

## Determinants of Mortality among Low Birthweight Infants During Hospitalization in Karangasem District Hospital

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### Abstract

**Background and purpose:** Infant mortality rate in Indonesia is still high and is largely related to low birthweight (LBW) infants. Previous studies reported the socio demographic and clinical factors as determinants of mortality of LBW infants, but rarely examined factors related to their health services. This study aimed to determine the demographic, clinical and health services as determinants of mortality of LBW infants during hospitalization.

**Methods:** This study was a retrospective using cohort data of medical record of LBW infants in Karangasem Hospital since January 2012 to October 2014. Logistic regression was done to determine the relationship between demographic, clinical and health services factors with LBW infants' mortality.

**Results:** The proportion of mortality among LBW infants during hospitalization was 12.12%. Most parents (64.6%) live in good access to health services. The proportion of female infants (51.4%) was higher than male. LBW infants who were born in hospital (85.7%) greater than born outside hospital. Vaginal delivery (75.3%) was greater than C-section. Preterm infants (57.1%) was greater than at term with median of birthweight was 2100 grams. Proportion of asphyxia, respiratory distress syndrome (RDS), sepsis, hypoglycemia and hypothermia, respectively 24.1%, 4.66%, 0.78%, 7.92% and 3.73%. Variables associated with LBW mortality were increasing of 50 grams of birthweight, asphyxia, RDS and referred infants.

**Conclusion:** The mortality of LBW infants during hospitalization was 12.12% with increasing of 50 grams of birthweight, asphyxia, RDS and referred infants found as determinant factors.

**Keywords:** Low birth weight mortality, demographic factors, referral system, clinical factors

## Determinan Kematian Bayi Berat Lahir Rendah Selama Rawat Inap di RSUD Karangasem

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### Abstrak

**Latar belakang dan tujuan:** Angka kematian bayi di Indonesia masih tinggi terutama pada periode perinatal yang sebagian besar disebabkan oleh bayi berat lahir rendah (BBLR). Penelitian sebelumnya tentang determinan kematian BBLR lebih banyak menganalisis faktor sosiodemografi dan klinis tetapi tidak banyak tentang faktor pelayanan kesehatan. Penelitian ini bertujuan untuk mengetahui faktor demografi, klinis dan pelayanan kesehatan sebagai determinan kematian BBLR selama rawat inap.

**Metode:** Penelitian ini adalah studi retrospektif dengan analisis data kohor BBLR pada rekam medis pasien yang dirawat di RSUD Karangasem sejak 1 Januari 2012 sampai 31 Oktober 2014. Analisis regresi logistik dilakukan untuk mengetahui hubungan faktor demografi, klinis dan pelayanan kesehatan dengan kematian BBLR.

**Hasil:** Angka kematian BBLR selama rawat inap adalah 12,12%. Sebagian besar (64,6%) orang tua pasien bertempat tinggal di daerah dengan akses yang mudah terhadap pelayanan kesehatan. Proporsi BBLR bayi perempuan (51,4%) lebih besar dari laki-laki, lebih banyak BBLR yang lahir di RSUD Karangasem (85,7%) dibanding lahir di luar RS. Cara persalinan pervaginam (75,3%) lebih banyak dari seksio, bayi prematur (57,1%) lebih banyak dari aterm dengan median berat lahir 2100 gram. Proporsi asfiksia, *respiratory distress syndrome* (RDS), sepsis, hipoglikemia, hipotermia masing-masing 24,1%, 4,66%, 0,78%, 7,92% dan 3,73%. Variabel yang ditemukan berhubungan secara independen dengan kematian BBLR yaitu peningkatan 50 gram berat lahir, asfiksia, RDS dan rujukan.

**Simpulan:** Angka kematian BBLR di RSUD Karangasem cukup tinggi sebesar 12,12% dengan determinan peningkatan 50 gram berat lahir, asfiksia, RDS dan rujukan.

**Kata kunci:** Kematian bayi berat badan lahir rendah, faktor demografi, sistem rujukan, faktor klinis

## Introduction

Low birthweight (LBW) infant is infant with birthweight less than 2500 grams regardless of gestational age. Very low birthweight (VLBW) infant is infant with birthweight less than 1500 gram and extremely low birthweight (ELBW) infant is infant with birthweight less than 1000 grams.<sup>1</sup> Incidence and mortality of LBW infants are still high and considered as a major cause of neonatal mortality in developing countries.<sup>2</sup> In Indonesia, up to 30.3% of LBW infant died in perinatal period.<sup>3</sup> About 12.2% of neonatal mortality in 2011 was caused by LBW.<sup>4</sup> The District Health Office of Karangasem reported that during 2004 to 2011 the proportion of neonatal mortality related to LBW was very high (up to 58.42%). In addition, during 2012 to 2014, Karangasem hospital also reported high mortality of LBW during hospitalization.

