

## Low birth weight profiles at H. Boejasin Hospital, South Borneo, Indonesia in 2010-2012

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### Abstract

**Background** The prevalence of low birth weight (LBW) is still high in Indonesia. Intrauterine growth restriction (IUGR) and prematurity are the most frequent causes. Prematurity has higher mortality rate. Cultural diversity has an impact on regional LBW profiles in Indonesia. However, data on LBW is unavailable in South Borneo.

**Objective** To describe the LBW profiles and in-hospital mortality of newborns at H. Boejasin Hospital, South Borneo.

**Methods** This was a cross-sectional study using secondary data from medical records and neonatal registry at H. Boejasin Hospital, Pelaihari, South Borneo from 2010 to 2012. Subjects were newborns with birth weight <2,500 grams. Categorical data was presented in percentages, while survival analysis was assessed by Kaplan-Meier test. The difference among groups was analyzed with log-rank test.

**Results** The proportion of LBW was 20.2% of total live births and the mortality rate was 17.3%. Mortality rates according to birth weight category was 96% in <1000 g group, 62% in 1,000-1,499 g group, 19% in 1,500-1,999 g group, and 4% in 2,000-2,499 g group. The highest hazard ratio was in the <1,000 gram birth weight group (HR 40.21), followed by the 1,000-1,499 gram group (HR 12.95), and the 1,500-1,999 gram group (HR 4.65); (P<0.01). Asphyxia, hyaline membrane disease (HMD), and sepsis were the most common causes of mortality (at 50%, 21%, and 16%, respectively).

**Conclusion** The prevalence of LBW in this study is quite high and mortality of LBW infants is significantly different between each low birth weight category. [Paediatr Indones. 2016;56:155-61].

**Keywords:** low birth weight; profile; mortality; South Borneo

The World Health Organization (WHO) defines low birth weight (LBW) as birth weight of less than 2,500 grams.<sup>1</sup> Globally, as many as 15.5% of live newborns have LBW, and 90% of them are found in developing countries.<sup>1,2</sup> In Indonesia, LBW prevalence has decreased from 9-30% in 2002 to 7.2-16.8% in 2013, depending on regional socioeconomic status.<sup>1,3</sup> In South Borneo, LBW prevalence is relatively high at 16.6% of total live births.<sup>3</sup> Only one-third of those LBW infants were preterm. Many developing countries have similar causes of LBW, where more than half of LBW infants are small-for-gestational age (SGM), while preterm babies comprise a much smaller proportion.<sup>4,5</sup>

Low birth weight is a major health problem, resulting in 20 to 30 times higher morbidity and mortality rates than in infants with normal birth weight. In fact, more than 30% of global infant mortality rates are caused by LBW.<sup>6</sup> In Indonesia, infant mortality due to LBW is estimated to reach as high as 29%.<sup>7</sup> The high mortality rates are caused by complications related to LBW, such as hypothermia,

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hypoglycemia, asphyxia, fluid and electrolyte imbalance, hyperbilirubinemia, anemia, malnutrition, and sepsis.<sup>8</sup>

Intrauterine growth restriction (IUGR) and prematurity (defined as gestational age of less than 37 weeks) are the most common causes of LBW.<sup>2</sup> Both conditions have multifactorial etiologies, from maternal factors (young or advanced maternal age, malnutrition, poverty, psychosocial conditions, and comorbidities such as hypertension, anemia, and infection) to fetal factors (twins or other multiples, congenital vascular disorders, and sex).<sup>1,2-9</sup> It is important to establish the cause of LBW, since mortality rates between the two conditions (IUGR and prematurity) differ significantly; complications leading to death are more common in prematurity compared to IUGR (8-92% vs. 0.3-13%, respectively).<sup>4,10</sup>

Cultural diversity in each region in Indonesia has an impact on the regional health profiles, including LBW status. However, there is not sufficient data, to date, describing LBW profiles in Indonesia, including South Borneo. This study was expected to provide insight on LBW profiles, including the most common causes of death in LBW infants. As such, we hope to contribute to the formulation of national guidelines on medical care for LBW infants in Indonesia, especially in Pelaihari, South Borneo.

