SURVIVAL DIFFERENCES OF LOW BIRTH WEIGHT BASED ON SOCIOECONOMIC FACTORS

*Hanin Ruliyani[1], Novi Lestari[1], Diah Indriani[1]
[1]Faculty of Public Health, Universitas Airlangga, 60115 Surabaya, East Java, Indonesia
*Corresponding Author: Hanin Ruliyani ; **Email**: hanin.ruliyani-2019@fkm.unair.ac.id

ABSTRACT

IDHS 2017 showed the prevalence of low birth weight (LBW) infants in Indonesia is 7%. LBW can increase the risk of mortality, morbidity, and growth disorders. The survival of LBW infants can be influenced by socioeconomic factors. The purpose of this study is to analyze survival time differences of LBW infants based on socioeconomic factors. This research is a non-reactive study using secondary data from the IDHS 2017. Survival analysis using the Kaplan-Meier method and analysis of differences in survival curves using the Log Rank method. The independent variables in the study include parents' occupation, household wealth index, mother's education, and father's education. The measured event is infant mortality within one year. Mother's education (p value=0.069) has no difference in the survival time of LBW. The parent's occupation (p value=0.013) has a difference in the survival time of LBW. The probability of survival is 99% in LBW with non-working mothers. There is a difference in the survival time of LBW based on the household wealth index factor (p value=0.000) with the probability of survival for LBW born in the lowest wealth index family is 90%. Differences in the survival time of LBW have been found in the parents' occupation and household wealth index variables.

Keywords: *Kaplan Meier, LBW, Log Rank, survival, socioeconomic*

ABSTRAK

Data SDKI 2017 menunjukkan prevalensi bayi Berat Badan Lahir Rendah (BBLR) di Indonesia sebesar 7%. BBLR menjadi masalah yang mengancam kelangsungan hidup bayi dengan meningkatkan risiko mortalitas, morbiditas, dan gangguan pertumbuhan. Kelangsungan hidup bayi BBLR dapat dipengaruhi oleh faktor sosial-ekonomi. Tujuan penelitian ini adalah menganalisis perbedaan waktu kelangsungan hidup bayi BBLR berdasarkan faktor sosial-ekonomi. Penelitian ini adalah penelitian bangun non-reaktif menggunakan data sekunder SDKI 2017. Analisis yang digunakan adalah analisis kelangsungan hidup dengan metode *Kaplan Meier* dan analisis perbedaan kurva *Kaplan Meier* dengan metode *Log Rank*. Variabel independen, yaitu pekerjaan orang tua, indeks kekayaan rumah tangga, pendidikan ibu, dan pendidikan ayah. Peristiwa yang diukur adalah kematian bayi dalam waktu satu tahun. Faktor pendidikan ibu (p value=0.069) tidak memiliki perbedaan waktu kelangsungan hidup bayi lahir BBLR. Faktor pekerjaan orang tua (p value=0.013) memiliki perbedaan waktu kelangsungan hidup bayi lahir BBLR. Probabilitas kelangsungan hidup sebesar 99% pada bayi lahir BBLR dengan status ibu tidak bekerja. Terdapat perbedaan waktu kelangsungan bayi lahir BBLR berdasarkan faktor indeks kekayaan rumah (p value=0.000) dengan probabilitas kelangsungan hidup pada bayi BBLR yang lahir di keluarga indeks kekayaan terbawah sebesar 90%. Perbedaan waktu kelangsungan hidup bayi lahir BBLR ditemukan pada faktor pekerjaan orang tua dan indeks kekayaan rumah tangga.

Kata kunci: *Kaplan Meier*, BBLR, *Log Rank*, kelangsungan hidup, sosial-ekonomi

INTRODUCTION

Low birth weight (LBW) is the condition of a baby born with a body weight of less than 2500 grams regardless of gestational age which is measured one hour after birth (1). The LBW condition is an indicator of a baby's vulnerability to the risk of disease and survival. The risks that can threaten LBW are death at an early age, morbidity, malnutrition, susceptibility to infection, respiratory problems, and the risk of non-communicable diseases.

The World Health Organization (WHO) estimates that around 15% to 20% of births worldwide are babies born with LBW (2). The 2017 Indonesian Demographic and Health Survey (SDKI) shows that the prevalence of LBW in Indonesia is 7%, meaning that Indonesia is ranked sixth out of seven countries in Southeast Asia (3). In 2019, the Directorate of Family Health at the Indonesian Ministry of Health explained that 69% of the more than 29,000 deaths under five occurred during the neonatal period. The most common cause of neonatal death is LBW (4).

