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Factors related to low birth weight in Indonesia

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ABSTRACT

Introduction: Previous studies have reported that low birth weight (LBW) correlates with neonatal death and 15 - 20% of all births worldwide are LBW. This research aimed to analyse the factors related to LBW in Indonesia. **Methods:** The authors collated secondary data from the 2017 Indonesian Demographic and Health Survey (IDHS). The sample consisted of 17,443 respondents. Besides LBW as the dependent variable, the independent variables consisted of maternal age, residence, wealth, education, employment, marital status, health insurance, antenatal care (ANC) visits, smoking behaviour, and gender of the baby. The final stage employed binary logistic regression. **Results:** Women aged 35-39 years were 0.688 times less likely than women aged 15-19 years to give birth to LBW babies. The wealthiest women were 0.712 times less likely than the poorest women to give birth to LBW babies. Women with higher education levels were 0.670 times less likely to have a LBW baby than women with no education level. Women who attended ≥4 ANC visits were 0.829 times less likely to have LBW babies than women who attended <4 ANC visits. Baby girls were 1.161 times more likely than baby boys to be born with LBW. **Conclusion:** The study concluded that the factors related to LBW in Indonesia were maternal age, wealth, education, ANC, and gender of the baby.

Keywords: antenatal care visit, education level, low birth weight, wealth status, women of reproductive age

INTRODUCTION

The term low birth weight (LBW), as defined by the World Health Organization (WHO), refers to babies born weighing less than 2500 grammes (g). Previous studies have reported that 15-20% of births worldwide are LBW. LBW has become a significant global public health problem associated with short-term and long-term complications. LBW babies need extra nursing care to survive and the risk is higher for smaller babies (Kusrini *et al.*, 2021; UNICEF & WHO, 2019).

Asian and African countries contribute most towards neonatal mortality rate globally, with Indonesia contributing 1-3% (Alifariki, Kusnan & Rangki, 2019). Of the 7000 stillbirths around the world daily, 185 are in

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Indonesia. The neonatal mortality rate in Indonesia is as high as 15/1000 live births. Three-quarters of Indonesia's neonatal deaths occur in the first week and as many as 40% died within the first 24 hours. Neonatal deaths are strongly correlated with the quality of labour and delivery, as well as non-optimal neonatal care (Achadi, 2019). LBW is also correlated with neonatal deaths (Vilanova *et al.,* 2019).

Usually, we find LBW babies being born with unfavourable conditions, unlike an average newborn baby. LBW babies are associated with asphyxia, recurring apnoea, hypothermia, hypoglycaemia, icterus, and a longer intensive care period at the hospital (Chidiebere *et al.,* 2018). A meta-analysis reported that children born with LBW tend to have more significant cognitive and motoric impairments than normal newborn babies (Upadhyay *et al.,* 2019). LBW has a complex impact on baby's growth and development, not only during delivery in terms of complications, but also in relation to long-term implications. LBW babies need optimal intensive care management, which includes oxygen maintenance, warm room temperature maintenance, minimising infection, breastfeeding, bonding, and relaxing (WHO, 2011).

A previous study found that there are several conditions that cause LBW, whereby ten conditions are associated with pregnancy and labour preparation. The first condition is the women's age during pregnancy (Siramaneerat, Agushybana & Meebunmak, 2018). The women's age is correlated to the reproduction system, which supports the foetus and its development. It is associated with the women's readiness to give birth and self-care during pregnancy. The second condition is the mother's place of residence. This relates to environmental air pollutant exposure which affects mother and foetal health. Third is wealth status that is associated with the mother's purchasing power, enabling her to fulfil her nutritional needs during pregnancy for the purpose of foetal health. Fourth is education level (Siramaneerat *et al.,* 2018), which correlates with the mother's knowledge concerning health care during pregnancy and foetal health. A knowledgeable mother is expected to have healthy habits. Fifth, the mother's employment status is associated with the mother's burden increment during pregnancy, which in turn will affect both pregnancy and foetal health (Laksono *et al.,* 2021). Sixth, marital status, which correlates to whether there is an unwanted pregnancy within or outside of the marriage. An unwanted pregnancy affects the mother's mental and foetal health (Tang *et al.,* 2017). Seventh, health insurance ownership correlates to the mother's opportunity to access good healthcare services. Eighth is ANC visit (Ngwira, 2019), which relates to the mother's chance of having good pregnancy health care and early detection of any pregnancy risk factors. Ninth is smoking behaviour, which is correlated to air pollutant exposure by cigarette smoke, affecting the mother's health as well as foetal health. Tenth, the gender of the foetus that is associated with the tendency of baby boys or baby girls being born with LBW (Ngwira, 2019). Based on the brief background above, this research aimed to analyse the factors related to LBW in Indonesia.