## Methods

This cross-sectional study was performed using secondary data from medical records and the neonatal registry at H. Boejasin General Hospital, Pelaihari, South Borneo, from 2010 to 2012. H. Boejasin Hospital is the only secondary health center in a region which has 296,282 residents. Healthcare facilities for neonates include a neonatal ward with one pediatrician, one neonatal nurse, general nurses, and midwives.

Subjects in this study were newborns or neonates with birth weight less than 2,500 grams, which were recorded in the hospital's neonatal registry from 2010 to 2012 and followed-up in medical records. Stillborn neonates (intrauterine fetal death), neonates with incomplete medical records, and neonates hospitalized due to any cause other than LBW, such as pneumonia or diarrhea, were excluded from this study.

Data from medical records included: (1) maternal age; (2) neonate gender; (3) Apgar scores at the first and fifth minutes; (4) length of hospitalization; (5) gestational age, which was estimated from the first day of the mother's last menstrual period or ultrasonography, and classified as fullterm (37-42 weeks), pre-term (less than 37 weeks), or post-term (more than 42 weeks); (6) birth weight; (7) outcomes at the end of hospitalization, using mortality as the endpoint; and (8) cause of death during hospitalization.

Subjects' characteristics and other specific data were shown in a descriptive table. Neonates' survival were analysed with SPSS *Statistics for Windows* version 13.0 software and summarized in a Kaplan-Meier survival curve, showing the survival of each neonate according to their birth weight category.

This study conforms to bioethics code of conducting research in live human subjects, and was approved by the Medical Committee of H. Boejasin General Hospital, Pelaihari, South Borneo.

## Results

There were a total of 3,299 live births from 2010 to 2012, 666 (20.2%) of whom had LBW. Of the LBW subjects, 115 subjects (17.3%) died during hospitalization, with a median survival of 35 (23-48) days. Subjects' characteristics are shown in **Table 1**.

**Table 2** shows that most LBW infants were in the 2,000–2,499 g group. At H. Boejasin Hospital, the available facilities generally provide adequate medical care for LBW infants weighing 1,500 to 2,499 grams. Kaplan-Meier survival analysis (**Figure 1**) shows that at the beginning of the hospitalization period, mortality was more prevalent in the <1,000 g group. As their length of hospitalization increased, mortality increased in the 1,000–1,499 g group, followed by the 1,500–1,999 g group. However, there was no significant increase in the mortality of the 2,000–2,499 g group. Compared to the 2,000–2,499 g group, the <1,000 g group had an increased mortality risk, with a hazard ratio (HR) of 40.20 (95% CI 21.15 to 76.42). The HR in the 1,000–1,499 g group was 12.95 (95%CI 7.06 to 23.73) and the HR in the 1,500–1,999 g group was 4.65 (95% CI 2.50 to 8.65), with P value <0.01.

The most common cause of death in LBW newborns in all birth weight categories was asphyxia (52%), with the largest proportion in 1,000–1,999 g group. Other common causes were HMD (21%) and sepsis (16%). The remaining causes(11%) included

non-septic neonatal icterus, hypovolemia, and congenital disorders, such as congenital heart defects and ventriculomegaly. An undetermined cause of death was defined as the absence of clinical conditions or disorders which could result in death.

**Table 1.** Baseline characteristics of LBW newborns

Characteristics	Total (n=666)
Median maternal age (range), years	24 (15-45)
Gender	
Male, n (%)	301 (45.2)
Female, n (%)	365 (54.8)
Median length of hospitalization (range), days	3 (0-39)
Median Apgar score at the 1 <sup>st</sup> minute (range)	7 (1-9)
Median Apgar score at the 5 <sup>th</sup> minute (range)	8 (1-10)
Median gestational age (range), weeks	37 (20-43)
Median birth weight (range), grams	2,100 (400-2,490)
Died, n (%)	115 (17.3)