Survival analysis is a statistical analysis method by observing the time until an event occurs as the variable under study. The unit of time used can be days, weeks, months, or years. Observed events may include death, disease incidence, recovery, or relapse. Types of survival analysis methods consist of parametric with the assumption that the survival time distribution follows a certain distribution, semi-parametric which does not require distribution information and does not have to be specified for estimation, and nonparametric with the assumption that survival time does not follow an existing distribution.

LBW conditions in babies can harm the health status and survival of the baby. LBW status is significantly related to infant mortality with a risk 1.336 times higher than babies with normal weight (5). The lower the baby's weight is below the ideal limit, the risk of death will increase by up to 200 times in the first year (6).

Survival of babies born with LBW conditions can be influenced by several socioeconomic factors, namely parental employment, household wealth index, and maternal education. A study in Madiun in 2017 found that working mothers had an increased risk of LBW and death compared to mothers who worked at home (7). The condition of balance in parental work is related to the health condition and development of LBW babies (8). Family economic conditions can be identified by classifying the household wealth index, which describes the household's ability to meet household needs, including food and nutrition. Research using multilevel analysis of data from Basic Health Research (Riskesdas), Village Potential (PODES), and Health Facilities Research (Rifaskes) in 2017 found that there was a relationship between maternal education and infant mortality with a greater percentage of infant deaths among mothers did not graduate from junior high school, compared to infant deaths of mothers who had more than a junior high school education (9). The higher the mother's education, the easier it will be for the mother to obtain information. A father's education can be correlated with the health and survival of the baby because education influences knowledge and attitudes in decision-making on consumer goods, one of which is food and health facilities. This study aims to analyze differences in the average survival time of LBW babies based on socioeconomic factors.

METHODS

The research used a non-reactive observational design. Observational research means that research subjects do not receive treatment. Non-reactive building design is research carried out using available data or secondary data originating from the 2017 SDKI which was obtained after submitting an access permit application via the official DHS websitewww.dhsprogram.com.

The population of this study is all the last children born alive before the time the survey was conducted. The last child was chosen as the population sample because the birth of the last child occurred close to the date of the survey so it was easier for the mother to remember. The samples taken for research were the last children born alive between 2012 and September 2016 with LBW conditions recorded in the 2017 IDHS data, totaling 707 children. Data cleaning was carried out to eliminate 82 respondents with unknown answers and missing data so that the research sample size was 625 children.

The dependent variable is the survival time of live-born babies with LBW conditions and which is measured from birth to one year of observation. Infant deaths that occur during one year of observation are classified as uncensored data. The independent variables studied were four socioeconomic variables. The parental employment variable consists of three categories, namely working father and mother, non-working mother, and non-working father. The status of working parents is closely related to economic status and time availability in children's development(10). The household wealth index variable describes the household's standard of living, which is divided into five quantiles, namely the lowest, lower middle, middle, upper middle, and top according to the categories in the IDHS. Parents play an important role in the growth and development of children. Mothers with a higher level of education have a positive impact on children's development because mothers have sufficient insight and skills regarding children's health needs so that the care and affection provided, especially in the form of nutritional needs, can be implemented well. Fathers with higher education can increase the family's economic capacity so that the family's basic needs, especially those of the children, can be met (11). The variables of mother's education and father's education are divided into five categories

from no school to school graduate at several levels of formal education, namely elementary school equivalent, junior high school equivalent, high school equivalent, and college.

Data collection begins with studying the data that will be used in the research to be submitted to the official Demographic and Health Surveys (DHS) website in the form of questionnaires, operational definitions, and descriptive data from reports. The received data will be filtered. Data that are not needed for the study will be deleted. Data will undergo a cleaning process, especially for missing and unreasonable data. Data editing was carried out to check the suitability of the data units. The criteria for each research variable will be coded so that the data can be processed by data processing software. The sampling technique in the 2017 IDHS uses a multistage random sampling method so that weight is given to the raw data using the weight variable in women's sample weight so that the probability of an event occurring for each individual is the same.

The analysis used is the Kaplan-Meier test to estimate the survival function in the form of a Kaplan-Meier survival curve. Analysis to determine differences in the Kaplan Meier survival curve was carried out using the Log Rank test with a Confidence Interval (CI) of 95%.

