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Determinants of Low Birth Weight in Indonesia (IFLS 5 Data Analysis)

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Abstract

Background: LBW is a condition where babies are born with a body weight of less than 2500 gr. In 2020, as many as 19.8 million babies (14.7%) of all babies born in the world experienced low birthweight. Based on data from the Maternal and Child Health Profile, the prevalence of LBW in Indonesia from 2020 to 2022 has increased. This study aims to know the determinants of LBW events with IFLS data.
Methods: The type of research used was quantitative observational analytic using a cross sectional design, with the data source used was IFLS 5 in 2014.
Results: The results showed that after controlling for other variables, the variables associated with LBW events were the number of ANC visits (p = 0.024), the number of children (p = 0.004), hypertension (p = 0.046), CED (p=0.003), pregnancy complications (p=0.003), and education (p=<0.001).
Conclusions: Mothers who have visited ANC <6 times, have a >2 child, are diagnosed with hypertension by a doctor, have CED, experience pregnancy complications, and take compulsory education <12 years have a greater chance of giving birth to a LBW baby. The advice for the education office is to ensure that every woman has been educated for at least 12 years to prevent low birth weight.

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INTRODUCTION

In 2020, as many as 19.8 million babies or around 14.7% of all babies born in the world experienced low birthweight (LBW). Of the 19.8 million LBW babies in the world, almost two are born in Asia (11.8 million LBW babies). LBW cases in Indonesia are around 5-10% and rank sixth among countries in Southeast Asia (UNICEF-WHO, 2023). Based on 2013 Riskesdas data, the prevalence of LBW in Indonesia is 10.2%. Meanwhile, based on Riskesdas 2018 data, the prevalence of low weight in Indonesia is 6.2% (Kemenkes, 2019). Data on the 2022 Maternal and Child Health Profile reported that the percentage of mothers who gave birth to children born alive with LBW was 11.37% in 2020, 12.27% in 2021, and 12.58% in 2022 (Badan Pusat Statistik, 2022). Based on these data, it can be seen that there has been an increase in the prevalence of LBW from 2020 to 2022.

One of the causes of stunting in Indonesia is LBW (Aryastami et al., 2017; Lestari et al., 2018). Based on research in Pakistan, found that LBW is the main cause of failure to thrive in babies younger than three years old (Avana et al., 2014). In line with this, research in Wuhan China also showed that babies with LBW are at risk of experiencing delays in gross motor development, fine motor and adaptability (Zhang et al., 2020). Other studies also state that children who have a history of LBW are at greater risk of gross motor development problems compared to children who have a history of normal birth weight (Anggorowati et al., 2021). The situation is aggravated if LBW babies do not get enough energy and nutritional intake. Babies with LBW also have a higher risk of jaundice and death (Puspita, 2018). This suggests that birth weight is important and an indicator of susceptibility to disease risk and child survival (Bekela et al., 2020; Sabbaghchi et al., 2020). In addition, LBW is one of the factors that increase the risk of chronic diseases in adulthood. Some of the reported conditions affected by LBW are cardiovascular disease, diabetes, and hypertension (Knop et al., 2018). In addition, the cause of the most neonatal deaths in 2021 in Indonesia is the low weight condition, which is 34.5% (Kemenkes RI, 2022).

Previous research stated that the incidence of LBW is influenced by various factors, both internal and external factors of the mother (Burhan et al., 2022; Falcão et al., 2020). Based on previous research, there is a relationship between maternal age, number of children, pregnancy complications, and the sex of the baby with the incidence of LBW (Dhirah et al., 2021; Srimiyati & Ajul, 2021). Previous research has suggested that there is an association between maternal education, ANC visits, pregnancy complications, and TTD administration and the incidence of LBW (Oktriyanto et al., 2022; Suciati et al., 2023). Based on previous research, blood pressure measurement and Hb measurement are associated with LBW events (Nur et al., 2016). Previous research stated that there is a relationship between anemia and the incidence of LBW (Figueiredo et al., 2019; Wahyuni et al., 2021). Based on previous research, CED in mothers is associated with the incidence of LBW (Fatimah & Yuliani, 2019). Previous research has suggested that there is a relationship between residence and LBW incidence (Sohibien & Yuhan, 2019). Based on previous research, there is a relationship between tuberculosis and the incidence of LBW (Sobhy et al., 2017). Previous research stated that there is a relationship between hypertension and the incidence of LBW (Agustin & Afrika, 2022). Other studies also state that there is a relationship between diabetes and the incidence of LBW (Moise et al., 2017).