**Table 2.** Subject categories according to birth weight at H. Boejasin General Hospital, Pelaihari, from 2010 to 2012

Birth weight groups	Outcomes		Total, n(%) (n=666)	Hazzard ratio* (95% CI)
	Died, n(%) (n=115)	Survived, n(%) (n=551)		
<1,000 g	26 (96)	1 (4)	27 (4)	40.20 (21.15 to 76.42)
1,000–1,499 g	44 (62)	27 (38)	71 (10)	12.95 (7.06 to 23.73)
1,500–1,999 g	30 (19)	128 (81)	158 (24)	4.65 (2.50 to 8.65)
2,000–2,499 g	15 (4)	395 (96)	410 (62)	1

\* compared to 2,000-2,499 g group

**Table 3.** Causes of death in LBW newborns

Cause of death	Birth weight groups				Total
	<1,000 g	1,000- 1,499 g	1,500- 1,999 g	2,000- 2,499 g	
Asphyxia, n (%)	12 (46)	25 (57)	15 (50)	8 (53)	60 (52)
Hyaline membrane disease(HMD), n (%)	10 (38)	9 (20)	5 (18)	0 (0)	24 (21)
Sepsis, n (%)	1 (4)	7 (16)	4 (13)	6 (40)	18 (16)
Neonatal icterus, n (%)	0 (0)	0 (0)	0 (0)	1 (7)	1 (1)
Congenital heart defects, n (%)	0 (0)	0 (0)	1 (3)	0 (0)	1 (1)
Other congenital disorders, n (%)	1 (4)	0 (0)	0 (0)	0 (0)	1 (1)
Hypothermia, n (%)	0 (0)	0 (0)	1 (3)	0 (0)	1 (1)
Hypovolemia, n (%)	0 (0)	1 (2)	0 (0)	0 (0)	1 (1)
Undetermined, n (%)	2 (8)	2 (5)	4 (13)	0 (0)	8 (6)
Total, n (%)	26 (100)	44 (100)	30 (100)	15 (100)	115 (100)

