form of children experiencing illness that required rest in the last month as the outcome variable, while Model 2 is the marginal effect value from the estimation results using the child's BMI value (overweight/underweight) as the outcome variable.

The results of the IV Probit model analysis show that the use of instrument variables in the form of distance to the nearest health facility and travel costs to health facilities is appropriate, relevant, and significantly correlated with the variable of children receiving complete immunization, so that the IV Probit method is valid for estimating the causal effect of immunization on child morbidity and growth and development (Wooldridge, 2016). In the standard Probit model, which assumes exogenous immunization, no significant effect was found on children receiving complete immunization on child health indicators, namely the risk of illness in the last month and BMI status (Overweight/Underweight), indicating a potential bias due to endogeneity. This bias may occur because factors that influence parents' decisions to vaccinate, such as education level, health knowledge, economic status, or preferences regarding children's health, may also correlate with children's health outcomes (Bhargava et al., 2014; Fajariyah & Hidajah, 2020).

Treating complete immunization as an endogenous variable in the IV Probit model revealed a significant negative causal effect on child morbidity and nutritional status. Specifically, IV Probit Model 1 estimates show that children who are fully immunised are 50.8% less likely to experience an illness requiring rest than children who are not fully immunised. Meanwhile, IV Probit Model 2 shows that fully immunised children are 50.9% less likely to have an unhealthy BMI. These results suggest that complete immunization increases the likelihood of children having better health and achieving optimal growth (Bhargava et al., 2014; Fajariyah & Hidajah, 2020; Nayir et al., 2020).

These findings are reinforced by international and national literature. Review studies show that routine immunization reduces child morbidity and mortality by up to 100% for target diseases such as polio, measles, diphtheria, mumps, and Hib, and improves child survival (Sangma et al., 2023; Bhatta, 2022; Zhou et al., 2024). Longitudinal studies in China and the US show that childhood immunization also has long-term effects on educational attainment and cognitive function in adulthood (Oskorouchi et al., 2020; Luca, 2016). In Indonesia and India, empirical evidence shows that complete immunization contributes to children's physical growth, reducing height-for-age deficits by up to 25% and weight-for-age deficits by up to 15%, especially among children from families with lower economic status and mothers with low education (Kusumawardani et al., 2019; Anekwe & Kumar, 2012; Ervinawati, 2022).

In addition to the direct effects of immunization, this analysis confirms the significant role of access to health facilities. IV Probit estimates show that long distances and high costs increase the probability of children not receiving complete immunization, which indirectly increases the risk of morbidity and BMI imbalance. This is consistent with the literature showing an indirect relationship between access, cost, and child health outcomes through the mediating variable of complete immunization (Croke et al., 2020; Karra et al., 2017; Herliana & Douiri, 2017; Jejaw et al., 2025). This mechanism suggests that physical and financial barriers can reduce parental compliance with children's immunization schedules, thereby increasing children's health risks.

Furthermore, parents' decisions to vaccinate their children are influenced by multiple factors, including parental knowledge, attitudes, and behaviors, the quality and accessibility of health services, and the role of health workers as trusted sources of information. Social support and health policies, such as free immunization services and immunization cards, also influence immunization coverage rates (Balgovind & Mohammadnezhad, 2022; Fadl et al., 2024). Thus, the endogenous variable of complete immunization reflects not only individual parental decisions but also interactions with structural and social factors, so that IV Probit estimates capture more realistic causal effects than ordinary Probit.

Overall, these results show that complete immunization is an important intervention that causally reduces morbidity, improves nutritional status, and supports optimal child growth, as well as having long-term effects on education and cognitive capacity. The policy implications that can be drawn are the importance of reducing barriers to access to health facilities, for example, by building facilities closer to communities, subsidizing transportation costs, and implementing parent education programs on the benefits of immunization, in order to increase immunization coverage and reduce child health disparities. These findings also reinforce the urgency of immunization as a key strategy for achieving the Sustainable Development Goals related to child health and well-being (UN, 2015; WHO, 2017; Bogler et al., 2019; Pecetta et al., 2019).

Conclusion

This study aims to examine the impact of complete immunization on children's health and morbidity based on their medical history, as well as their growth based on their BMI values. The results show that providing complete immunization to children can reduce the probability of them experiencing illness or other health risks, as well as reduce the probability of them having an unhealthy weight. Furthermore, this study also found that the distance between the nearest health facility and the place of residence, as well as the cost of traveling to the health facility, indirectly affects children's health indicators. Living far from health facilities and the high cost of traveling to them cause parents to neglect their children's immunization needs, which ultimately increases the probability of morbidity and an unhealthy posture, as indicated by BMI values.

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