What distinguishes this study from previous studies is the use of IFLS 5 data. Researchers also updated by using calculations to predict the probability of LBW events. This study aims to determine the determinants of LBW events based on IFLS 5 data and also to calculate the probability of LBW events.

METHODS

This research has been approved by the Research Ethics Committee of Universitas Negeri Semarang with Number 421/ KEPK/EC/2023. This study is an analytical observational quantitative study using a cross sectional design due to analyze the relationship between independent and dependent variables at one time. The study was conducted in Indonesia using data from Indonesia Family

Life Survey (IFLS) 5. IFLS 5 data was collected from October 2014 to April 2015, while researchers used IFLS data from September to October 2023.

The variable tied to this study is the incidence of LBW which is categorized into two, namely "yes (birth weight <2500 grams)" and "no (birth weight ≥2500 grams)". The independent variables in this study included the sex of the baby categorized into "male" and "female", the provision of TTD of pregnant women categorized into "no" and "yes", the age of the mother at childbirth which was categorized into "risky" and "not at risk", the number of ANC visits categorized into "<6 times" and "≥6 times", the number of children categorized into "> 2" and "≤2", diagnosis of hypertension, diagnosis of diabetes, diagnosis of tuberculosis, CED, anemia, pregnancy complications, Hb tests, blood pressure tests categorized into "yes" and "no", residences categorized into "rural" and "urban", and maternal education categorized into "compulsory education <12 years" and "compulsory education 12 years or higher".

