Perinatal mortality in Indonesia: an unfinished agenda

Riawati Jahja

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Abstract

Perinatal mortality is a profound issue in maternal and child health due to its close relation with the maternal condition. There exist Millennium Development Goals (MDGs) which are to be achieved by 2015. These are coupled with a continuing need for comprehensively monitoring and identifying factors associated with perinatal mortality, which is a primary concern for developing countries inclusive of Indonesia. Previous and on-going health programs could have brought about strategic interventions but as different attributes can emerge due to epidemiological transition, and given the fact that associated factors may remain persistent, forward thinking strategies in public health are forever in need of renewal.

Results from our research show that educational variables, poor awareness towards proper antenatal care visits and weak services at the front-line of healthcare delivery (community outreach) worsen the condition of childbearing women, raising the question of biological risk factors in line with socio-economic variables.

Keywords: *perinatal mortality; Indonesia; population studies; child mortality; maternal and child health services*

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Riawati Jahja[1]

I. Introduction

2015, four years from now, developing countries, inclusive of Indonesia are to achieve the 4th and 5th Millennium Development Goals (MDGs). Until now, these countries have been struggling with the problematic scenario of maternal and child health.[2] Globally, there are approximately six million perinatal deaths each year, 98% occur in the developing world and nigh on 350, 000 in south-east Asia.[3] In Indonesia, though judged successful in the reduction in maternal mortality, the decline rates do not show rapid momentum to achieving the target.[4] However, child mortality has a greater chance of achieving it.

Earlier studies found that factors associated with child mortality vary across countries and death rates have substantial variations within world regions[5] – countries still need to recognize problems of child mortality in their own territories. Moreover, previous and on-going health programs with strategic interventions could have brought changes and safeguards to society over time.[6] This said, associated factors in the past may no longer be significant and different attributes can emerge due to epidemiological transition. A report from *Riskerdas 2007* (Indonesia Basic Health Research) evidenced that 97% of the underlying causes of perinatal death were preventable. Such

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[1] Post-doctoral researcher, DUKE-NUS Graduate Medical School, National University of Singapore

[2]WHO. 2009. World Health Statistics 2009. Geneva: World Health Organization. http://www.who.int/whosis/whostat/EN_WHS09_Full.pdf.

[3]WHO. 2007. Neonatal and Perinatal Mortality. Country, Regional and Global Estimates 2004. World Health Organization 2007. Available from http://whqlibdoc.who.int/publications/2007/9789241596145_eng.pdf

[4]Hogan, Margaret C., Kyle J. Foreman, Mohsen Naghavi, Stephanie Y. Ahn, Mengru Wang, Susanna M. Makela, Alan D. Lopez, Rafael Lozano, and Christopher J. L. Murray. 2010. Maternal mortality for 181 countries, 1980-2008: a systematic analysis of progress towards Millennium Development Goal 5. The Lancet 375 (9726):1609-1623.

[5]Barros, F. C., C. G. Victora, J. P. Vaughan, and H. J. Estanislau. 1987. Perinatal mortality in southern Brazil: a population-based study of 7392 births. Bull World Health Organ 65 (1):95-104. Other studies also bear importance: Black, R. E., S. S. Morris, and J. Bryce. 2003. Where and why are 10 million children dying every year? Lancet 361 (9376):2226-34; Fikree, F. F., and R. H. Gray. 1996. Demographic survey of the level and determinants of perinatal mortality in Karachi, Pakistan. PaediatrPerinatEpidemiol 10 (1):86-96; Garssen, Joop. 2004. Perinatal mortality in the Netherlands. Backgrounds of a worsening international ranking.Demographic Research (13), http://www.demographic-research.org/volumes/vol11/13/11-13.pdf; Kusiako, T., C. Ronsmans, and L. Van der Paal. 2000. Perinatal mortality attributable to complications of childbirth in Matlab, Bangladesh. Bull World Health Organ 78 (5):621-7; Mellington, N., and L. Cameron. 1999. Female education and child mortality in Indonesia. Bull Indones Econ Stud 35 (3):115-44; Safonova, Tamara, and E. A. Leparsky. 1998. The unwanted child. Child Abuse & Neglect 22 (2):155-157; Seidman, D. S., R. Gale, P. E. Slater, P. Ever-Hadani, and S. Harlap. 1987. Does grand multiparity affect fetal outcome? Int J GynaecolObstet 25 (1):1-7.

[6]Bhutta, Z. A., G. L. Darmstadt, B. S. Hasan, and R. A. Haws. 2005. Community-based interventions for improving perinatal and neonatal health outcomes in developing countries: a review of the evidence. Pediatrics 115 (2 Suppl):519-617.

causes were maternal conditions during pregnancy and childbirth.[7] These data form the remit of our present enquiry through which we seek to evaluate factors associated with perinatal mortality in the period between 1 January 2003 and 31 December 2007, selecting factors for public health impact using from the Indonesian Demographic Health Survey 2007 (IDHS 2007).