Previous studies in several countries, including Indonesia have reported determinants of LBW mortality.<sup>5,6,7,8,9,10,11,12</sup> Most of those studies were conducted in tertiary or central hospital with focus on sociodemographic and clinical factors. Limited studies were conducted in district hospitals with referral system and access to health services as determinants factors.

Karangasem Hospital is a district public hospital located in Karangasem District, Bali, where most of the people living in rural area and have difficult access of health services. This study was conducted to determine the relationship of LBW infants mortality with demographic, clinical, and health service during hospitalization in Karangasem Hospital.

## Method

This study was a retrospective using cohort data of LBW infant in Karangasem Hospital

since January 2012 to October 2014. Data on demographics, clinical and health service and also LBW mortality were taken from available medical records. Exclusion criteria were infant with birthweight less than 500 grams, those who was hospitalized in Karangasem hospital but referred to another hospital, having congenital anomalies and parents living outside Karangasem District.

Demographics data included in the analysis were residence and gender. Residence was divided in two categories, good access and difficult access. The difficult access implies to the area where people have less access to the health services with travel time to the hospital more than 1 hour. Referral status was divided to referred and non-referred infant. Referred infant was infant who was born outside of the hospital then referred to Karangasem Hospital. Non referred infant was infant who was born and hospitalized in Karangasem Hospital. Clinical factors included were mode of delivery (vaginal and C-section), birthweight, asphyxia, respiratory distress syndrome (RDS), sepsis, hypoglycemia and hypothermia.

Extraction forms were used to extract the data from medical record and then were inputed to MS Excel format. Data were analyzed by logistic regression to determine the relationship between demographic, health services and clinical factors with infants mortality.

The study has gained ethical approval from the Ethics Committee of the Faculty of Medicine Udayana University.

## Result

A total of 672 medical records of LBW infants were available, and 28 of them were excluded from the study; therefore, 644

**Table 1. Sample characteristics**

Variable	Categories	Total		Alive infants		Death infants	
		n	(%)	n	(%)	n	(%)
Residence	Good areas	416	(64.6)	368	(88.4)	48	(11.6)
	Difficult access	221	(34.3)	190	(85.9)	31	(14.1)
	Missing	7	(1.1)				
Sex	Female	331	(51.4)	132	(91.7)	12	(8.3)
	Male	313	(48.6)	45	(93.7)	3	(6.3)
Referral status	Not referred	552	(85.7)	494	(89.5)	58	(10.5)
	Referred	86	(13.4)	65	(75.6)	21	(24.4)
	Missing	6	(0.9)				
Birthweight/50 grams	Median	644	42	565	43	79	24
	(IQR)		(36-46)		(38-46)		(18-32)
Mode of delivery	Vaginal	485	(75.3)	423	(87.2)	62	(12.8)
	C-section	154	(23.9)	137	(88.0)	17	(11.0)
	Missing	5	(0.8)				
Maturity	At term	261	(40.5)	253	(96.93)	8	(3.07)
	Preterm	368	(57.1)	298	(80.0)	70	(19.0)
	Missing	15	(2.4)				
Asphyxia	No	489	(75.9)	451	(92.2)	38	(7.8)
	Yes	155	(24.1)	114	(73.5)	41	(26.45)
RDS	No	614	(95.3)	548	(89.3)	66	(10.7)
	Yes	30	(4.7)	17	(56.7)	13	(43.3)
Sepsis	No	639	(99.2)	562	(87.9)	77	(12.1)
	Yes	5	(0.8)	3	(60.0)	2	(40.0)
Hypoglycemia	No	593	(92.1)	516	(87.0)	77	(13.0)
	Yes	51	(7.9)	49	(96.1)	2	(3.9)
Hypothermia	No	620	(96.3)	545	(87.9)	75	(12.1)
	Yes	24	(3.7)	20	(83.3)	4	(16.7)

IQR = Inter Quartile Range

LBW infants were eligible for the analysis. From 644 LBW infants, there were 90 (13.98%) VLBW infants and 25 (3.88%) ELBW infants. Among 644 LBW, there were 79 death cases (12.12%), while among 90 VLBW infants there were 52 (57.78%) death case and from 25 ELBW there were 24 (96.0%) death cases.