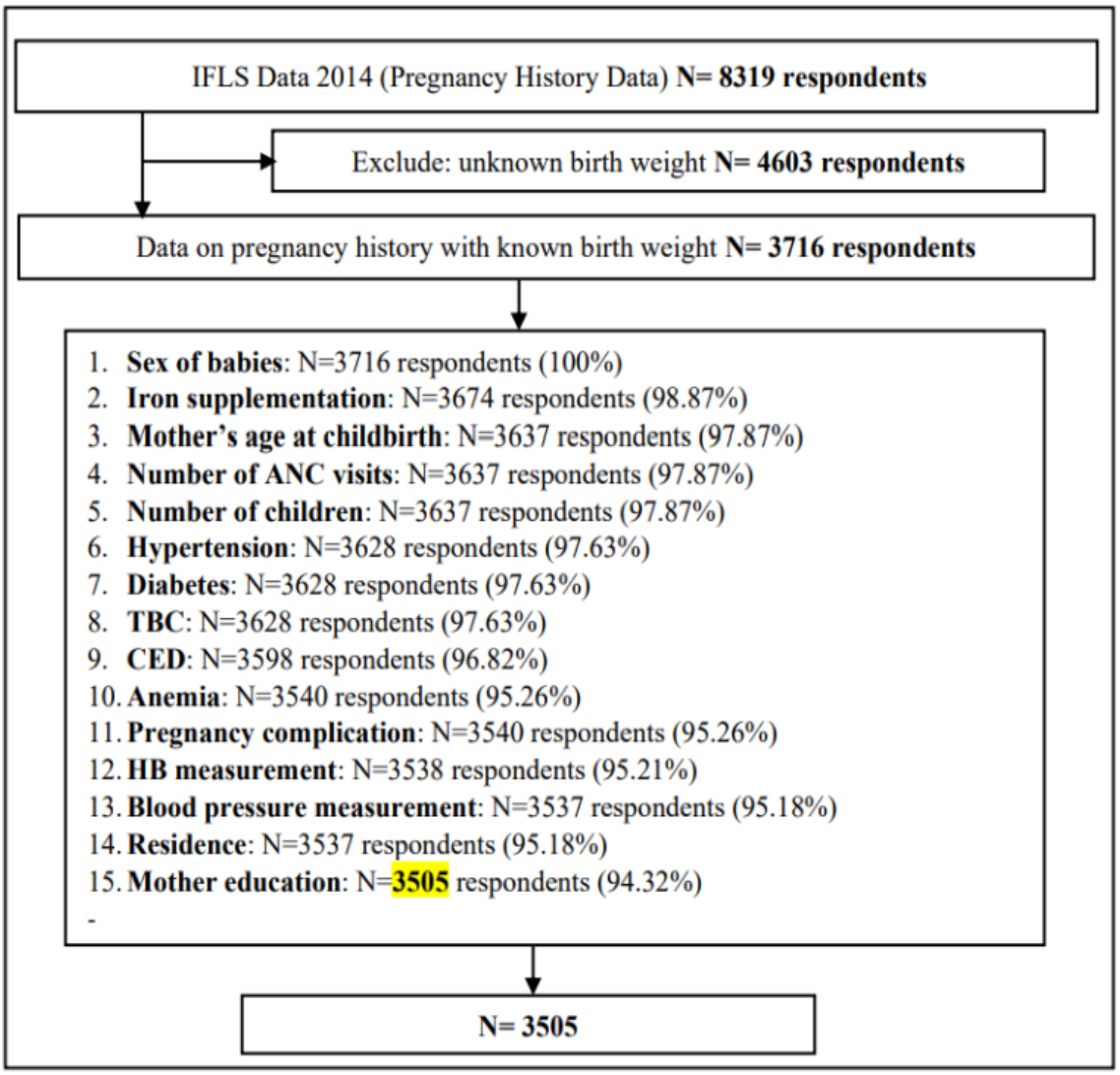

Figure 1. Flowchart IFLS 5 Data Respondents

RESULTS AND DISCUSSIONS

Univariate analysis is performed to describe the characteristics of each variable.

Table 1. Univariate Analysis Result

Variable	Frequency (N)	Percentage (%)
LBW		
Yes	314	9
No	3191	91
Sex of babies		
Male	1815	51,8
Female	1690	48,2
Iron Supplementation		
No	502	14,3
Yes	3003	85,7
Mother's age at childbirth		
Risk	680	19,4
No risk	2825	80,6
Number of ANC visit		
<6 times	331	9,4
≥6 times	3174	90,6
Number of children		
>2	26	0,7
≤2	3479	99,3
Hypertension		
Yes	285	8,1
No	3220	91,9
Diabetes		
Yes	18	0,5
No	3487	99,5
TBC		
Yes	27	0,8
No	3478	99,2
CED (Chronic Energy Deficiency)		
Yes	261	7,4
No	3244	92,6
Anemia		
Yes	1081	30,8
No	2424	69,2
Pregnancy Complication		
Yes	797	22,7
No	2708	77,3
Hb Measurement		
No	1810	51,6
Yes	1695	48,4
Blood Pressure Measurement		
No	97	2,8
Yes	3408	97,2
Residence		
Rural	1458	41,6
Urban	2047	58,4
Mother Education		
Compulsory education <12 years	1667	47,6
Compulsory education of 12 years or higher	1838	52,4

Based on the results of univariate analysis contained in Table 1, it can be seen that as many as 314 respondents (9%) gave birth weight babies with LBW, while as many as 3191 respondents (91%) gave birth weight babies with normal birth weight. A total of 1815 respondents (51.8%) gave birth to a baby boy, while 1690 respondents (48.2%) gave birth to a baby girl. A total of 502 respondents (14.3%) were not given iron supplementation during pregnancy, 680 respondents (19.4%) gave birth at a risk age (<20 years or >35 years), there were 331 respondents (9.4%) who visited ANC <6 times, there were 26 respondents (0.7%) who had children >2. In the history of maternal disease based on a doctor's diagnosis, as many as 285 respondents (8.1%) suffered from hypertension, 18 respondents (0.5%) suffered from diabetes, and 27 respondents (0.8%) suffered from tuberculosis. There were 261 respondents (7.4%) who experienced CED (BMI <18.5 kg/m2), as many as 1081 respondents (30.8%) had anemia (Hb<12 g / dl), as many as 797 respondents (22.7%) experienced pregnancy complications. for measurement up during pregnancy, as many as 1810 respondents (51.6%) did not have HB measurements, and there were 97 respondents (2.8%) did not have blood pressure measurements. Based on the area of residence, as many as 1458 respondents (41.6%) live in rural areas, while 2047 respondents (58.4%) live in urban areas. Based on education level, there were 1667 respondents (47.6%) Compulsory education is <12 years, while 1838 respondents (52.4%) have compulsory education for 12 years or higher.