Population data of IDHS and perinatal mortality

The use of population data for secondary analysis such as that provided by ICF Macro and the Demographic Health Survey (DHS) is beneficial for the eventual generalization of results. DHS is a regular population survey across many countries with a period of implementation approximately every five years. The other benefit of using DHS data is the possibility of comparing factors of interest between two periods of population surveys. For example, according to the IDHS 2007 report, it appears that perinatal mortality rates in Indonesia have persisted for a decade (24 and 25 per 1000 pregnancies during 1998─2002 and 2003─2007 respectively).[8] This can be evaluated by comparing the associated factors between IDHS 2002/03 and IDHS 2007 (the most recent survey to date). However, in Indonesia, by reason of conflict, four provinces were not surveyed in IDHS 2002/03 thereby the aforementioned comparison is not assured for a generalized national picture. While factors presented in the report of IDHS 2007 are only background characteristics such as the mother's age at birth; birth interval; type of residence; the mother's education and economic status in wealth quintile, there are more variables available that can be drawn from the population dataset of IDHS 2007, related to the mortality risk.

Our present study therefore draws upon data from the latest population survey of IDHS 2007 to address issues and factors associated with perinatal mortality, with a view to grasping a wider reaching picture and a better field ratio providing the professional with a practical measure and point of reference.

Socio-cultural Indonesia

Indonesia is a Republican country, located between Asia and Australia; it belongs to the body of South-East Asian nations. Indonesia is a reference, historically and naturally, well-known as the world's largest archipelago with a geographical dispersion over a vast expanse. This results in a diverse culture and a multitude of ethnic groups which are defined by their linguistic dialects. There are five large landmasses named Sumatera, Java, Kalimantan, Sulawesi and Irian Jaya. Amongst the extensive number of islands –17,000 in fact – only 6,000 are inhabited. Furthermore, 59% of the country's population is concentrated on Java Island, which measures as a mere 7% of Indonesian lands, within which lies the historically poignant Jakarta.

The 2000 Population Census pegged inhabitants at 205.8 million people, a number which was projected to reach 225.6 million by 2007. This qualifies Indonesia as the fourth most populated country in the world (sheer land mass considered).[8] There are 33 provinces in Indonesia, each, is subdivided into districts and municipalities. The next lower administrative units are sub-districts and villages. In total, there were 6,131 sub-districts and 73,405

[7]Riskerdas. 2007. Indonesia National Health Report 2007. Basic Health Reseach (RisetKesehatanDasar) (in Indonesian). Jakarta, Indonesia: BadanPenelitiandanPengembanganKesehatan, DepartemenKesehatan, Republik Indonesia, 2008. http://www.litbang.depkes.go.id/LaporanRKD/Indonesia/laporanNasional.pdf.

[8]Statistics Indonesia (BadanPusatStatistik--BPS) and Macro International 2008.Indonesia Demographic and Health Survey 2007. Calverton, Maryland, USA: BPS and Macro International.

villages in Indonesia by 2007. Villages are classified as either urban or rural. There are more rural areas than urban whereby agriculture is the country's largest employer.

The Indonesian population is predominantly Muslim. Forty-two percent of the people lived in urban areas escalating to 52% according to the 2007 survey. There were relatively similar proportions of reproductive women aged 15 to 49 years, who completed primary school (26.2%) but did not complete secondary school (25.1%).[8] Almost 5.7% of the reproductive women recorded had no education and only a small proportion accessed higher education (9.2%). The majority of these women work in the agricultural sectors of society. Given these cultural, statistical and geographic variants, health and a generalized national picture, for perinatal mortality particularly, is a challenge both for those in the field and those at the wheels of public health policy, research and its practices.

II. METHODOLOGY

Data

The 2007 IDHS used multiple-stage sampling stratified by urban (two stages) and rural areas (three stages) in all 33 Indonesian provinces, both in urban and rural settings. The Primary Sampling Unit was Census Block (CB). At the first stage, systematic sampling was employed to select CBs in urban areas while in rural areas sampling was conducted at the second stage following the selection of sub-districts with probability proportional to the number of households. At the last stage, 25 households were randomly selected from the household listing in each cluster.

There were four types of questionnaires used in the IDHS 2007.In this study we used the Women's questionnaire. We analyzed birth data reported from a nationally representative sample of ever-married women aged 15 to 49 years old, who were identified from the selected households. The details of the sampling procedures and questionnaires can be found elsewhere. [8]

Definition

The Perinatal period is the period after seven completed months of gestation until first week of life. Our study used the World Health Organization (WHO) definition for estimating the perinatal mortality rate (PMR), defined as the sum of stillbirths and early neonatal deaths (deaths occurring during the first seven days of life) per 1000 total births (sum of live and stillbirths).[9] Stillbirth and early neonatal deaths are summed, in our study, as "perinatal deaths."

Study variables

There were 19 variables identified based on the conceptual framework for the study of perinatal mortality.[10] We restricted this to singletons. The variables then were classified into two groups of (1) biological factors, and (2) maternal and child health factors. There were five biological factors worthy for the variables of study: gender, newborn size at birth; maternal age at the time of delivery; birth in past year and parity. The term "Newborn size at birth" was used instead of "birth weight" because half of the data on newborn birth weight were in fact missing and untraceable.