Most LBW infants were residing at good access areas (64.6%), mostly girl (51.4%), not referred cases (85.7%), vaginal delivery (75.3%), preterm infants (57.1%), with median birthweight 2100 grams. The proportion of asphyxia, RDS, sepsis, hypoglycemia and hypothermia, were respectively 24.10%, 4.66%, 0.78%, 7.92% and 3.73% (Table 1).

Eleven independent variables were analyzed to determine crude OR of death infants. Eight variables with crude OR <0.2 were continued in multivariate analysis. Multi collinearity test showed that there was no strong correlation across variables, therefore, fit to be analysed in multivariate model. In the multivariate analysis, three variables were independently found as predictors of LBW death. Those variables were referred infants (AOR=2.30; 95%CI: 1.07-4.95), asphyxia (AOR=2.85, 95%CI: 1.43-5.66) and RDS (AOR=4.62, 95%CI: 1.69-12.62). One variable found to be a protective factor of LBW death was increasing of 50 grams birthweight (AOR=0.84, 95%CI=0.81-0.87).

**Table 2. Crude and adjusted OR of determinants of LBW mortality**

Variable	Categories	Crude OR	95%CI	p value	Adjusted OR	95%CI	p value
Residence	Good areas	1(ref)			-	-	-
	Difficult access	1.25	0.77–2.03	0.37	-	-	-
Sex	Female	1(ref)			1(ref)		
	Male	1.75	1.08–2.84	0.02*	1.43	(0.76-2.70)	0.27
Referral status	Not referred	1(ref)			1(ref)		
	Referred	2.75	1.57–4.83	<0.001*	2.30	(1.07-4.96)	0.03
Birthweight/50 grams		0.83	0.80–0.85	<0.001*	0.84	(0.81-0.87)	<0.001
Mode of delivery	Vaginal	1(ref)			-	-	-
	C-section	0.84	0.48–1.49	0.57	-	-	-
Maturity	At term	1(ref)			1(ref)		
	Preterm	7.43	3.51–5.73	<0.001*	1.03	(0.40-2.67)	0.96
Asphyxia	No	1(ref)			1(ref)		
	Yes	4.27	2.62–6.95	<0.001	2.85	(1.43–5.66)	0.003
RDS	No	1(ref)			1(ref)		
	Yes	6.35	2.95–13.65	<0.001	4.61	(1.69-12.62)	0.003
Sepsis	No	1(ref)			1(ref)		
	Yes	4.87	0.80–29.58	0.09	1.45	(0.15-14.11)	0.75
Hypoglycemia	No	1(ref)			1(ref)		
	Yes	0.27	0.07–1.15	0.08	0.49	(0.11-2.24)	0.34
Hypothermia	No	1(ref)			-	-	-
	Yes	1.45	0.48–4.37	0.51	-	-	-

- = was not analyzed in to multivariate analysis

\*= statistically significant

## Discussion

This study found that the death rate among LBW infants during hospitalization were high and were determined by referral and clinical condition at the first contact with the hospital. The death rate among LBW infants during hospitalization in Karangasem Hospital was 12.27%. The LBW mortality in this study was still high compared to 5,35% national mortality data from Demographic and Health Survey Indonesia (IDHS) in 2007.<sup>5</sup> This comparison should be treated carefully because samples of IDHS also included LBW infants who were not hospitalized.

This study found that asphyxia was independent risk factor to the death of the LBW infants. Asphyxia often related to infants with fetal distress in prenatal period, which associated to the condition of mother, including the condition the umbilical cord

and the placenta. In a state of asphyxia, the baby will be deprived of oxygen and the first occurred sign was stopped of breath and ended with the death.<sup>13</sup> The training in handling of newborn asphyxia need to be implemented more intensively. This is interesting because previous study in other province (Sardjito Hospital) reported asphyxia was not found to be a risk factor of LBW infants death. The Sardjito Hospital study also found that among six clinical factors, only sepsis and hypoglycemia were found as risk factors of LBW infants death. Furthermore, four factors (sepsis, HMD, hypoglycemia and hypothermia) were found as risk factor of VLBW infant death.<sup>6</sup>

This study also found that RDS as a risk factor of LBW infants death. It was consistent with the study in Dr. Sadjito Hospital in Indonesia<sup>6</sup> and with other study in Vali-e-Asr Hospital, Iran.<sup>10</sup> RDS is a

respiratory disease that primarily affects preterm LBW. Many factors involved to physiological changes that occur in RDS, is not fully understood. The primary dysfunction that occurs is the synthesis of surfactant reduced. RDS is a state of emergency in perinatal period which may be harmful to the newborn which ended with death.<sup>13</sup> RDS was found in about 50% of infants who was born weighing 501-1500 grams or gestational age <34 weeks. Measures of RDS prevention need to be implemented through the prevention of LBW/preterm delivery, corticosteroids in antenatal period with the threat of LBW/preterm labor. Surfactant administration is one of the special management for LBW/preterm infants to prevent RDS,<sup>14</sup> but has not yet become standard procedure in Karangasem Hospital. Need to further evaluation of administration and a policy or protocol of surfactants in LBW/preterm infant approved by the institution concerned.