The bivariate test used in this study is the chi square test if qualified, if not qualified then use an alternative test, namely fisher exact. Based on the results of bivariate analysis contained in Table 2, out of 15 variables, there are 7 variables related to LBW events. Variables related to LBW are maternal age at childbirth (p value 0.009), number of ANC visits (p value 0.009), number of children (p value 0.006), hypertension (0.031), CED (p value 0.006), pregnancy complications (p value 0.003), and education (p value 0.001). Variables that are not related to the incidence of LBW because it has a p value of >0.05 are the sex of the baby, iron suplementation, diabetes, tuberculosis, anemia, hb measurement, blood pressure measurement, and place of residence.

In the variable age of mothers at childbirth, having PR = 1.397 which means that mothers who give birth at risk age (<20 years or >35 years) have a 1.397 times greater chance of giving birth to babies with LBW compared to mothers who give birth at an age not at risk. This study is in line with previous research conducted by (Adawiyah et al., 2021) which stated that age is significantly associated with LBW. Mothers who give birth at the age of <20 or >35 years are at greater risk of giving birth to LBW babies because at the age of <20 years the reproductive organs are immature and not functioning optimally because they are still in their growth period and will interfere with fetal growth. While mothers who give birth at the age of >35 years there is a decrease in biological functions in the organs of the body, one of which is a decrease in intestinal mobility which causes a decrease in appetite, which will affect the nutritional intake of the mother and fetus (Setiati & Rahayu, 2017).

In the variable number of ANC visits has PR = 1.522 which means that mothers whose number of ANC visits are <6 times have a 1.522 times greater chance of giving birth to LBW babies compared to mothers whose number of ANC visits is ≥6 times. This research is in line with previous research conducted by (Damayanti et al., 2022) which stated that there is a relationship between the number of ANC visits and the incidence of low birthweight. ANC aims to monitor the health of the mother and fetus regularly, so that if the ANC visit is not in accordance with the established standards, it will affect the health of the mother and fetus, there by increasing the possibility of LBW (Adam et al., 2019).

Tabel 2. Bivariat Analysis Result

Variabel	LBW				P Value	PR (95% CI)
	Yes		No			
	N	%	n	%		
Sex of babies						
Male	151	8,3	1664	91,7	0,189	0,863 (0,698 - 1,065)
Female	163	9,6	1527	90,4		
Iron Supplementation						
No	48	9,6	454	90,4	0,670	1,079 (0,806 - 1,446)
Yes	266	8,9	2737	91,1		
Mother's age at childbirth						
Risk	79	11,6	601	88,4	0,009*	1,397 (1,098 - 1,777)
No risk	235	8,3	2590	91,7		
Number of ANC visit						
<6 times	43	13	288	87	0,009*	1,522 (1,126 - 2,056)
≥6 times	271	8,5	2903	91,5		
Number of children**						
>2	7	26,9	19	73,1	0,006*	3,051 (1,605 - 5,799)
≤2	307	8,8	3172	91,2		
Hypertension						
Yes	36	12,6	249	87,4	0,031*	1,463 (1,057 - 2,026)
No	278	8,6	2942	91,4		
Diabetes**						
Yes	1	2,6	17	94,4	1	0,619 (0,092 - 4,170)
No	313	9	3174	91		
TBC**						
Yes	5	18,5	22	81,5	0,088	2,084 (0,938 - 4,631)
No	309	8,9	3169	91,1		
CED (Chronic Energy Deficiency)						
Yes	36	13,8	225	86,2	0,006*	1,610 (1,165 - 2,224)
No	278	8,6	2966	91,4		
Anemia						
Yes	98	9,1	983	90,9	0,933	1,017 (0,810 - 1,278)
No	216	8,9	2208	91,1		
Pregnancy Complication						
Yes	93	11,7	704	88,3	0,003*	1,430 (1,137 - 1,798)
No	221	8,2	2487	91,8		
Hb Measurement						
No	157	8,7	1653	91,3	0,582	0,936 (0,758 - 1,157)
Yes	157	9,3	1538	90,7		
Blood Pressure Measurement						
No	9	9,3	88	90,7	1	1,037 (0,551 - 1,949)
Yes	305	8,9	3103	91,1		
Residence						
Rural	136	9,3	1322	90,7	0,558	1,073 (0,867 - 1,327)
Urban	178	8,7	1869	91,3		
Mother Education						
Compulsory education <12 years	179	10,7	1488	89,3	0,001*	1,462 (1,181 -1,810)
Compulsory education of 12 years or higher	135	7,3	1703	92,7		