[9]WHO. 2006. Neonatal and Perinatal Mortality. Country, Regional and Global Estimates Geneva: World Health Organization. http://whqlibdoc.who.int/publications/2006/9241563206_eng.pdf.

[10]Kikhela, D. Nzita. 1989. Techniques for collection and analysis of data on perinatal mortality in Kinshasa, Zaire. Canada: IDRC.

This was measured according to the mother's recall of size and thus adjectival language was employed as a means of practical measure ("smaller", "average", and "larger"). The average size referred to the weight of 2500—<4000 grams and the maternal age at the time of delivery was categorized into five-year age groups starting with the cut-off age of less than 16 years. [11] The "Short birth interval" was determined by "birth/s in past year" (yes or no), defined as any birth/s within one year preceding the current newborn. Parity was according to the birth order number of the child: primiparity (1st child), multiparity (2nd to 4th), and grand-multiparity (≥5th).

Fourteen factors for maternal and child health included the frequency of antenatal care (ANC) visits. The WHO Standard for Maternal and Neonatal Care for all pregnant women recommends at least four ANC assessments by, or under, the supervision of a skilled attendant.[12] Our variable was only for the frequency of visits irrespective of who conducted the ANC. Assistance at delivery was divided into four levels: (1) health professionals (doctors, obstetrician/gynaecologists, nurses, midwives and village midwives, (2) by others (relatives, friends, and no-one), (3) traditional birth attendant (TBA), (4) ≥2 assistants at delivery.[13]

"Place of delivery" refers to services offered by government, private, or public sectors which were grouped as "Health facilities" while "Non-health facilities" were the respondent's home or someone else. The "Maternal desire for pregnancy" was examined by the variable as "wanted child" ("yes"; "no"). The sign/s of obstetric complications during pregnancy and childbirth were categorized into three groups: (1) no, (2) one sign, and (3) ≥2 signs.

Adverse signs/symptoms during pregnancy were listed as vaginal bleeding; fever; convulsion and fainting; breech presentation; swelling or retained fluid; hypertension; and dizziness. Adverse signs during childbirth were prolonged labor; excessive vaginal bleeding; fever and foul smelling vaginal discharge; convulsions; and water breaking >6 hours before delivery.

Economic status was ascertained using the wealth index of the World Bank [14] where assets or wealth rather than income or consumption are measured such as ownership of consumer items like a fan, television, car, and dwelling characteristics such as flooring materials, source of drinking water and toilet facilities.

Factors such as marital status; religion; history of pregnancy termination; maternal smoking status; maternal and paternal education, and type of residence were also included in the study to ensure a full engagement with the variables composing the socio-economic landscape of the Indonesian population.

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[11] Law of Marriage in Indonesia No.1, 1974 (in Indonesian).Pustaka: yayasanpeduliAnakNegeri (YPAN). http://bsdm.bappenas.go.id/data/Perundangan/UU%20No.%201%20Tahun%201974%20Tentang%20Perkawinnpdf.

[12] WHO. 2006. Standards for Maternal and Neonatal Care. Geneva: World Health Organization. http://www.who.int/making_pregnancy_safer/publications/standards/en/index.html.

[13] Suggesting a referral from non-health professional/s to health professional/s

[14] Gwatkin, DR, S Rustein, K Johnson, RP Pande, and A Wagstaff. 2000. Socio-Economic Differences in Health, Nutrition, and Population in Indonesia. The HNP/Poverty Thematic Group of the World Bank. http://siteresources.worldbank.org/INTINDONESIA/Resources/Human/socio-economic.pdf.

The Data analysis of our study

Our study used statistical software of PASW Statistic 17.0 for Windows® (SPSS Inc., Chicago, IL, USA) in order to analyze the data. Firstly, univariable analysis was carried out to identify any association between each variable and the perinatal outcome, death (internal value = 1) or survivor (internal value = 0), and subsequently, unadjusted odds ratio (ORs) and their 95% CI were calculated. Next, all variables were simultaneously entered into a multivariate logistic regression after checking for any evidence of co-linearity, and adjusted odds ratios (AORs) and their 95% CI estimated.

We found a partial non-response type of missing data in our analysis. The missing data occurred in five variables (birth size; ANC visit; wanted child; adverse sign/s during pregnancy and labor), which accounted for 22% of the total sample in the multivariate analysis. A hot-deck imputation method was applied because it is the most appropriate approach to dealing with the missing data in a sample survey.[15]The aforementioned method (which may appear stringently quantitative to the sociologist versed in qualitative analysis and experiential data), is further supported by the results of testing three assumptions using what is known as "sensitivity analysis:"

1) Complete-case analysis of missing data would not only decrease the sample size by 22% in multivariable regression (hence decrease power to detect significant patterns and associations) but would also put more weight on the selection bias. [16]

2) Inserting a missing category may increase residual confounding. [17]

3) Imputation of missing values may also lead to attenuation or exaggeration of the association of interest. [17]

Based on the above assumptions three models were generated:

(1) The First model was to eliminate all missing data.

