

Low birth weights and risk of neonatal mortality in Indonesia

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Received: October 11, 2016; Revised: November 21, 2016; Accepted: Desember 5, 2016

Abstrak

Latar Belakang: Angka kematian neonatal di Indonesia mengalami stagnansi sejak sepuluh tahun terakhir. Dalam rangka mengakselerasi penurunan angka kematian neonatal di Indonesia, intervensi spesifik diperlukan pada faktor utama penyebab kematian. Penelitian ini bertujuan untuk mengetahui kontribusi berat badan lahir rendah terhadap kematian neonatal di Indonesia.

Metode: Data Survei Demografi dan Kesehatan Indonesia tahun 2012 digunakan untuk analisis. Sejumlah 18021 kelahiran hidup dalam periode lima tahun terakhir telah dilaporkan oleh responden. Terdapat 14837 anak memiliki informasi lengkap untuk analisis. Adjusted relative risk dengan analisis survival digunakan untuk mengukur hubungan antara variable dengan kematian neonatal.

Hasil: Anak yang lahir dengan berat badan rendah memiliki risiko 9.89 kali lebih tinggi untuk kematian neonatal bila dibandingkan dengan anak yang lahir dengan berat badan normal [adjusted relative risk (aRR) = 9.89; 95% confidence interval (CI): 7.41 – 13.19]; $P = < 0.0001$]. Anak yang lahir dari ibu berumur muda (15 - 19 tahun) memiliki risiko 94% lebih tinggi bila dibandingkan dengan anak yang lahir dari ibu dengan umur antara 20-35 years. Anak dari ibu yang bekerja 81% memiliki risiko kematian neonatal lebih tinggi bila dibandingkan dengan anak yang lahir dari ibu tidak bekerja.

Kesimpulan: Anak yang lahir dengan berat badan rendah dan lahir dari ibu muda memiliki risiko kematian neonatal lebih tinggi. Bayi yang lahir dengan berat badan rendah membutuhkan perawatan yang tepat untuk memperpanjang ketahanan hidup anak. (*Health Science Journal of Indonesia 2016;7(2):113-7*)

Kata Kunci: Berat badan lahir rendah, kematian neonatal, Indonesia

Abstract

Backgrounds: Neonatal mortality rates in Indonesia remain steady in the past decades (20 in 2002 to 19 per 1000 live births in 2012). In order to accelerate the decline in neonatal mortality rate in Indonesia, specific interventions would have to target key factors causing mortality. This study aims to examine contribution of low birth weight on neonatal mortality in Indonesia.

Methods: Data from the Indonesia Demographic and Health Survey (IDHS) conducted in 2012 were used in the analysis. A total of 18021 live births in the last five years preceding the survey were reported from the mothers. Completed information of their children (14837 children) were taken for this analysis. The adjusted relative risk with cox proportional hazard regression analysis were used to assess the strength of association to neonatal mortality.

Results: Children born in low birth weight were 9.89-fold higher risk of neonatal mortality compared to children born in normal weight [adjusted relative risk (aRR) = 9.89; 95% confidence interval (CI): 7.41 – 13.19]; $P = < 0.0001$]. Children delivered from younger mothers (aged 15 - 19 years) had 94% higher risk of neonatal mortality compared to children delivered from mothers aged 20-35 years. Working mothers had 81% higher risk of neonatal mortality compared to unemployed mothers.

Conclusions: Children born in a low birth weight and born from younger mothers had higher risk of neonatal mortality. Appropriate care and treatment for children born in low birth weight is needed to prolonged survival rates of the children. (*Health Science Journal of Indonesia 2016;7(2):113-7*)

Keywords: Low birth weight, neonatal mortality, Indonesia

The fourth Millennium Development Goal (MDG-4) targeted to reduce under-five mortality by two-third between 1990 to 2015. Globally, under-five mortality rate had been reduced by 53% since 1990.¹ Indonesia has greater decline of under-five mortality which around 59 percent, from 97 deaths per 1,000 live births in the IDHS 1991 to 40 deaths per 1,000 live births in IDHS 2012.² However, it was estimated that 6.3 million children died before complete age of five and around 41.6% of under-five mortality occur in the first months (neonatal period).¹ In addition, neonatal mortality rates in Indonesia remained steady in the past decades (20 in 2002 to 19 per 1000 live births in 2012).²

The slow decline of neonatal mortality and a widening inequity across geographic and socio-demographic groups remains a concern in Indonesia.³ The eastern provinces tend to have higher neonatal mortality rates compared to the western area. Disparities across provinces and districts occur due to social stratification, ecological-cultural diversity, and Indonesia's large geographical area. In addition, Indonesia has a complex health system, including the decentralization of health at the district level.