*= *p value <0,05;* **=*Uji Fisher Exact*

The variable number of children has PR=3,051 which means that, mothers who have the number of children >2 have a 3,051 times greater chance of giving birth to LBW babies compared to mothers who have children ≤2. This study is in line with previous research conducted by (Handayani et al., 2019) which stated that there is a relationship between the number of children and the incidence of low birthweight. The large number of children will have an impact on the emergence of health problems for mothers and also babies who will be born. Repeated pregnancy and childbirth will cause damage to blood vessels in the uterine wall and reduced elasticity of tissue that has been repeatedly stretched during pregnancy so that fetal growth abnormalities tend to arise which results in babies born with LBW (Nurseha & Berlannov, 2017).

The hypertension variable has PR = 1.463 which means that mothers diagnosed by doctors with hypertension have a 1.463 times greater chance of giving birth to LBW babies compared to mothers who are not diagnosed with hypertension by doctors. This study is in line with previous research conducted by (Agustin & Afrika, 2022) which stated that there is a relationship between hypertension and the incidence of low birthweight. Hypertensive mothers are at risk of giving birth weight babies because in people with hypertension there will be a decrease in blood flow in the mother's body, where it will interfere with the supply of oxygen and nutrients to the fetus which will cause organizational disorders in the fetus (Setiati & Rahayu, 2017).

The CED variable has PR = 1.610 which means that mothers with CED conditions have a 1.610 times greater chance of giving birth to LBW babies compared to mothers who are not CED. This research is in line with previous research conducted by (Damayanti et al., 2022) which stated that there is a relationship between CED and LBW. CED in pregnant women can cause the size of the placenta to become smaller so that the transfer of oxygen and nutrients to the fetus is reduced, this will have an impact on the occurrence of LBW (Inpresari & Pertiwi, 2020).

The pregnancy complications variable has PR = 1,430 which means that mothers who experience pregnancy complications have a 1,430 times greater chance of giving birth to LBW babies compared to mothers who do not experience pregnancy complications. This study is in line with previous research conducted by (Kujariningrum et al., 2023) which stated that there is a relationship between pregnancy complications and the incidence of low birthweight. Mothers who experience pregnancy complications will affect maternal health and interfere with fetal growth in the womb (Manurung & Helda, 2021).

The education variable has PR = 1,462 which means that mothers who take compulsory education <12 years have a 1,462 times greater chance of giving birth to LBW babies compared to mothers who take compulsory education 12 years or higher. The results of this study are in line with previous research conducted by (Safitri et al., 2022) which stated that there is a significant relationship between maternal education and the incidence of low birthweight. The level of education affects the knowledge and mindset possessed by the mother. Mothers who have higher education will have a better mindset and knowledge, and have a good awareness of health, one of which is about exclusive breastfeeding (Falcão et al., 2020; Rini & Trisna, 2012). Mothers with higher education will have a greater tendency to practice exclusive breastfeeding compared to mothers who have low education (Raharjo, 2014). Another study states that maternal education is one of the determining factors for stunting (Nugroho et al., 2023).