(2) A second model was to add a "missing category" into each of the five variables.

(3)A third model was to replace the missing values using hot-deck imputation method. [18]

It was found that similar variables and strength of associations were in model two and model three in multivariate analysis while model one is inconsistent with 2 and 3. Lastly, we estimated the population attributable

[15]Ford, B.L, ed. 1983. An overview of hot-deck procedures. Edited by W. G. Madow, I. Olkin and D. B. Rubin, Incomplete data in sample surveys. New York: Academic Press.

[16]Little, R.J.A, and D.B. Rubin. 2002. Statistical analysis with missing data. 2nd ed. New Jersey, USA: John Wiley & Sons, Inc.

[17]Vach, Werner, and Mana Blettner. 1991. Biased Estimation of the Odds Ratio in Case-Control Studies due to the Use of Ad Hoc Methods of Correcting for Missing Values for Confounding Variables. Am. J. Epidemiol 134 (8):895-907.

[18]Madow, W.G., I. Olkin, and D.B. Rubin. 1983. Incomplete data in sample surveys. New York: Academic Press.

risk proportion in percentage (PAR%), using the following formula:[19] Pe is the effective proportion of the population (in the control group) exposed to the risk factor, and the OR is the adjusted risk factor:

$$PAR\% = \frac{Pe\,(OR-1)}{1+[Pe(OR-1)]} \times 100\%$$

This method and procedure are believed to be the most suited for compiling data which constitutes the "national picture" within a highly variable landscape. High technicality in the accumulation and sorting of data, within such investigation, cannot be emphasized strongly enough for helping us professionals to establish the state-of-affairs of disease and syndromes affecting individuals and society. It is findings which enable further speculations and debate allowing the evolution of policy, its practice, revision and adjustment to social realities.

Results

There were 17,409 total births during the study period, of which 304 were perinatal deaths, yielding a perinatal mortality rate of 17.5 per 1000 total births. Stillbirth to early neonatal death ratio was 1:1.5. There were 16,763 singletons, among these were 270 perinatal deaths (1.6%) and 16,493 survivors. Most of the newborn deaths carried a larger proportion of biological risk factors such as small birth size (43.3%), young maternal age (48.2%), short birth interval (49.6%), multiparity (65%), adverse signs during pregnancy (50%) and childbirth (54.8%) (table1).

Table 1. Distribution of Perinatal Deaths and Survivors in Indonesia with Selected Background Characteristics, 2003─2007

Background Characteristics	Survivors n (%)	Deaths n (%)
Gender		
Male	8664 (52.5)	178 (65.9)
Female	7829 (47.5)	92 (34.1)
Birth size		
Smaller	2838 (17.2)	117 (43.3)

[19]Jekel, James F., David L. Katz, Joann G. Elmore, and Dorothea M.G. Wild. 2007. Epidemiology, biostatistics and preventive medicine. 3rd ed. Philadelphia: Saunders, Elsevier.

Average	8347 (50.6)	92 (34.1)
Larger	5308 (32.8)	61 (22.6)
Maternal age at the delivery		
< 16	85 (0.5)	5 (1.9)
16—< 20	1659 (10.1)	39 (14.4)
20—< 25	4594 (27.9)	86 (31.9)
25—< 30	4439 (26.9)	51 (18.9)
30—< 35	3439 (20.9)	50 (18.5)
≥ 35	2277 (13.8)	39 (14.4)
Maternal education		
None	688 (4.2)	11 (4.1)
Incomplete primary	2184 (13.2)	45 (16.7)
Complete primary	4242 (25.7)	87 (32.2)
Incomplete secondary	4030 (24.4)	69 (25.6)
Complete secondary	4055 (24.6)	48 (17.8)
Higher	1294 (7.8)	10 (3.7)
Type of residence		
Urban	6233 (37.8)	91 (33.7)
Rural	10,260 (62.2)	179 (66.3)
Economic status		
Poor	8341 (50.6)	157 (58.1)
Middle	2886 (17.5)	46 (17.0)
Rich	5266 (31.9)	67 (24.8)
Religion		
Muslim	12,882 (78.1)	216 (80.0)
Christian	2913 (17.7)	48 (17.8)
Others	698 (4.2)	6 (2.2)
Place of delivery		
Health facilities	6692 (40.6)	111 (41.1)
Home	9801 (59.4)	159 (58.9)

Average size at birth = birth weight between 2500 and <4000 grams

Health facilities = health services offered by government, private, or public sectors

Level of economic status is based on Wealth Index [14]

Others = Buddhism, Hinduism, Confucian and others

As evidenced, "universal mortality risk" is higher in males than females, and our findings showed that male babies at this disadvantage were approximately 82% more likely to die than females. This result was supported by both the unadjusted and adjusted odds ratios. Smaller size at birth increased the risk 3.7 times compared to larger size and was slightly attenuated following the adjustment to 3.2. The factor yielded a 35.3% impact on the population (Table 2).