Non-clinical factors that significantly associated with LBW mortality was referred infants. It was likely associated with the high proportion of VLBW in referred infants (22.1%) compared to non referred (12.86%). The lower birthweight has higher risk of death.<sup>13</sup> Ideally, the mother who is suspected to have LBW infants should be referred during the ante partum period. However, we could not refer all cases to hospital earlier could be caused by the limited resources at primary health care to be diagnosed early of LBW. Frequency of antenatal care (ANC) and knowledge of pregnant women about the signs of high risk pregnancy can also effect of early diagnosis of LBW. The evaluation was necessary to improve the referral system of LBW infants. Especially in the groups of VLBW and ELBW infants, should be referred to the adequate

resource hospital. In Indonesia, this type of hospital is called type A and B hospital (in accordance to the criteria of hospital competence).<sup>15</sup> Infants should be referred using transport incubator, but very rarely available in midwife or public health centre. Although transport incubators have been available in most hospital, but have not been used to refer infants from a midwife or health center to the hospital. Another method that can be utilized to keep the infant warm during the referral process is the Kangaroo Care.<sup>13</sup>

Proportion of mortality in preterm LBW (19.02%) was greater than at term LBW (3.07%), crude OR=7.43 and statistically significant. However, in multivariate analysis, the maturity variable was not independently associated with mortality. It was likely to happens because there was correlation between the maturity with birthweight, indicated by moderate correlation index in the multicollinearity test. While multivariate analysis were performed without birthweight variable, maturity independently significantly associated with LBW mortality (AOR=5.23, 95%CI: 2.41-11.36). Maturity is determined based on gestational age, that the younger gestational age and longer impaired growth causing the greater possibility of lower birthweight.<sup>13</sup>

The increase of 50 grams of birthweight was found as a protective factor. This result is similar to many previous studies.<sup>6,7,8,9,10,11,12</sup> This was occurred because infants with higher birthweight had lower growth disorder problem than infants with lower birthweight.<sup>13</sup>

Proportion of mortality among C-section delivery was higher than vaginal delivery but it was not statistically significant. It was in line to several previous studies,<sup>12,16,17</sup> A study analyzed the maternal and infant data from National Center for

Health Statistics (NCHS), used the US birth linked birth/infant death certificate data reported that survival of C-section in preterm LBW increased in 31 weeks of gestation but decreased in gestational age > 33 weeks.<sup>18</sup> Other study in Lagos University Teaching Hospital (LUTH), Nigeria found that mode of delivery was independently associated with mortality in perinatal period.<sup>19</sup> The analysis in our study was not done at a certain gestational age and was performed during hospitalization, not only in perinatal period which was different from previous study.<sup>18,19</sup>

This study found that LBW infants with hypoglycemia had not significantly a lower risk of death than those without hypoglycaemia. Lower risk of death might due to the success of handling of the LBW with hypoglycemia. Hypoglycemia of LBW infants can be caused by low blood glucose reserves. Hypoglycemia is a serious problem, can lead to seizures resulting in hypoxia of the brain. If does not managed properly, hypoxia will damage the central nervous system and ended up being the death.<sup>13</sup>

Sepsis, hypothermia and hyperbilirubinemia were not significantly associated with LBW mortality, in contrast to the previous study that uses a case-control design and only examined the referral LBW infants.<sup>6</sup> The proportion of sepsis, hypothermia, and hyperbilirubinemia in this study was very small (0.78%, 3.73%, 1.24%), so it is more appropriate to use a case-control design.

Limitation of this study was a retrospective study with secondary data. Data was extracted from infant medical records without extraction of maternal medical records. Recording, reporting, and diagnosis was made by a different clerk and difficult to perform data validation. Bias

might also due to inaccuracies in determining the category of residence.

## Conclusion

The mortality of LBW infants during hospitalization was 12.12% with increasing of 50 grams of birthweight, asphyxia, RDS and referred infants found as determinant factors.

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