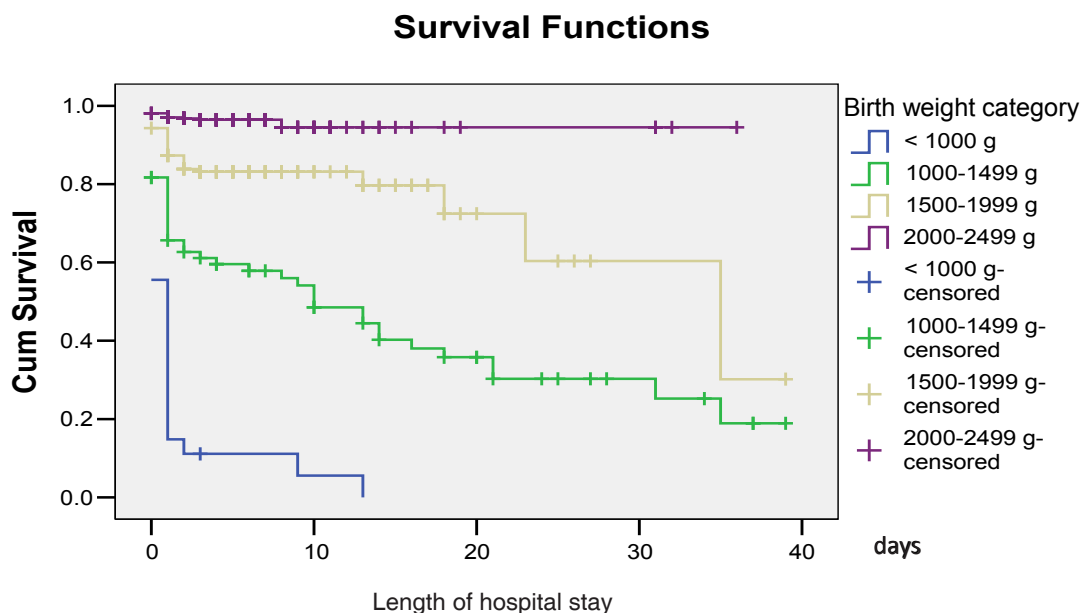


Figure 1. Survival rates of LBW infants according to birth weight category

## Discussion

The prevalence of LBW in this study was 20.2%, slightly higher than LBW prevalence in South Borneo, which was 16.6%.<sup>3</sup> More than half of the LBW subjects were fullterm, but small-for-gestational age. This prevalence was similar to several studies in developing countries, where most LBW is caused by IUGR, not prematurity, in contrast to what is found in developed countries.<sup>4,5</sup> Compared to other developing countries, such as India, Colombia, Malawi, Sri Lanka, and Myanmar, the prevalence of IUGR in Indonesia was relatively lower at 19.8%, but slightly higher than Thailand, Vietnam, and Cuba.<sup>5</sup> Various factors influence IUGR prevalence, such as inadequate nutrition in pregnancy, low body mass index (BMI) before pregnancy, short stature, high malaria incidence, smoking, primiparity, gestational hypertension, congenital disorders, and other genetic factors.<sup>4,11</sup> With regards to maternal malnutrition, several studies showed that the average calories consumed by pregnant women in developing countries was 1,500 kcal per day, much lower than in developed countries.<sup>12</sup> Combined with vigorous physical activity during pregnancy, these factors would increase the odds of having an offspring with IUGR.<sup>13,14</sup> One of the unique eating habits in Pelaihari

is high consumption of salted fish, roasted rice, and *mandai* (*cempedak* fruit skin preserved with salt). These food products are popular because they can be stored for a long periods and have delicious flavors, albeit low nutritional value.

In Pelaihari, LBW was most prevalent in mothers with histories of hypertension, premature rupture of membranes, twin pregnancy, or preterm birth. Mothers who gave birth to infants with LBW were all at productive age, and thought to be in good condition for pregnancy, both physically and mentally.<sup>15</sup> Socioeconomic factors and level of education were among the influencing factors in LBW prevalence.<sup>17</sup> Residents of Pelaihari mostly work in the agricultural sector, such as growing crops, farming, and gardening,<sup>16</sup> with fluctuating incomes dependent on seasonal harvests. Moreover, the highest educational level of the residents was predominately primary school, both at the district and provincial levels.<sup>15,16,17</sup> The 2010 Indonesian National Basic Health Registry (*Riskesdas*) showed that LBW was most prevalent in infants born to parents who did not complete primary school education (15.1%), and those who worked as farmers, fishermen, or labors.<sup>3</sup>

Most of the LBW newborns hospitalized for more than three or four days were diagnosed with

sepsis or hyperbilirubinemia. Limited laboratory facilities at this hospital made it difficult to diagnose sepsis, basing diagnoses only on clinical conditions and routine blood tests. Another limitation was the inadequate hyperbilirubinemia treatment for neonates, diagnosed on the basis of bilirubin levels, while not following the *American Academy of Pediatrics* (AAP) guidelines on exchange transfusion and phototherapy. These facility limitations could have resulted in longer hospitalizations than needed, because of overtreatment, or undertreatment.

In our study, the LBW mortality rate was 17.3%, similar to that of other developing countries in peri-urban healthcare settings, such as Bangladesh, which had a mortality rate of 13.3%.<sup>18</sup> At our health center, neonates with birth weight of 1,500–2,499 g had the highest survival rates. If the number of deaths in the 1,000–1,499 g group could be diminished, the mortality rates would have significantly decreased to 10.6%. One effort to decrease mortality rate is adequate neonatal resuscitation by trained healthcare professionals.<sup>5</sup>

The most common causes of death in this study, were asphyxia, followed by HMD, then sepsis. Neonatal asphyxia is defined as an inability to breathe adequately after birth. The AAP and *American Congress of Obstetricians and Gynecologists* (ACOG) stated that a diagnosis of asphyxia can be established based on four criteria, (1) metabolic acidosis or mixed acidosis (pH less than 7 in umbilical blood); (2) Apgar score of 0-3 for more than five minutes; (3) neurological sequelae (seizure, coma, orhypotonia); or (4) multiple organ involvement (kidney, lung, heart, intestines, orliver).<sup>19</sup> In our study, a diagnosis of asphyxia was often based on the second and third criteria only, because of limited facilities. As such, asphyxia may have been underdiagnosed at our hospital.