The "maternal age at delivery" and perinatal mortality showed a reversed J-shaped relation with a noticeably significant increased odds ratio starting with an age <16 years, which had the greatest risk of five times, with risk decreasing as age increased. Women aged ≥35 years in comparison to mothers in the age group of 25—<30 had an increased adjusted odds ratio by 55% with PAR% of 15.7. Although having a wide CI, adolescent age at delivery remained a strong risk factor in the final model. There was a significant increased risk of perinatal death with multi- and grand-multiparity before and after adjustment. In addition, approximately half of the newborns' mothers aged 35 years and above were grand-multipara when giving birth. "Having a birth/s in the past year" retained its importance as a risk factor confirmed by both the unadjusted and adjusted ORs.

Women, who reported less than three visits of antenatal care, were at greater risk to suffer a newborn death in comparison with mothers who had ≥4 visits (demonstrating the need for monitoring and access to assistance). While 66% of mothers reported visiting the ANC ≥4 times during pregnancy, 58% birthed with a non-health professional. Women who birthed with a traditional birth attendant were at risk when entered in a univariable analysis but this factor was not statistically significant in the multivariable analysis. Conversely, babies born in "health facilities" had no risk compared with "home delivery" and the place at delivery became a risk factor as shown in the AOR 1.62 [95%CI 1.17, 2.26] with contribution to the PAR% of 20.1(Table 2).

Table 2. Association and selected PAR% of identified factors with perinatal mortality in Indonesia 2003—2007

	Odds Ratio (95% Confidence Interval)		**PAR%**
Factors	**Crude**	**Adjusted**	
Gender			
Female vs Male	1.75 [1.36—2.25] *	1.82 [1.41—2.36] *	
Birth size			
Average vs Smaller	3.74 [2.84—4.93] *	3.15 [2.36—4.19] *	35.3

Average vs Larger	1.04 [0.75–1.44]	1.01 [0.73–1.40]	
Maternal age at the delivery			
25—< 30 vs< 16	5.12 [1.99–13.15] *	3.66 [1.31–10.26] *	4.8
25—< 30 vs 16—< 20	2.05 [1.34–3.12] *	1.84 [1.16–2.91] *	18.6
25—< 30 vs 20—< 25	1.63 [1.15–2.31] *	1.69 [1.17–2.43] *	25.9
25—< 30 vs 30—< 35	1.27 [0.86–1.87]	1.33 [0.89–2.01]	
25—< 30 vs ≥ 35	1.49 [0.98–2.27]	1.55 [0.98–2.47]	
Birth in past year			
No vs Yes	2.04 [1.61–2.59] *	1.53 [1.19– 1.98] *	14.7
Parity			
one vs 2—4	1.79 [1.29–2.49] *	1.50 [1.03–2.20] *	23.8
one vs ≥ 5	2.31 [1.54–3.47] *	1.75 [1.00–3.07]	
Maternal education			
Higher vs No	2.07 [0.87–4.89]	1.29 [0.46–3.63]	
Higher vs Incomplete primary	2.67 [1.34–5.31]	2.03 [0.87–4.72]	
Higher vs Complete primary	2.65 [1.38–5.12]	2.48 [1.11–5.51] *	53.1
Higher vs Incomplete secondary	2.22 [1.14–4.31]	1.89 [0.87–4.15]	
Higher vs Complete secondary	1.53 [0.77–3.04]	1.39 [0.66–2.97]	
Place of delivery			
Home vs Health facilities	1.02 [0.80–1.31]	1.62 [1.17–2.26] *	20.1
Antenatal care visit			
≥4 vs none	3.76 [2.74–5.16] *	2.09 [1.45–3.01] *	10.8
≥4 vs 1—3	2.38 [1.81–3.14] *	1.51 [1.11–2.05] *	10.5
Assistant of delivery			
≥2 vs Health professional	1.09 [0.79–1.50]	0.99 [0.70–1.39]	
≥2 vs TBA	1.43 [1.01– 2.01] *	1.12 [0.78–1.61]	
≥2 vs Others	2.31 [1.59–3.37] *	1.76 [1.20–2.58] *	1.0
Economic status			
Rich vs Poor	1.48 [1.11–1.97] *	0.99 [0.66–1.47]	
Rich vs Middle	1.25 [0.86–1.83]	1.09 [0.75–1.58]	
Adverse sign/s during pregnancy [a]			

None vs one	4.52 [3.42─, 5.97] *	2.99 [2.19─4.07] *	19.1
None vs ≥2 signs	5.59 [4.05─, 7.75] *	3.67 [2.58─5.22] *	14.9
Adverse sign/s during childbirth [b]			
None vs One	1.29 [0.95─1.74]	1.25 [0.92─1.71]	
None vs ≥2 signs	1.69 [1.27─ 2.24] *	1.56 [1.16─ 2.10] *	13.7
Type of residence			
Urban vs Rural	1.19 [0.93─1.54]	1.00 [0.73─1.39]	

Others = Friends or family or relative or no one; PAR% = Population Attributable Risk proportion in Percentage; TBA = Traditional Birth Attendant

[a] Vaginal bleeding, fever, convulsion and fainting, breech presentation, oedema, hypertension, and dizziness

[b] Prolonged labor, excessive vaginal bleeding, fever and foul smelling vaginal discharge, convulsions, and water breaking >6 hours before delivery

* Statistically significance

Factors, not shown in this table but included in the analysis were paternal education; religion; history of previous termination of pregnancy; desire for the pregnancy; marital and smoking status.