Several studies have shown low birthweight closely associated with neonatal mortality and affect child development and future risk of chronic disease.^{4,5} Low birth weights (with or without prematurity) decrease the odds of the children surviving in the first months of life.^{6,7} Around 10.2% of children in Indonesia born in low birth weight.⁸ This may account for lack of improvement in neonatal mortality reduction. Therefore, this study aims to examine the contribution of low birthweight on neonatal mortality in order to accelerate the decline in neonatal mortality rate in Indonesia.

METHODS

The analysis was conducted in 2016 derived from the 2012 Indonesia Demographic and Health Survey (IDHS) data. The 2012 IDHS was designed to produce estimates of health indicators at the national, urban-rural, and provincial levels. A total of 46,024 households were selected in the sample, of which 44,302 were occupied. Of these households, 43,852 were successfully interviewed, resulting in a 99% household response rate. In the interviewed households, 47,533 women were identified as eligible for individual interview and of these candidates completed interviews were conducted with 45,607 women, yielding a response rate of 96 percent. A total

of 18,021 live births in the last five years preceding the survey were reported by the mothers.² Out of them, 14837 children completed information for the analysis.

The outcomes of the analysis were neonatal and under-five mortality rates. The neonatal mortality rates defined as the number of children died before reaching 28 days of age per 1000 live births. While the under-five mortality defined as the number of children died before reaching exact age 5. In these analyses, the outcomes were recorded as a binary variable (0=Alive and 1=Died). Potential predictors variables included in the analysis were *birth weight, gender, delivery complication, place of delivery, type of delivery, mother's age, mother's occupation, mother's education, household wealth status and residence.*

Estimation of neonatal and under-five mortality rates were calculated for live births in the last five years preceding the survey. Frequency tabulations were then conducted to show the distribution of the data and followed by the contingency table analysis to examine the impact of potential predictors on neonatal and child mortality without adjusting for other covariates. A backwards stepwise cox proportional hazard regression analysis was used to identify independent variables that were significantly associated with the study outcomes. The adjusted relative risk with 95% confidence intervals were calculated to assess the strength of association, and those relative risk with $p < 0.05$ were retained in the final model.⁹ The analysis used STATA 12.0 software.

RESULTS

As shown in Table 1, out of 14837 children, nearly 51% lived in rural areas and they were almost equally between male and female. About 30% of the children came from the poorest household and more than half of the mothers had complete secondary education. Table 1 also revealed that more than half of the mothers were working and most of them aged between 20 to 35 years old.

Table 1 shows percentage of neonatal mortality by socio-demographic characteristics and pregnancy history of mothers. As shown in Table 1, male children were more likely to have higher risk of neonatal mortality compared to female children. Neonatal mortality was similarly distributed in terms of history of delivery complication, place of delivery, type of delivery, mother's education, socio-economic status and type of residence.

Table 1. Socio-demographic, pregnancy history and risk of neonatal mortality

Variables	Alive		Death		Crude Odds Ratio	95% Confidence Interval	P
	n	%	n	%			
Gender of the children							
Female	7,078	98.9	79	1.1	1.00	reference	0.011
Male	7,558	98.4	122	1.6	1.45	1.09 - 1.92	
Delivery complication							
No	7,950	98.8	100	1.2	1.00	reference	0.197
Yes	6,686	98.5	101	1.5	1.20	0.91 - 1.59	
Place delivery							
Home/others	5,243	98.9	59	1.1	1.00	reference	0.058
Health facilities	9,393	98.5	142	1.5	1.34	0.99 - 1.82	
Type delivery							
Normal/others	12,624	98.7	166	1.3	1.00	reference	0.136
C-section	2,012	98.3	35	1.7	1.32	0.92 - 1.91	
Mother's age							
15-19	436	97.5	11	2.5	2.04	1.09 - 3.79	0.025
20-35	11,133	98.8	138	1.2	1.00	reference	0.056
36-49	3,067	98.3	52	1.7	1.37	0.99 - 1.88	
Mothers occupation							
Not working	6,953	99.0	69	1.0	1.73	1.29 - 2.32	0.000
Working	7,683	98.3	132	1.7			
Mother's education							
No education	172	98.3	3	1.7	1.00	reference	0.739
Primary	3,918	98.6	56	1.4	0.82	0.25 - 2.64	
Secondary	8,284	98.5	125	1.5	0.87	0.27 - 2.75	
Higher	2,262	99.3	17	0.8	0.43	0.13 - 1.48	
Socio-economic status							
Poorest	3,270	98.3	57	1.7	1.00	reference	0.073
Poorer	3,034	98.8	36	1.2	0.68	0.45 - 1.04	
Middle	2,912	98.5	44	1.5	0.87	0.58 - 1.29	0.480
Richer	2,833	98.7	37	1.3	0.75	0.49 - 1.14	0.175
Richest	2,587	99.0	27	1.0	0.60	0.38 - 0.95	0.029
Type of residence							
Urban	7,468	98.7	100	1.3	1.00	reference	0.720
Rural	7,168	98.6	101	1.4	1.05	0.80 - 1.39	

