

Frequency of Antenatal Care Visits and Neonatal Mortality in Indonesia

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Summary

Objective: To examine the relationship between frequency of antenatal care visits, as a whole and in each trimester, and neonatal mortality in Indonesia. **Subjects:** 13 055 single births from the fifth Indonesia Demographic Health Survey in 2006–07. **Methods:** Estimate adjusted odds ratios (ORs) and their 95% confidence intervals (95% CIs). **Results:** Pregnant women who had more antenatal care visits experienced a lower risk of neonatal mortality and more benefit in the last trimester: the ORs against the 0–1 visit group, were 0.76 (95% CI 0.45–1.29) for 2 visits group, 0.54 (95% CI 0.33–0.87) for 3 visits group and 0.31 (95% CI 0.17–0.57) for 4 visits group, respectively. Individual ORs as a whole period were not significant, but ORs declined markedly at 7 visits or more. **Conclusion:** The results may provide a valuable recommendation for the care of pregnant women in Indonesia.

Key words: prenatal care, neonatal mortality, pregnancy trimesters, Indonesia.

Introduction

Indonesia remains one of the countries with the highest neonatal mortality in the world, namely 15–29/1000 livebirths [1]. The recent provision of any form of four pregnancy and delivery care services (i.e. mode of delivery, place of delivery, skilled medical care at delivery and antenatal care) is considered to have reduced the risk of neonatal mortality in Indonesia [2]. According to Indonesian statistics, the neonatal mortality rate has been decreasing recently, but the reduction in neonatal mortality during the past 15 years (40%) was less than the reductions in infant mortality (48%) or mortality of children under the age of 5 years (53%) [3].

Neonatal mortality refers to deaths during the first 28 days after birth [4]. Recent studies in developing countries reported that infections (e.g. sepsis/pneumonia, tetanus and diarrhea) [1] and preterm delivery were major contributors to neonatal mortality [5, 6]. In addition, one study in Indonesia reported a more detailed list of the determinants associated with neonatal mortality in Indonesia: birth order, short birth interval infants, smaller than average size

infants, complications during delivery and male infants [3].

Given the evidence of these studies, several strategies have been suggested to decrease neonatal mortality in developing and transitional countries [7, 8], such as better antenatal care. Thus, those who had fewer than three antenatal visits were exposed to a greater prenatal risk than those who had three or more visits [9, 10]. Because, there is a wide variation in the number of antenatal care visits among pregnant women in developing and transitional countries, there is a need to propose an appropriate number of antenatal care visits in such countries [11].

The Indonesian Maternal Health Program recommends that pregnant women have at least four antenatal care visits during pregnancy [12]. However, only 66% of the pregnant women in Indonesia have the recommended number of antenatal care visits [13].

In the present study, we examined the relationship between frequency of antenatal care visits and neonatal mortality using data from the Indonesia Demographic Health Survey (IDHS). In particular, we evaluated in which trimester of pregnancy antenatal care had the most beneficial effect.

Methods

Study area and participants

Data were extracted from the fifth IDHS conducted in 2006–07. The IDHS is part of the worldwide Demographic and Health Survey (DHS) program that is designed to collect data on fertility, family planning and maternal and child health [14]. The fifth survey was implemented by Statistics Indonesia (Badan Pusat Statistik-BPS) and the questionnaire consisted of the following three sections: Household Questionnaire, Ever-Married Women's Questionnaire and Married Men's Questionnaire [15]. Collection of data was carried out by trained field staff from 25 June to 31 December 2007. However, fieldwork had to be extended in several provinces and was completed in all areas in February 2008.

The IDHS used a stratified two-stage design consisting of 1694 census blocks. The blocks were allocated to each province and stratified by urban and rural areas. Finally, 25 households were randomly selected from each of the selected census blocks [13].

A total of 42 341 households were selected for the sample, of which 41 131 were occupied, and 40 701 households were successfully interviewed. Among the households that provided interviews, 34 227 women were identified and 32 895 babies had been born [13].

In the present study, we included 13 055 single births from 2003 to 2007, excluding babies that lacked information about frequency of antenatal care visits, and neonatal deaths ($n = 1409$).

Measurement of exposure, outcomes and covariates

The main exposure variable was frequency of antenatal care visits during pregnancy (total visits and visits in each trimester). Total visits were categorized into 2–3, 4–6, 7–9 and 10 visits or more. Antenatal care visits in each trimester were determined during the first 3 months, during the 4th–6th months and from the 7th month until delivery. During the first and second trimesters, visits were categorized into 0, 1, 2 and 3 visits or more. Visits during the third trimester were categorized into 0–1, 2, 3 and 4 visits or more.

The primary outcome of this study was neonatal mortality, which was defined as the probability of dying within the first 28 days of life.

In addition, we adopted the following variables from the questionnaire as potential confounders: area of residence (urban or rural); 5-year maternal age groups (15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49); highest educational level (no education, primary, secondary and higher); and birth order (first child, second child and third child or more).

Statistical analysis

We first conducted a descriptive analysis. Then we used cross tabulation to analyze the association

between total visits during pregnancy and neonatal mortality. We estimated the adjusted odds ratios (ORs) and their 95% confidence intervals (95% CIs) for the association using the least visits group as a reference by using logistic regression. We adjusted for 5-year maternal age groups, area of residence, highest educational level and birth order. We also examined the relationship between antenatal care visits during each trimester and neonatal mortality. Finally, we conducted a statistical test for trend, treating the groups as an ordinal variable to examine a linear relationship between frequency of antenatal care visits, as a whole and in each trimester and neonatal mortality. The statistical analyses in this study were performed by using SPSS software (SPSS Japan, Inc., version 16) and $p < 0.05$ were considered significant.