Mothers who experienced adverse sign/s during pregnancy and childbirth showed statistically significant greater risk before and after adjustment compared to women experiencing no signs of danger, except those mothers who had one sign during labour (AOR 1.25 [0.92, 1.71]).

On the contrary, factors of socio-economic and demographic disadvantages did not show any association with the mortality except maternal education. The maternal primary level of education contributed to 2.6 times the risk, and remained significant following adjustment, with a resulting PAR% of 39.3 and 53.1 for both "Incomplete" and "Complete" primary schooling respectively. Paternal education did not show any significant risk to the mortality.

There was no perinatal risk with regards to smoking behavior and history of pregnancy termination whereas desire for the current child tended to have 52% increased risk of perinatal death though not statistically significant in comparison with "no desire".

III. Discussion and recommendation

In a ten year period (1998-2002 and 2003-2007), it appears that perinatal mortality in Indonesia has persisted. This is the first study, which identified factors associated with perinatal mortality in the country by employing a retrospective approach and using the latest population data of the 2007 IDHS. The findings could help health policy makers to understand the factors contributing to perinatal death, identify issues in which to intervene, and monitor the success or otherwise of these efforts. In the least, it creates questions as to why perinatal mortality occurs in certain variable conditions, and what can be done and implemented, at the level of public health strategy, outreach and assistance, to possibly reduce the respective frequency.

In relation to findings of a previous Indonesian study, [20] the current study confirms that biological risk factors such as "small baby size at birth", "very young and older mothers" and "short birth intervals" have been unrelenting, continuing to adversely affect perinatal mortality in the country. Concerted efforts and integrated strategies need to be implemented to deal with the issues in order for pregnant women to deliver average size newborns at birth. These are no doubt culturally sensitive issues, and raises questions for the theorists between pathology, accessibility and culture. While such interventions should include better maternal nutrition during pregnancy and optimal birth spacing, it could be that the inter-relationship amongst risk factors also needs to be considered. The "small size at birth" could also be due to either preterm delivery or fetal growth retardation.[21,22] Studies should be carried out to find out what exactly constitutes a proximate determinant in relation to mortality in local community contexts. Similarly, pregnancy in adolescence could also contribute to "small birth size" because of preterm delivery associated with biological and physiological immaturity. But again, this necessitates further substantiation through an in-depth study. [23,24,25] In addition to biological and physiological factors, adolescent pregnant mothers in our study were more likely to have other attributes such as being socio-economically disadvantaged, residing in a rural area, and receiving poor ANC and obstetric care. The variables to building a national picture are indeed complex.

Social and cultural factors may also contribute to adverse perinatal outcomes. In the case of young mothers, the majority (90%) lived in rural areas where there is a strong socio-cultural norm for young marriages and early childbearing.[26] It is challenging for local public health officers and health cadres (*kaderkesehatan*) to intervene and change community attitudes and behavioral practices. Greater health promotion, outreach and education are needed to enlighten community attitudes and raise awareness of the importance of the physical maturity required for safe

[20] Hatt, L., C. Stanton, C. Ronsmans, K. Makowiecka, and A. Adisasmita. 2009. Did professional attendance at home births improve early neonatal survival in Indonesia? Health Policy Plan 24 (4):270-8.
[21] Wilcox, AJ. 2001. On the importance - and the unimportance - of birthweight. Int J Epidemiol 30:1233 - 41.
[22] Wilcox, AJ, and R Skjoerven. 1992. Birth weight and perinatal mortality: the effect of gestational age. Am J Public Health 82:378 - 82.
[23] Chen, Xi-Kuan, Shi Wu Wen, Nathalie Fleming, KitawDemissie, George G Rhoads, and Mark Walker. 2007. Teenage pregnancy and adverse birth outcomes: a large population based retrospective cohort study. Int. J. Epidemiol. 36 (2):368-373.
[24] Da Costa, Antonio Gadelha, Francisco Mauad Filho, Adilson Cunha Ferreira, Patricia Spara, and Fernando MarumMauad. 2004. Uterine volume in adolescents. Ultrasound in Medicine & Biology 30 (1):7-10.
[25] Moerman, M. L. 1982. Growth of the birth canal in adolescent girls. Am J ObstetGynecol 143 (5):528-32.
[26] WHO. 2008. Adolescent Pregnancy. MAPSNOTES (1), http://www.who.int/making_pregnancy_safer/documents/mpsnnotes_2_lr.pdf.

childbirth and the need for birth spacing with at least a one year interval. [27,28]Such public campaigns should not only target childbearing women and their partners but also educate school aged youth.