RESULT

The last number of children born with LBW recorded in the 2017 IDHS was 625 babies with distribution based on year of birth, namely 45 babies in 2012, 136 babies in 2013, 149 babies in 2014, 161 babies in 2015, and 134 babies in 2015. Based on the period from 2012 to September 2016, the largest percentage of babies born with LBW was in 2015. Table 1 shows that the majority of the last children born with LBW had mothers who did not work (54.4%), the household wealth index lower middle class (24.3%), mothers with at least elementary school or

equivalent (32.6%), and fathers with at least high school or equivalent (31.5%).

Table 1. Distribution of LBW Babies According to Independent Variables Born in 2012-September 2016

Variable	f	%
Parents' job		
Mother and father work	281	45
Mom doesn't work	340	54.4
Dad doesn't work	4	0.6
Household wealth index		
Bottom	122	19.5
Lower middle	152	24.3
Intermediate	134	21.4
Upper middle	115	18.4
Top	102	16.3
Mother's education		
No school	120	19.2
Completed elementary school equivalent	204	32.6
Completed junior high school or equivalent	114	18.2
Completed high school equivalent	152	24.3
Graduated from college	35	5,6
Father's education		
No school	55	8.8
Completed elementary school equivalent	171	27.4
Completed junior high school or equivalent	159	25.4
Completed high school equivalent	197	31.5
Graduated from college	43	6.9

Eighteen ((2.9%) LBW babies experienced death (event) during the observation, so the number of babies who were censored or still alive at the end of the observation was 607 babies (97.1%). The minimum survival time for LBW babies is one month. The maximum survival time for LBW babies is 12 months. Babies born with LBW have an average life span of 11.744 months. The median survival time for LBW babies cannot be calculated because more than 50% of the data is classified as censored. The majority of infant deaths observed occurred in the first month after birth with a probability of survival time of 99%. Analysis of the results of the Kaplan Meier curve for the survival of LBW babies based on socioeconomic factors was carried out to determine the characteristics of each factor and continued with the Log Rank test.

The event value for LBW babies whose mothers and fathers work is greater than for LBW babies whose mothers do not work and whose fathers do not work. The highest average survival rate for LBW babies was 11.838 months for babies whose mothers did not work. The Kaplan Meier survival curve for the parental employment variable in Figure 1 shows that the lines of the father and mother working and the line of the mother not working do not coincide with the days of the father not working, so it is suspected that there is a difference in survival time.

The probability of survival of LBW babies aged one month is highest in babies whose mothers do not work, namely 99%. The p value of the Log Rank test is 0.013 with the α value being 0.05, meaning that there is a difference in the survival time of LBW babies based on the parents' occupation.
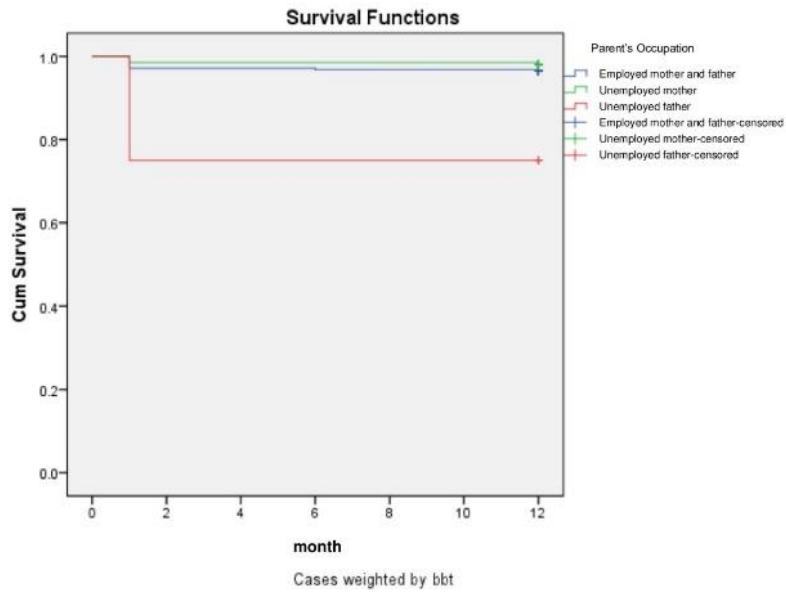
Figure 1. Kaplan Meier Survival Curves of LBW Infants Based on Parental Occupation

Events

The highest (deaths) of LBW babies based on the household wealth index are babies with the lowest middle household wealth. LBW babies with middle to upper household wealth have the longest average survival compared to other wealth indices, namely 12 months.