MATERIAL AND METHODS

The authors collated secondary data from the 2017 Indonesian Demographic and Health Survey (IDHS). The 2017 IDHS is a nationwide cross-sectional survey conducted by Statistics Indonesia, the Indonesian Agency of National Population and Family Planning, and the Indonesia Ministry of Health.

The study population included women of reproductive age (15-49 years old) who had given birth in Indonesia in the last five years and who had birth

weight reports available, either written records or maternal memories. The data for this research were collected using two-step stratified multistage random sampling. The sample consisted of 17,443 respondents.

The dependent variable in this research was LBW. Meanwhile, the independent variables were maternal/ household characteristics (age, residence, wealth status, education level, employment status, marital status, health insurance ownership, ANC visits, and smoking behaviour) and individual baby's characteristics (gender).

The term LBW defined in this manuscript refers to the Statistics Indonesia's category of babies who were born weighing less than 2500 g. The maternal age group of 15-49 years old consisted of seven groups. The types of residence consisted of urban and rural groups, as determined by Statistics Indonesia.

The 2017 IDHS used the wealth index computation of the survey to assess wealth status. Wealth status consisted of five categories: the poorest, poorer, middle, richer, and the richest. The wealth index was a composite assessment of a household's whole level of life. The 2017 IDHS produced the wealth index using simple data on a household's possession of certain goods, such as television and bicycle; the building materials used in housing construction; and the type of water access and sanitation services (Wulandari *et al.*, 2019).

The study determined the respondents' education level by acknowledging the most recent diplomas. Education level consisted of four groups: no education, primary, secondary, and higher. On the other hand, employment status referred to the mother's current job. Employment status consisted of two groups, namely unemployed and employed. Marital status consisted of three groups: never in a union, married/ living with a partner, and widowed/ divorced. Health insurance ownership consisted of two groups: uninsured and insured.

On the other hand, ANC was the total ANC visit attendance. ANC consisted of <4 ANC visits and ≥4 ANC visits. Smoking behaviour of the mother consisted of two types: non-smoker and smoker. Finally, the gender of the baby consisted of two groups: boy and girl.

In this research, the researcher analysed the data using a two-step analysis. First, we conducted a chi-square bivariate test because all of the variables were in a state of dichotomy. Second, we performed the multivariate test using binary logistic regression to determine the LBW determinants in Indonesia.

The 2017 IDHS adhered to the Standard DHS survey procedure under The Demographic and Health Surveys (DHS) Programme (DHS-7) authorised by ICF International's Institutional Review Board. This had been evaluated initially and approved by the ORC Macro IRB 2002. The DHS-7 Programme supported the DHS surveys that adhered to the Standard, including the approval paperwork. ICF International's Institutional Review Board follows the US Department of Health and Human Services criteria for "Protection of Human Subjects" (45 CFR 46).

RESULTS

Table 1 presents an overview of LBW in Indonesia. The results show that the national average for newborns with low birth weight is 13.6%. The teenage group (15-19 years) has the highest proportion of babies born with low birth weight. Moreover, women in rural residences were more likely to birth LBW babies than those in urban areas.

The lowest wealth status women gave birth to the most LBW babies, and women with no education gave birth to the most LBW babies as well. More unemployed women had LBW babies than employed women. Meanwhile,

Table 1. Descriptive statistics of LBW in Indonesia (n 17,443)

Characteristics	All n (%)	Low birth weight, n (%)		p-value
		No	Yes	
Maternal age				
15-19 years	424 (2.4)	344 (81.1)	80 (18.9)	0.003**
20-24 years	2740 (15.7)	2334 (85.2)	406 (14.8)	
25-29 years	4484 (25.7)	3873 (86.4)	611 (13.6)	
30-34 years	4618 (26.5)	4031 (87.3)	587 (12.7)	
35-39 years	3425 (19.6)	2990 (87.3)	435 (12.7)	
40-44 years	1446 (8.3)	1238 (85.6)	208 (14.4)	
45-49 years	306 (1.8)	260 (85.0)	46 (15.0)	
Place of residence				
Urban	8671 (49.7)	7528 (86.8)	1143 (13.2)	0.055
Rural	8772 (50.3)	7542 (86.0)	1230 (14.0)	
Wealth status				
Poorest	4690 (26.9)	3921 (83.6)	769 (16.4)	<0.001***
Poorer	3433 (19.7)	2949 (85.9)	484 (14.1)	
Middle	3221 (18.5)	2795 (86.8)	426 (13.2)	
Richer	3109 (17.8)	2724 (87.6)	385 (12.4)	
Richest	2990 (17.1)	2681 (89.7)	309 (10.3)	
Education level				
No education	244 (1.4)	199 (81.6)	45 (18.4)	<0.001***
Primary	4268 (24.5)	3591 (84.1)	677 (15.9)	
Secondary	9753 (55.9)	8431 (86.4)	1322 (13.6)	
Higher	3178 (18.2)	2849 (89.6)	329 (10.4)	
Employment status				
Unemployed	9281 (53.2)	7966 (85.8)	1315 (14.2)	0.020*
Employed	8162 (46.8)	7104 (87.0)	1058 (13.0)	
Marital status				
Never in a union	28 (0.1)	22 (78.6)	6 (21.4)	0.104
Married/living with partner	16896 (96.9)	14613 (86.5)	2283 (13.5)	
Widowed/divorced	519 (3.0)	435 (83.8)	84 (16.2)	
Health insurance				
Uninsured	6553 (37.6)	5683 (86.7)	870 (13.3)	0.327
Insured	10890 (62.4)	9387 (86.2)	1503 (13.8)	
ANC visits				
<4 times	3972 (22.8)	3339 (84.1)	633 (15.9)	<0.001***
≥4 times	13471 (77.2)	11731 (87.1)	1740 (12.9)	
Smoking behaviour				
No	17144 (98.3)	14812 (86.4)	2332 (13.6)	0.956
Yes	299 (1.7)	258 (86.3)	41 (13.7)	
Baby's gender				
Male	8993 (51.6)	7845 (87.2)	1148 (12.8)	0.001**
Female	8450 (48.4)	7225 (85.5)	1225 (14.5)	