The interaction between parity and maternal age in the risk of adverse perinatal outcome is widely known and variations occur among studies from different countries.[29,30,31] In our study, the synergistic effect between grand-multiparity and advanced maternal age yielded an additive interaction for older mothers to experience greater risk. Results from pooled data regression of four periods of IDHS (1986—2002) concluded that family planning policies should be continued. [20] In this case, in depth family planning interventions for this group of women should be implemented.

Maternal education at primary school level did not seem a protective measure against perinatal death in this study. While the risk estimate evidenced that completion of secondary schooling lowered the risk, there was no statistical significance in the unadjusted and adjusted ORs. In fact, mothers with no education appeared to have lower risk. Furthermore, the results showed that only higher education had a benefit for perinatal survival. The Indonesian government is actively encouraging people to undertake higher education. There was a 52% reduction of women with no education in the 2007 IDHS compared with the 1991 IDHS. [8,32]This remarkable achievement is further boosted by a law passed in 2008 mandating nine years of compulsory, free elementary and junior high school education for all people.[33] This is the first step to open access to education for people, especially women, and to ensure the possibilities of obtaining higher education, a better quality of life and thereby better health safeguards and wellbeing. The long-term impact of this strategy on reducing child mortality will need to be investigated more extensively.

The importance of proper ANC has been widely advocated particularly in the early detection of obstetric complications during pregnancy in order for the mothers to obtain appropriate and adequate care for labor and birth.[12] Our results showed that the symptomatology mothers experienced during pregnancy and labor could be linked to poor ANC. Although 66% of mothers had sufficient antenatal clinic visits during their pregnancy, those who suffered adverse symptom/s may have received inadequate management and monitoring in poor-resource settings. [12] Further, it is not evident why one sign during pregnancy increased risk and one sign during childbirth did not. It could be that an unresolved adverse symptom during pregnancy may have contributed to complication/s during labor. A separate study to investigate the obstetric complications experienced among mothers is required to determine the quality of maternity services in Indonesia.

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[27]Smith, G. C., J. P. Pell, and R. Dobbie. 2003. Interpregnancy interval and risk of preterm birth and neonatal death: retrospective cohort study. BMJ 327 (7410):313.

[28]Smits, Luc J. M., and Gerard G. M. Essed. 2001. Short interpregnancy intervals and unfavourable pregnancy outcome: role of folate depletion. The Lancet 358 (9298):2074-2077.

[29]Schempf, A. H., A. M. Branum, S. L. Lukacs, and K. C. Schoendorf. 2007. Maternal age and parity-associated risks of preterm birth: differences by race/ethnicity. PaediatrPerinatEpidemiol 21 (1):34-43.

[30]Kiely, John.L., Nigel Paneth, and MervynSusser. 1986. An assessment of the effects of maternal age and parity in different components of perinatal mortality. Am. J. Epidemiol 123 (3):444-454.

[31]Andersson, T., U. Hogberg, and S. Bergstrom. 2000. Community-based prevention of perinatal deaths: lessons from nineteenth-century Sweden. Int J Epidemiol 29 (3):542-8.

[32]Statistics Indonesia (BadanPusatStatistik--BPS) and Macro International 1992. Indonesia Demographic and Health Survey 1991. Calverton, Maryland, USA: BPS and Macro International.

[33]Indonesian Government Regulation on 9-year compulsory education for all people (in Indonesian) 2008. http://hukum.unsrat.ac.id/pp/pp_47_2008.pdf.

The reverse situation in the variables of assistance at birth and place at delivery may suggest an interaction between the two factors. Evidence showed that the delays in reaching the hospitals affected the women's condition, who were at that time in critical state.[34] It could be that the non-health professionals sent the mothers, who were in labor and suffering unmanageable obstetric complications, directly to health facilities. The newborns might have died en route to the health centre and the mortality was subsequently documented in that domain.

Poverty and residing in rural areas are well known demographic characteristics associated with child mortality. Our results showed that being poor was not an attribute for increasing the risks of perinatal death after controlling other factors. Types of residence did not seem, moreover, to make a difference to perinatal risk. This contradicts the findings of a previous study, where women living in rural areas were more susceptible to increased risk of child mortality than those from urban areas. Indeed urban areas usually provide better access to healthcare services: research findings from *Riskerdas* 2007 supported that child mortality was more common in rural areas than in urban zones. [7]

With the increasing rate of urbanization in Indonesia over the past decade, [35] epidemiological studies have inevitably included respondents in urban slum dwellings. Slum dwellers are a socio-economically disadvantaged group, with poor access to proper maternal and child health care, with living conditions and health status lower than those living in rural areas. The risk of perinatal mortality amongst this group of urban dwellers requires further investigation.