Four of the five lines in the survival curve in Figure 2 coincide with each other so it is assumed that there is no difference in the survival curve between the lower middle, middle, upper middle, and top wealth indices. The survival time for babies with the lowest wealth index is lower than other wealth indexes with a probability of 90%. The Log Rank test concluded that there was a difference in the survival time of LBW babies based on the household wealth index (p value = 0.000).
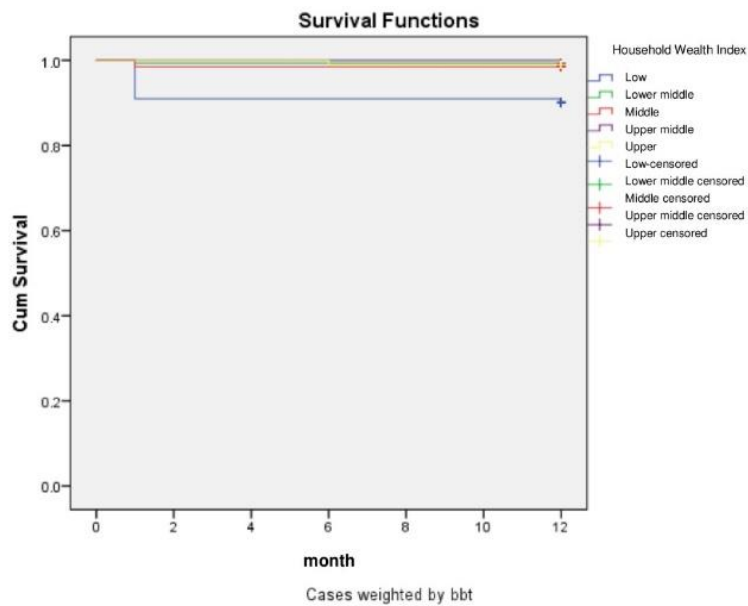

Figure 2. Kaplan Meier Survival Curve for LBW Babies Based on Household Wealth Index

LBW babies with the mother's final education equivalent to junior high school had the largest number of events compared to other final education categories. The average survival rate for LBW babies was the longest for babies with a mother with a high school or equivalent education at 11.855 months. The results of the Kaplan Meier curve output in Figure 3 based on maternal education show that four of the five curve lines coincide with each other, so it is assumed that there is no difference in the survival curve for LBW babies based on maternal education.

The probability of survival of babies born with LBW conditions in the first 1 month of age based on the mother's latest education has a high value, namely between 97% and 99%. The Log Rank test carried out produced a p value of 0.069 so that there was no difference in the survival time of LBW babies based on maternal education.
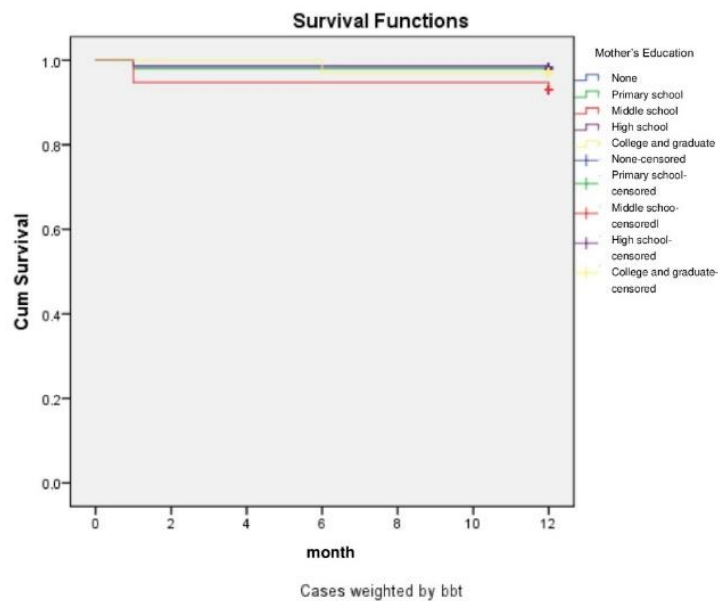