Note: Chi-square test; *$p<0.05$; **$p<0.01$; ***$p<0.001$

women who were never in a union were also found to be prevalent in giving birth to LBW babies. However, women with insurance ownership had higher prevalence of giving birth to LBW babies than women who did not have insurance. The percentage of LBW was higher for women who attended <4 ANC visits. The proportion of LBW babies born from a smoker and non-smoker mother seemed almost equal; whereas there were more baby girls who were born with LBW than baby boys. Age, wealth status, education level, employment status, ANC visits, and gender were statistically significantly correlated with LBW occurrence in Indonesia.

Table 2 shows the logistic binary regression test results for LBW occurrence. The reference in this research was the non-occurrence of LBW. The analysis results showed that women in the 15-19 years age group had the highest chance of giving birth to LBW in Indonesia. As shown in Table 2, women in the 25-29 years age group

Table 2. Binary logistic regression for low birth weight in Indonesia (n=17,443)

Determinants	*Low birth weight*			*p-value*
	OR	*95% CI*		
		Lower bound	*Upper bound*	
Maternal age				
15-19 years	-	-	-	-
20-24 years	0.788	0.604	1.029	0.080
25-29 years	0.754	0.581	0.978	0.033*
30-34 years	0.699	0.539	0.908	0.007**
35-39 years	0.688	0.527	0.898	0.006**
40-44 years	0.780	0.585	1.041	0.091
45-49 years	0.805	0.539	1.203	0.290
Wealth status				
Poorest	-	-	-	-
Poorer	0.889	0.784	1.008	0.067
Middle	0.848	0.743	0.968	0.015*
Richer	0.821	0.713	0.944	0.006**
Richest	0.712	0.609	0.833	<0.001***
Education				
No education	-	-	-	-
Primary	0.915	0.652	1.283	0.606
Secondary	0.814	0.580	1.142	0.233
Higher	0.670	0.469	0.958	0.028*
Employment				
Unemployed	-	-	-	-
Employed	0.973	0.888	1.065	0.552
ANC visits				
<4 times	-	-	-	-
≥4 times	0.829	0.749	0.917	<0.001***
Baby's gender				
Girl	1.161	1.065	1.267	0.001**
Boy	-	-	-	-

Note: *p<0.05; **p<0.01; ***p<0.001

were 0.754 times less likely than those in the 15-19 years age group to give birth to LBW babies (OR 0.754; 95% CI 0.581-0.978). Moreover, the 35-39 years age group women were 0.688 less likely than those in the 15-19 years age group to give birth to LBW babies (OR 0.688; 95% CI 0.527-0.898).

Table 2 presents that wealth status was one of the predictors of LBW occurrence. Women of the middle wealth status were 0.848 times less likely than the most deficient women to give birth to LBW babies (OR=0.848; 95% CI 0.743-0.968). The wealthiest women were 0.712 times less likely than the most impoverished women to give birth to LBW babies (OR=0.712; 95% CI 0.609-0.833). The analysis results found that the poorer the women, the more extraordinary the LBW occurrence.

Based on education level, women with higher education were 0.670 times less likely than women with no education to give birth to LBW babies (OR=0.670; 95% CI 0.469-0.958). This analysis result showed that women with the highest education were the least likely to give birth to LBW babies (OR=0.670; 95% CI 0.469-0.958).