Table 2. Low birth weight and risk of neonatal mortality

Variables	Alive		Death		Adjusted Odds Ratio	95% Confidence Interval	P
	n	%	n	%			
Birth Weight (grams)							
500 - 2499	13,632	99.2	116	0.8	1.00	reference	0.000
2500 - 8000	1,004	92.2	85	7.8	9.89	7.41 - 13.19	
Mother's age							
15-19	436	97.5	11	2.5	1.94	1.02 - 3.68	0.043
20-35	11,133	98.8	138	1.2	1.00	reference	0.195
36-49	3,067	98.3	52	1.7	1.24	0.90 - 1.72	
Mothers occupation							
Not working	6,953	99.0	69	1.0	1.00	reference	0.000
Working	7,683	98.3	132	1.7	1.81	1.34 - 2.44	

The final model showed that *birth weight*, *mother's age* and *mother's occupation* were associated with neonatal mortality (Table 2). Low birth weights were risk factors of neonatal mortality. Children born in low birth weight had a 9.89-fold higher risk of neonatal mortality compared to children born in normal weight range [adjusted relative risk (aRR) = 9.89; 95% confidence interval (CI): 7.41 – 13.19].

Our final model also revealed that children delivered from younger mothers (aged 15 - 19 years) had 94% higher risk of neonatal mortality compared to those delivered from mothers aged 20-35 years [adjusted relative risk (aRR) = 1.94; 95% confidence interval (CI): 1.02 – 3.68]. Furthermore, mother's working status were associated to neonatal mortality. Working mother had 81% higher risk of neonatal mortality compared to unemployed mothers [adjusted relative risk (aRR) = 1.81; 95% confidence interval (CI): 1.34 – 2.44].

DISCUSSION

Our analysis showed that low birth weights increased the risk of neonatal mortality. Previous study in neonatal intensive care unit of Alzahra Educational-Medical centre Iran¹⁰, suggest that low birth weights had negative and direct relationship on infant mortality rates. The similar result also shown in further analysis of DHS 2002-2003 Indonesia.¹¹ The birth weight remained as a strong predictor after adjusted for several confounders, with the odds for neonatal death for low birth weight infants (<2500 grams) was 5.5 times higher than the normal weight infants (2500 – 3500 grams).¹¹ Some of common reasons of low birth weights include preterm births and small for gestational age.¹² These findings suggest the need to improve mother care during pregnancy and child birth, particularly of low birth weight infants. Improving supplementation for chronic maternal nutritional deficiencies¹³ and advocate appropriate care for preterm birth is important to reduce neonatal mortality. The kangaroo mother care can be an option for neonatal care with low birth weights; to put skin-to-skin contact between a mother and her newborn.¹⁴ The World Health Organization promotes essentials newborn care and developed clinical guidelines in order to prolonged newborn survival.¹²

Children delivered from mothers aged 15-19 years had higher risks of neonatal mortality. Studies in Bangladesh and India also showed that an

increase in mothers age is associated with child mortality reduction.¹⁵ The risk of a younger mother was a biological effect mediated by the mother's physiological immaturity.^{16,17} Further systematic review suggests difficulties of younger mother to access health facilities due to stigmatization and negative attitude from health providers.¹⁷ The younger mother was less likely than older mother to give adequate prenatal care to the children.¹⁸ This result suggests the important of delayed marriage and improved contraceptive use among younger mothers in order to reduce neonatal mortality rates in Indonesia.

Our findings report mother's occupation is also a risk factor in neonatal mortality. Similar to our findings, a study in India revealed that unemployed mothers had lower odds of neonatal mortality.^{19,20} In order to provide equal child care between employed and unemployed mothers, child day care should be existing in workplace. Furthermore, we suggest to ensure working mothers to have proper maternity leaves to provide better child care in early lives.²¹

The study had several limitations. First, only surviving mothers were interviewed, which may lead underestimate of neonatal mortality. Second, limitation of this study were related to recall bias. Estimation of neonatal mortality based on survey may also suffer from mothers misreporting their children's birth dates, current age or age at death.

Our study suggests that low birth weight has significant impact on neonatal mortality. These findings suggest an appropriate care and treatment for children born in low birth weight are needed to prolonged survival rates of the children, including kangaroo mother care for newborn care intervention.