Figure 3. Kaplan Meier Survival Curve of LBW Infants Based on Maternal Education

The highest event value is an LBW baby born with the father's final education at the junior high school or high school level. Babies born LBW with the father's final education equivalent to elementary school had the longest average survival time, namely 11.936 months. The results of the Kaplan Meier curve output in Figure 4 show that there are overlapping lines, so it is thought that there is no difference in the survival curve of LBW babies based on the father's education. The conclusion from the Log Rank test is by the predictions from the Kaplan-Meier curve (p value = 0.109).
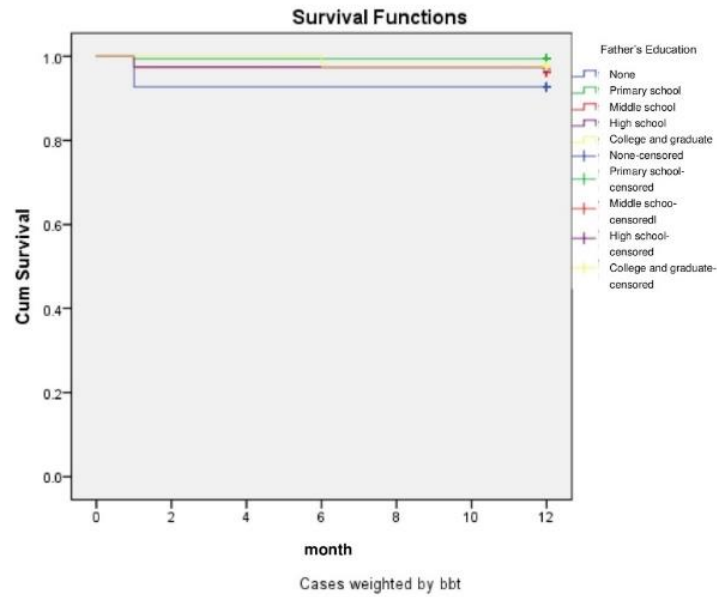
Figure 4. Kaplan Meier Survival Curves of LBW Infants Based on Father's Education

Table 2. Survival of LBW Babies Based on Independent Variables

Variable	Events	Censored	% Censored	Mean (month)	*p* value (Log Rank)
Parents' job					
Mother and father work	10	271	96.4	11.665	
Mom doesn't work	7	333	97.9	11.838	0.013
Dad doesn't work	1	3	75.0	9,.250	
Household wealth index					
Bottom	12	110	90.2	11.008	
Lower middle	2	150	98.7	11.928	
Intermediate	2	132	98.5	11.836	0,000
Upper middle	1	114	99.1	12.000	
Top	1	101	99.0	11.941	
Mother's education					
No school	2	118	98.3	11.817	
Completed elementary school equivalent	4	200	98.0	11.784	
Completed junior high school or equivalent	8	106	93.0	11.421	0.069
Completed high school equivalent	3	149	98.0	11.855	
Graduated from college	1	34	97.1	11.829	
Father's education					
No school	4	51	92.7	11.200	
Completed elementary school equivalent	1	170	99.4	11.936	0.109
Completed junior high school or equivalent	6	153	96.2	11.723	

Variable	Events	Censored	% Censored	Mean (month)	p value (Log Rank)
Completed high school equivalent	6	191	97.0	11.721	
Graduated from college	1	42	97.7	11.860	

DISCUSSION

LBW is the condition of babies born with a weight of less than 2500 grams and is an indicator of the baby's health because LBW can cause babies to be more susceptible to death in the first month after birth, have stunted growth, and a lower IQ than the average child (12). In 2015, the United Nations Children's Fund (UNICEF) explained that almost 15% of babies in the world were born with LBW and 95% of them were born in developing countries (13). LBW babies have a poorer immune system and a higher risk of experiencing malnutrition, non-communicable diseases, infectious diseases, mental disabilities, and delays in growth and development (14). Previous studies in Africa have shown that LBW babies have a higher risk of stillbirth. The risk of babies born with a weight below the normal limit of experiencing death is 3.8 times higher than babies born with a normal weight (15). Babies born with LBW are also at risk of developing hypertension as adults (16).

This study found that 2.9% of babies born with LBW conditions from 2012 to September 2016 experienced death with a fairly high probability of survival, namely between 0.9 to 1. The average survival time for LBW babies was 11.744 months and the median cannot be calculated because more than 50% of LBW babies remained alive during the observation period. Previous research conducted in Uganda found the LBW factor to be the biggest contributor to infant mortality with a percentage of 74% of infant deaths occurring during the neonatal period, 95% of which were deaths occurring in the first week after the birth of the baby (15).