The sex variable of the baby was not associated with the incidence of low birthweight. This is in line with previous research conducted by (Oktriyanto et al., 2022) which stated that there was no relationship between the sex of the baby and the incidence of low birthweight. The mechanism by which a baby's sex affects birth weight remains unclear. On average, male babies are born 150 grams heavier than female babies, but male babies tend to be born less months than female babies (Elshibly & Schmalisch, 2008).

The variable iron suplementation is not associated with the LBW event. This is in line with previous research conducted by (Oktriyanto et al., 2022) which stated

that there was no relationship between iron suplementation and the incidence of low birthweight.

The TB variable is not associated with LBW events. Based on research from (Yusuf & Sari, 2018) mothers suffering from TB can have an impact on perinatal complications such as small fetal size for pregnancy so that it makes LBW. Pregnant women with active TB have a smaller risk of fetal size, low weight, risk of bleeding, and even miscarriage (Kementerian Kesehatan RI, 2023). In this study there was no relationship between TB and low weight, this was because respondents were diagnosed with TB not during pregnancy, so TB did not affect low birthweight.

Variable anemia is not related to low weight. This is in line with research (Damayanti et al., 2022) which states that there is no relationship between anemia and low weight. In this study anemia is not the main factor in the incidence of low birthweight, the incidence of LBW can be influenced by other factors such as maternal age, number of children, number of ANC visits, and pregnancy complications.

Variable Hb measurement and blood pressure measurement during pregnancy are not associated with the incidence of low birthweight. Blood pressure and hb measurements during pregnancy are part of the ANC examination which is important to monitor the health of mothers and babies (Adam et al., 2019). However, in this study, hb and blood pressure tests during pregnancy were not related to the incidence of LBW because it was not the main factor determining low birthweight. There are other factors that are more influential such as maternal age, pregnancy complications, number of children, and maternal education.

The residence variable has no effect on the LBW event. This is not in line with research (Yuwana et al., 2022) which states that residence is related to LBW events. In theory, residence affects the incidence of LBW because it is related to ease of access to health services. However, in this study the place of residence did not affect the incidence of LBW because it is likely that access to health services in rural areas is also good and also easier.

Furthermore, multivariate analysis was carried out using logistic regression tests. Logistic regression tests were carried out on variables that had p values <0.25 with the aim of determining the variables that most influenced the incidence of LBW. Based on the results of the multivariate analysis contained in Table 3, it can be seen that the variables that most influence the incidence of LBW are the number of ANC visits, the number of children, hypertension, CED, pregnancy complications, and education. The variable number of ANC visits has a value of OR=1,494 which means that after controlling for other variables, mothers whose number of ANC visits <6 times risked giving birth to LBW babies compared to mothers who made ANC visits ≥6 times. The variable number of children has a value of OR=3,743 which means that after controlling for other variables, mothers who have the number of children >2 have a 3,743 times greater risk of giving birth to LBW babies compared to mothers who have LBW compared to mothers who Have a ≤2. The hypertension variable has a value of OR=1,466 which means that after controlling for other variables, mothers diagnosed with hypertension by a doctor have a 1,466 times greater risk of giving birth to LBW babies compared to mothers who are not diagnosed with hypertension by a doctor. The CED variable has a value of OR=1,764 which means that after controlling for other variables, mothers who experience CED have a 1,764 times greater risk of giving birth to LBW babies compared to mothers who do not experience CED. The pregnancy complications variable has a value of OR=1,480 which means that after controlling for other variables, mothers who experience pregnancy complications have a 1,480 greater risk of giving birth to LBW babies compared to mothers who do not experience pregnancy complications. The education variable has a value of OR=1,549 which means that after controlling for other variables, mothers who take compulsory education <12 years have a risk of giving birth to LBW babies compared to mothers who take compulsory education for 12 years or more.