In conclusion, in this study, we found that children born in a low birth weight and born from younger mothers had higher risk of neonatal mortality. Specifically, for mothers aged less than 20 years old had high neonatal mortality. A further study to understand nature of adolescence pregnancy in Indonesia is required.

Acknowledgments

The author would like to thank the Department of Foreign Affairs and Trade (DFAT) and University of South Australia for the support of conducting this analysis through the Short Term Awards (STA) on Quantitative Data Analysis for Policy Evaluation and Formulation.

REFERENCES

1. Wang H, Liddell CA, Coates MM, et al. Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2014;384(9947):957-79.
2. Statistics Indonesia (Badan Pusat Statistik—BPS), National Population and Family Planning Board (BKKBN), Kementerian Kesehatan (Kemenkes—MOH), and ICF International. *Indonesia Demographic and Health Survey 2012*, BPS, BKKBN, Kemenkes, and ICF International, Jakarta, Indonesia. 2013.
3. Hodge A, Firth S, Marthias T, et al. Location matters: trends in inequalities in child mortality in Indonesia. Evidence from repeated cross-sectional surveys. *PLoS One*. 2014;9(7): e103597.
4. Varela-Silva MI, Azcorra H, Dickinson F, et al. Influence of maternal stature, pregnancy age, and infant birth weight on growth during childhood in Yucatan, Mexico: a test of the intergenerational effects hypothesis. *American Journal of Human Biology*. 2009;21:657-63.
5. Bakketeig LS, Jacobsen G, Skjerven R, et al. Low birthweight and mortality: the tendency to repeat low birthweight and its association with early neonatal and infant morbidity and mortality. *Paediatric Perinatal Epidemiology*. 2006;20(6):507-11.
6. Gage TB. Birth-weight-specific infant and neonatal mortality: effects of heterogeneity in the birth cohort 2002. *Hum Biol*. 2009;81:753-72.
7. Jensen EA, Lorch SA. Effects of a Birth Hospital's Neonatal Intensive Care Unit Level and Annual Volume of Very Low-Birth-Weight Infant Deliveries on Morbidity and Mortality. *JAMA Pediatr*. 2015;169(8):e151906.
8. Balitbangkes Kementerian Kesehatan. *Report of Basic Health Research Year 2013*. Jakarta. 2013. Indonesian.
9. Hosmer DW, Lemeshow S, May S. *Applied Survival Analysis: Regression Modeling of Time to Event Data* 2nd ed: Wiley, 2011.
10. Ghojzadeh M, Velayati A, Mallah F, et al. Contributing death factors in very low-birth-weight infants by path method analysis. *Nigerian Medical Journal: Journal of the Nigeria Medical Association*. 2014;55(5):389-93.
11. Titaley CR, Dibley MJ, Agho K, et al. Determinants of neonatal mortality in Indonesia. *BMC Public Health*. 2008;8: 232.
12. The World Health Organization. *Born too soon: the global action report on preterm birth*. Geneva. 2012.
13. Purandare CN. Maternal nutritional deficiencies and interventions. *The Journal of Obstetrics and Gynecology of India*. 2012;62:621-3.
14. Conde-Agudelo A, Belizan JM, Diaz-Rossello J. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. *Cochrane Database System Review*. 2011:CD002771.
15. Huda TM, Tahsina T, El Arifeen S, et al. The importance of intersectoral factors in promoting equity-oriented universal health coverage: a multilevel analysis of social determinants affecting neonatal infant and under-five mortality in Bangladesh. *Global Health Action*. 2016;9:29741.
16. Chen XK, Wen SW, Fleming N, et al. Teenage pregnancy and adverse birth outcomes: a large population based retrospective cohort study. *International Journal of Epidemiology*. 2007;36:368-73.
17. Ramaiya A, Kiss L, Baraitser P, et al. A systematic review of risk factors for neonatal mortality in adolescent mother's in Sub Saharan Africa. *BioMed Central Research Notes*. 2014;7(1):750.
18. Raj A, McDougal L, Rusch ML. Effects of young maternal age and short interpregnancy interval on infant mortality in South Asia. *International Federation of Gynecology and Obstetrics*. 2014;124(1):86-7.
19. Singh A, Kumar A, Kumar A. Determinants of neonatal mortality in rural India, 2007-2008. *PeerJ*. 2013;1:e75.
20. Gouda J, Gupta AK, Yadav AK. Association of child health and household amenities in high focus states in India: at district-level analysis. *BMJ Open*. 2015;5:e007589.
21. Earle A, Mokomane Z, Heymann J. International perspectives on work-family policies: lessons from the world's most competitive economies. *Future Child*. 2011;21:191-210.