The major strength of our study is that it seeks to engage with all geographical areas of Indonesia with a nationally representative sample, in seeking to construct the "national picture". DHS data are known to be high quality and accurate, nevertheless, there are some limitations. For example, in a country such as Indonesia where births and deaths are not always registered (the problem of missing data), using the DHS dataset to estimate death and birth rates may be more accurate than data from a registry office. However, underestimation of the mortality data still occurred due to selection bias as only data from ever-married surviving women aged 15 to 49 years were included. Nonetheless, this bias may be minimal as the fertility between surviving and non-surviving women did not differ substantially.[8] Analysis of mortality in our study was limited to a period of five years preceding the interview (2003-2007) in order to minimize the effect of excluding women over the age of 49 at the time of survey. Misreporting the date of birth and age at death can bias mortality data which is dependent on maternal recall if they fail to present any relevant documentation. Furthermore, the selection of perinatal deaths and survivors was that they represented the same base population but at the level of provinces, therefore our ability to assess the impact of maternity services in a particular location on perinatal outcome was limited. Our analysis also revealed a low *Nagelkerke R square* value indicating that there could be other factors, which were not included in this study, but which can potentially affect perinatal outcome such as the age of the biological father, maternal occupation during pregnancy, etc. This occurred due to the unavailability of information in the dataset. Once again, constructing the national picture of Indonesian perinatal mortality is a complex undertaking, geographically, socially, culturally and even, statistically.

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[34] Adisasmita, A., P. E. Deviany, F. Nandiaty, C. Stanton, and C. Ronsmans. 2008. Obstetric near miss and deaths in public and private hospitals in Indonesia. BMC Pregnancy Childbirth 8:10.

[35] Sarosa, Wicaksono. 2006. Urbanization and Sustainability in Asia. Case Studies and Good Practice. INDONESIA. In Indonesia, ed B. R. a. T. Kanalev: Asian Development Bank. http://www.adb.org/Documents/Books/Urbanization-Sustainability/chapter07.pdf.

Points to be noted

- The perinatal mortality rate, defined by the Indonesia Demographic Health Survey (IDHS) as the sum of stillbirths and early neonatal deaths (deaths in the first seven days of life) per 1000 pregnancies of seven or more months, was 24 during the period 1998-2002 and 25 between the years 2003-2007. In our analysis, the estimation of perinatal mortality rates is lower than that reported in the IDHS 2007. This may be due to different definitions of the denominator for the perinatal mortality rate, therefore different results are yielded.
- The unrelenting domination of biological factors for perinatal deaths requires national initiatives and strong commitment inter-territorial research.
- Using the population data of the DHS, factors associated with perinatal mortality can be regularly evaluated. It is useful to monitor whether any different attribute emerges as a consequence of epidemiological transition and health interventions over time, or whether the associated factors remain persistent.

IV. Conclusion

The above discussion reveals several main points important for the strategization of public health. First, the utilization of maternal health care services was not optimized as more than half of the mothers delivered at home and only one-third of the pregnant women attended by health professionals during childbirth. While 17.5% of the women suffered adverse signs during pregnancy, the use of health care services for antenatal care was discouraged hence the proportion of pregnant women experiencing danger signs during labor appeared 2.5 times higher. Given this, the quality of maternal health services needs substantial improvement: 46% of the bereaved mothers lost their newborns despite complying with the requirement of visiting antenatal care clinics at least four times during pregnancy. This raises the question of the quality of monitoring by medical services and the patients themselves, again indicating further urgencies of research to build and work with these realities.

In the case of women's education, there is a need to review and improve curricula especially in primary school where perinatal mortality was the greatest risk, following the adjustment. It should be noted that the domination of biological risk factors raises a doubt about women's knowledge on maternal and child health (autonomous monitoring), and indeed the public knowledge at large. This situation had persisted for a decade (1998 to 2007), which is also supported by another study using the 2002/03 IDHS data. [36]

Focused attention should be given to adolescent pregnant mothers, in order to monitor their pregnancy and arrange for safe childbirth. Furthermore, older women need to be encouraged to attend family planning whose children are numerous.

Greater attention should also be given to the childbearing women, who live in urban slum dwellings. Enhancing the standard of living of those in poverty, their access to health facilities and the strengthening of healthcare delivery (public outreach) services especially in rural areas can reduce the mortality rate. Nonetheless, the

[36] Sugiarto, Teguh. 2007. Knowledge and practice of maternal healthcare in Indonesia. JurnalKependudukan Indonesia (2), http://74.125.153.132/search?q=cache:iUb2vEKOo28J: www.ppk.lipi.go.id/file/buletin/Artikel%25201%2520Teguh%2520Sugiyarto.doc+why+low+antenatal+care+visit+in+indonesia&cd=10&hl=en&ct=clnk&gl=sg.

complexity of interaction among associated social, economic and cultural factors should separately be investigated at a micro level as our study is unable to determine specific geographical locations requiring improvements due to unavailable information. Our study is an in-depth preliminary to further research, one which highlights avenues and the necessary navigation for a strategic national healthcare framework, its socio-economic data clusters and the policies and practices which enframe the national picture. Our study demonstrates that while we are able to cleave important statistical information from existing data, helping us piece together a complex puzzle of perinatal mortality, there exist social, historical and cultural variables which need constant attention, engaging with the psychological beliefs, habits and practices of communities as well as the geographical (and indeed economic) landscape within which society and healthcare seek to evolve into a comprehensive far reaching system of medical assistance and attention. Indeed, the issue of perinatal mortality in Indonesia is very much an unfinished agenda.

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