Table 3. Multivariat Analysis Results

Variable	B	Wald	P Value	OR (CI 95%)
Number of ANC Visit	0,401	5,098	0,024	1,494 (1,054 - 2,116)
Number of Children	1,320	8,482	0,004	3,743 (1,540 - 9,100)
Hypertension	0,383	3,965	0,046	1,466 (1,006 - 2,137)
CED	0,568	8,688	0,003	1,764 (1,209 - 2,573)
Pregnancy Complications	0,392	8,756	0,003	1,480 (1,142 - 1,920)
Mother Education	0,438	13,223	<0,001	1,549 (1,224 - 1,961)
Constant	-2,796	705,745	<0,001	0,061

Based on the results of logistic regression, the regression equation can be formulated as follows:

y= -2,796+ 0,401 (number of ANC visits < 6 times) + 1,320 (number of children >2) + 0,383 (diagnosed with hypertension) + 0,568 (CED) + 0,392 (pregnancy complications) + 0,438 (compulsory education <12 years)

The above equation can be used to calculate the probability of LBW using the formula:

$$p = \frac{1}{(1+exp^{(-y)})}$$

Table 4. Results of probability calculation in several scenarios

Respondents	Number of ANC visit	Number of Children	Hypertension	CED	Pregnancy complications	Mother Education	LBW event probability
Respondent A	<6 times	>2	Yes	Yes	Yes	<12 years	66,9%
Respondent B	≥6 times	≤2	No	No	No	≥12 years	5,8%
Responden C	≥6 times	≤2	No	No	No	<12 years	8,6%
Respondent D	≥6 times	>2	Yes	Yes	Yes	<12 years	57,5%
Respondent E	<6 times	≤2	Yes	Yes	Yes	<12 years	35,1%
Respondent F	<6 times	>2	No	Yes	Yes	<12 years	58%
Respondent G	<6 times	>2	Yes	No	Yes	<12 years	53,4%
Respondent H	<6 times	>2	Yes	Yes	No	<12 years	57,8%
Respondent I	<6 times	>2	Yes	Yes	Yes	≥12 years	56,6%

Based on the results of probability calculations, mothers who visited ANC <6 times, had a >2 child, were diagnosed with hypertension by a doctor, experienced CED, experienced pregnancy complications, and took compulsory education <12 years had a probability of giving birth to a baby with LBW of 66.9%. While mothers who visited ANC ≥6 times, had a ≤2 child, were not diagnosed with hypertension by a doctor, did not have CED, did not experience pregnancy complications, and took compulsory education for 12 years or higher had a probability of giving birth to a LBW baby of 5.8%. The variables that are risk factors for LBW based on multivariate analysis of IFLS 5 data are the number of ANC visits, the number of children, hypertension, CED, pregnancy complications, and education. Based on the results of probability calculations, respondents in the same condition and taking compulsory education ≥12 years have a probability of 5.8% to give birth with LBW, while respondents in the same condition but taking compulsory education <12 years have a probability of giving birth with of 8.6%. The probability difference between respondents who take compulsory education ≥12 years and <12 years is 2.8%.

The weakness of this study is that the variables studied can only follow the variables available in the secondary data of IFLS 5 in 2014. In addition, for variable diagnoses of hypertension, diabetes, and tuberculosis, it is not known when the diagnosis was given to respondents. For anemia variables obtained from Hb measurements, where hb measurements are not carried out during pregnancy but are carried out at the time of the survey. CED variables are obtained from the results of calculating BMI based on the results of weight and height measurements at the time of the survey.

CONCLUSION

Based on the results of this study, it can be concluded that the risk factors associated with the incidence of LBW in Indonesia are the age of the mother at childbirth, the number of ANC visits, the number of children, diagnosis of hypertension, CED, pregnancy complications, and education. The most influential factor on the incidence of LBW is maternal education. Mothers who have visited ANC <6 times, have a >2 child, are diagnosed with hypertension by a doctor, have CED, experience pregnancy complications, and take compulsory education <12 years have a greater chance of giving birth to a LBW baby. The advice for the education office is to ensure that every woman has been educated for at least 12 years to prevent low birthweight. BKKBN must ensure the implementation and effectiveness of the bride-to-be class, especially for young brides-to-be. The Ministry of Health can develop a program on LBW prevention that is prioritized for mothers who visit ANC <6 times, have a >2 child, are diagnosed with hypertension by a doctor, experience CED, experience pregnancy complications, and take compulsory education <12 years.

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