As causes of death in LBW infants, asphyxia and acute respiratory distress syndrome (ARDS) mostly have non-septic origins in early neonatal death (age of less than 7 days); however, these conditions are closely related to sepsis in late neonatal death (age of 7 to 27 days).<sup>20-23</sup> Moreover, LBW infants have a high risk of iatrogenic infection.<sup>24,25</sup> Therefore, the risk of mortality, most likely from sepsis, would be increased as the hospitalization period is prolonged, as seen in our 1,000–1,499 gram and 1,500–1,999 gram groups.

Other than asphyxia, HMD also contributed to LBW mortality at our hospital. A diagnosis of HMD was established by chest x-ray. HMD may be effectively prevented with antenatal steroid injections.<sup>26,27</sup> Antenatal steroid injections have been included in the standard protocol for preterm labor in developed countries, but are not routinely administered in Indonesia. In other developing countries in Southeast Asia, this discrepancy was also found to be a problem, resulting in vastly different antenatal steroid injection rates between regions.<sup>27</sup> Had antenatal steroid injections been included in the protocol for preterm labor care in low-to-middle income regions, such as at our health center, neonatal mortality rates could have been decreased by more than 50%.<sup>26</sup>

In addition to antenatal steroid injections, healthcare facilities specifically aimed for treating neonates with respiratory distress, such as by providing continuous positive airway pressure (CPAP), could decrease neonatal mortality rates from asphyxia and HMD. If CPAP had been available in the healthcare settings, it was estimated that survival rates may have increased up to 70%.<sup>28</sup> At our hospital, only one CPAP device is available, and trained healthcare personnel capable of operating it are limited in number. This problem should be addressed immediately to decrease neonatal mortality rates, and a systematic referral system should be made for high-risk neonates (birth weight less than 1,500 grams or gestational age less than 32 weeks), or even for pregnant mothers expected to give birth to high-risk neonates, who need to be admitted to the NICU.<sup>29,30</sup>

At our hospital, sepsis was the third most frequent cause of death (16%). Sepsis may have been caused by LBW infants' higher susceptibility to infection.<sup>31</sup> Other contributing factors might include inadequate hygiene and infection control, such as neonatal ward hygiene, hand hygiene, and the presence of vectors (e.g., cats, mice, and flies).<sup>25</sup> Hygiene could be improved by providing individual physical examination equipment (stethoscopes and thermometers) for each neonate, or cleaning the equipment with alcohol-based antiseptics before and after use, cleaning neonatal beds or incubators daily, strict limitation on numbers of visitors and the visitation schedule, as well as good hand hygiene.<sup>31</sup>



A limitation of our study was the possibility of inaccuracy in determining gestational age, which was mainly based on the maternal last menstrual period. Actually, data on gestational age (preterm and non-preterm) of LBW infants were available, but we decided to not use it in the survival analysis due to concerns of inaccuracy. Therefore, we categorized LBW newborns based on their birth weight, which was a more objective measurement. Using a modified Ballard score in future studies to get a more accurate gestational age might be an option.<sup>32</sup> Another limitation was the observational design of the study, as we were unable to analyze comorbidities or other causes of death in LBW.

This study was, to our knowledge, the first of its kind to examine the profile of LBW infants in one of Indonesia's regions. Therefore, our preliminary data may be used to establish the profile of LBW in Indonesia, in order to improve neonatal healthcare in peri-urban health centers which have neonatal care units.

In conclusion, the prevalence of LBW in this study is quite high, but we observe slightly lower mortality rates compared to similar studies in other developing countries. However, there are differences in mortality rates between birth weight categories. Therefore, we suggest several means to improve neonatal healthcare, such as training programs for doctors and nurses in neonatal resuscitation, gestational age estimation based on Ballard score, providing more CPAP devices, and inclusion of antenatal steroid injection in routine preterm labor care. We also recommend that general practitioners practicing at rural or peri-urban healthcare settings have adequate skills and knowledge in basic neonatal care. Future studies are also needed, preferably with more comprehensive design, such as a long-term cohort to better evaluate the already existing neonatal healthcare procedures, factors influencing LBW prevalence and LBW mortality rates, as well as risk factors for nosocomial infection in LBW during hospitalization.

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## Conflict of interest

None declared.

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