Based on the research results, there are differences in the survival time of LBW babies according to the parents' occupation. The probability of survival of LBW babies at the age of one month with a non-working mother has the highest value compared to the probability of survival of LBW babies with a working mother and a non-working father. Research on the 2017 IDHS data states that working mothers will increase the mortality rate of babies aged 0 to 11 months up to twice the rate compared to mothers who do not work (17). Neonatal deaths occur more often in working mothers who do not have complete Antenatal Care (ANC) visits and who have poverty factors (18). The development and growth of children cannot be separated from the role and care of father and mother. Working parents can help increase the family's economic income so that children's nutritional needs can be met. However, mothers have a big role in caring for children, especially in the mother's availability of time to provide a variety of foods for children (10). Mothers who don't work have more time to organize, process, and provide food for their children. Infancy is a vulnerable period so the mother has a big role in ensuring that the baby's nutritional needs are met, especially in the first year of a child's life, where breast milk is still needed as a source of complete nutrition for the child.

The household wealth index is a combination of cumulative household living standard indicators calculated using data on a household's asset ownership, house-building materials, and access to clean water and sanitation facilities. The wealth index categories are divided into five wealth quintiles, namely the lowest,

lower middle, middle, upper middle, and top (17). The household wealth index was created as an evaluation indicator of programs by the government. The results of this study show that there are differences in survival time based on the household wealth index. The lowest wealth index has an average survival time for babies aged one month (11.008 months) and the lowest probability of survival (90%) compared to other wealth index categories. This research is in line with previous research on the 2007 IDHS data which states that there is a relationship between socioeconomic conditions and baby survival (19). The probability of survival of a 1-month-old baby at a capable socioeconomic level has a greater value, namely 99% compared to the probability of survival for babies living at a sufficient and low socioeconomic level. Other research also states that middle and rich-wealth-index households have a lower risk of death before the age of five compared to poor-wealth-index households (20). The middle to upper-middle wealth index shows that households can access health facilities, meet nutritional needs, and meet household needs more optimally than those with lower wealth indexes (21). High accessibility to public facilities, especially health, is an important thing that must be achieved by families during emergencies which are risks to LBW babies.

Education can influence a mother's mindset, knowledge, skills, and access to information to maintain the health of herself and her child. Knowledge about the mother's health before and during pregnancy can influence the health and survival of the child. The results of this study were that there was no difference in survival time for LBW babies based on maternal education. The research supports previous research on the 2007 SDKI data which produced a p value of more than 0.05 (19). Infant deaths occur more often in mothers of babies with higher levels of education, such as high school graduates or college graduates because higher education has an impact on a career path that is sufficient to support the family so that child care can be handed over to someone other than the mother.

The father's main role in the family is to provide for the family so that the father's education level can influence income to meet household needs. This research showed that there was no difference in survival time for LBW babies based on the father's education. This research supports research on the nutritional status of students at SD Hangtuah 6 Surabaya in 2017 which stated that there was no relationship between father's education and baby survival (22). Fathers with a higher educational background may not necessarily be able to provide adequate nutrition for their children according to the portion of their needs according to their age. The distribution of events in the 2017 IDHS data shows that the number of events is higher in LBW babies with fathers who have a high school or equivalent education, so the father's education level cannot be used as a benchmark for the baby's survival.

CONCLUSIONS AND SUGGESTIONS
Conclusion

Differences in survival time for LBW babies based on socioeconomic factors were found in parental employment and household wealth index. The probability of survival of LBW babies aged one month in non-working mothers is higher (99%) compared to LBW babies in working mothers and fathers and non-working fathers. The probability of survival of LBW babies aged one month in families with lower middle, middle, upper middle, and top wealth indexes is greater (99%) than LBW babies in families with the lowest wealth index.

Suggestion

It is hoped that the government, especially the Indonesian Ministry of

Manpower, can formulate reaffirmation regulations regarding maternity leave so that working mothers can maintain their health and focus on child care. In addition, organizations or bodies where mothers work are expected to provide facilities in the form of flexible time and adequate space for breastfeeding mothers so that mothers can provide exclusive breast milk (ASI) regularly even though they are working.

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