Based on ANC visit attendance, women who attended ≥4 ANC visits were 0.829 times less likely than those who attended <4 ANC visits to give birth to LBW babies (OR=0.829; 95% CI 0.749-0.917). Furthermore, baby girls were 1.161 times more likely than baby boys to be born with LBW (OR=1.161; 95% CI 1.065-1.267).

DISCUSSION

This research has confirmed that age is an important factor that could lead to LBW occurrence in Indonesia. Women in the 15-19 years age group were the most likely to give birth to LBW in Indonesia; indicating that women who are too young (i.e. teenagers) during pregnancy, are more likely to have LBW babies. This finding is consistent with the data obtained in a previous study that found that age influences Indonesia's LBW occurrence (Siramaneerat *et al.*, 2018). Previous research in China also found that a young maternal age influences LBW occurrence (Tang *et al.*, 2017).

This current research found that the wealth status variable was correlated to LBW occurrence in Indonesia. Previous studies also found that women with the most deficient wealth status were correlated with LBW babies (Mahumud, Sultana & Sarker, 2017). Wealth status is associated with food purchasing power and nutritional fulfilment during pregnancy. Pregnant women who cannot afford nutritional dignity are at risk of malnutrition (He *et al.*, 2018). Poverty, an insufficiency when purchasing food, and a lack of high dietary foods during pregnancy influences foetal development, resulting in LBW babies.

Another important finding in this research was that education level was correlated to LBW occurrence in Indonesia. This finding is similar to a previous study that found that lower educational status is associated with LBW babies. A previous study showed that illiteracy predicts LBW occurrence in developing countries (Siramaneerat *et al.*, 2018). Moreover, a better level of education is often reported as a positive determinant to achieve better health outcomes (Megatsari *et al.*, 2020; Wulandari & Laksono, 2020); whereas a low level of education is a barrier to good performance (Laksono & Wulandari, 2022; Masruroh *et al.*, 2021; Rohmah *et al.*, 2020).

This research also found that women with fewer ANC visits were more likely to have an LBW occurrence. These results are similar to a previous study finding which showed that antenatal care visits are correlated with LBW (Tang *et al.*, 2017). Ngwira in Malawi in South Africa has also shown that the lack of ANC visits correlates with LBW frequency. ANC visits are connected to pregnancy

care and early detection of pregnancy complications (Ngwira, 2019), thus beneficial in reducing LBW occurrence.

According to this study, baby girls were more likely than baby boys to be born with LBW. This finding contradicts previous studies conducted in Pakistan and Japan, which suggested that baby boys were more likely than baby girls to be born with LBW (Ghouse & Zaid, 2016; Arima *et al.*, 2017).

This study has shown that poverty and a lack of ANC visits had a suggestive role in promoting LBW occurrence. However, ANC visits were found to be more beneficial than wealth status at preventing LBW in Indonesia. Women of reproductive age the wealthiest group but attending <4 ANC visits were more likely to have LBW babies than those attending ≥4 ANC visits. This is because ANC visits provide an insight into maternal health, advice, medical treatment, and nutritional supplements (Denny *et al.*, 2022; Wulandari *et al.*, 2021).

In this research, education level was also found to be more beneficial than employment status when controlling LBW occurrence. The study found that unemployed women with higher education levels were less likely to have LBW babies. Education is beneficial to health because teaching is a motivational opportunity to live healthily. Education can increase the women's skills and give them a chance to live a healthy life (Pakaya *et al.*, 2022). Women with a higher education level are more likely to have a healthier pregnancy and therefore less likely to encounter the risk of having LBW babies (Laksono *et al.*, 2021; Rohmah *et al.*, 2020).

This study was conducted using a quantitative approach, thus results obtained were superficial. This study cannot explain the phenomena obtained from previous studies such as the value of children and family values, including dietary restrictions for pregnant and lactating women (Kusrini, Ipa & Laksono, 2019; Laksono *et al.*, 2020).

CONCLUSION

Five factors related to LBW in Indonesia were determined in this study: maternal age, wealth status, education level, ANC visits, and gender of the baby. This study implies that it can provide specific targets for policy makers if they want to accelerate the reduction of LBW in Indonesia. These targets are young women, prospective brides, and pregnant women who are poor and have a low education level. On the other hand, policy makers need to encourage a policy for complete ANC visits among pregnant women because it has been proven to reduce the risk of LBW.

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Authors' contributions

NR, principal investigator, conceptualised and designed the study, prepared the draft of the manuscript and reviewed the manuscript; MM, prepared the draft of the manuscript and reviewed the manuscript; NBM, led the data collection, advised on the data analysis and interpretation, and reviewed the manuscript; NP, led the data collection, advised on the data analysis and interpretation, and reviewed the manuscript; JP, conducted the study, data analysis and interpretation; SW, conducted the study, data analysis and interpretation; ADL, assisted in drafting of the manuscript and reviewed the manuscript.

Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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