Results

As shown in (Table 1), mothers who were older, who lived in an urban area and who were more educated had more antenatal visits. In addition, the more children the women had, the less frequent the visits.

In the logistic regression analyses for the association between total number of visits and neonatal mortality (Table 2), none of the OR achieved statistical significance, e.g. the adjusted ORs were 0.67 (95% CI 0.40–1.13) in 7–9 visits and 0.62 (95% CI 0.32–1.22) in 10 visits or more, respectively. However, there was a statistically significant trend (p -value for trend = 0.039) between the number of antenatal care visits and lower neonatal mortality.

When we examined the relationship between antenatal care visits in the first and second trimester and neonatal mortality, we did not observe any beneficial effect (Tables 3 and 4). In contrast, we found that women who had a greater number of antenatal care visits in the third trimester experienced lower neonatal mortality (Table 5). The proportion of neonatal mortality in the 0–1 visits group was 16/100 live-births, but the proportion decreased as the number of visit increased (to 5/100 for the 4 or more visits group). The adjusted ORs for neonatal mortality at each visit category (with reference to 0–1 visit) were 0.76 (95% CI 0.45–1.29) for 2 visits, 0.54 (95% CI 0.33–0.87) for 3 visits and 0.31 (95% CI 0.17–0.57) for 4 visits or more. The trend was statistically significant ($p < 0.01$).

Discussion

In the present study, we found that pregnant women who had more frequent antenatal care visits, particularly in the third trimester, experienced a lower risk of neonatal mortality. Although individual ORs were not significant for the association between total number of antenatal care visits and overall neonatal mortality, we found a significant trend between number of visits and reduction in mortality. In addition,

TABLE 1
Descriptive characteristics of mothers ($n = 13\,055$)

Characteristics	Total number, n (%)	Total antenatal care visits			
		2–3 visits, n (%)	4–6 visits, n (%)	7–9 visits, n (%)	10 visits or more, n (%)
Age, 5-year groups					
15–19	423 (3.2)	94 (22.2)	138 (32.6)	149 (35.2)	42 (9.9)
20–24	2715 (20.8)	440 (16.2)	753 (27.7)	1132 (41.7)	390 (14.4)
25–29	3716 (28.5)	475 (12.8)	979 (26.4)	1544 (41.6)	718 (19.3)
30–34	3196 (24.5)	382 (12.0)	851 (26.6)	1330 (41.6)	633 (19.8)
35–39	2081 (15.9)	299 (14.4)	548 (26.3)	855 (41.1)	379 (18.2)
40–44	769 (5.9)	146 (18.5)	220 (28.6)	295 (38.4)	108 (14.0)
45–49	155 (1.2)	31 (20.0)	44 (28.4)	63 (40.7)	17 (11.0)
Type of place of residence					
Urban	5308 (40.7)	381 (7.2)	1100 (20.7)	2255 (42.5)	1572 (68.7)
Rural	7747 (59.3)	1486 (19.2)	2433 (31.4)	3113 (40.2)	715 (9.2)
Highest educational level					
No education	333 (2.6)	111 (33.3)	107 (32.1)	98 (29.4)	17 (5.1)
Primary	4847 (37.1)	1013 (20.9)	1520 (31.4)	1833 (37.8)	481 (9.9)
Secondary	6754 (51.7)	709 (10.5)	1716 (25.4)	2949 (43.7)	1380 (20.4)
Higher	1119 (8.6)	34 (3.0)	188 (16.8)	488 (43.6)	409 (36.6)
Birth order number					
1st child	4325 (33.0)	498 (11.5)	1061 (24.5)	1863 (43.1)	903 (20.9)
2nd child	3768 (28.0)	462 (12.3)	945 (25.1)	1634 (43.4)	727 (19.4)
3rd child and more	4962 (38.0)	907 (18.3)	1527 (30.8)	1871 (37.7)	657 (13.2)

TABLE 2
Total number of antenatal care visits during pregnancy and neonatal mortality ($n = 13\,055$)

	2–3 visits ($n = 1867$)	4–6 visits ($n = 3533$)	7–9 visits ($n = 5368$)	10 visits or more ($n = 2287$)	p -value for trend
Neonatal mortality (1/100)	12	12	8	7	
Crude OR (95% CI)	1	1.01 (0.61–1.68)	0.65 (0.40–1.08)	0.60 (0.32–1.13)	0.019
Adjusted OR (95% CI) ^a	1	1.02 (0.61–1.71)	0.67 (0.40–1.13)	0.62 (0.32–1.22)	0.039

^aAdjusted for 5-year maternal age groups, area of residence, highest educational level and birth order.

TABLE 3
Antenatal care in first trimester and neonatal mortality ($n = 13\,055$)

	0 visit ($n = 3047$)	1 visit ($n = 4160$)	2 visits ($n = 2430$)	3 visits or more ($n = 3418$)	p -value for trend
Neonatal mortality (1/100)	8	11	9	9	
Crude OR (95% CI)	1	1.33 (0.82–2.15)	1.11 (0.63–1.95)	1.06 (0.63–1.78)	0.904
Adjusted OR (95% CI) ^a	1	1.37 (0.86–2.25)	1.20 (0.68–2.13)	1.19 (0.69–2.05)	0.729

^aAdjusted for: 5-year maternal age groups, area of residence, highest educational level and birth order.

the ORs markedly decreased at 7 visits or more, which is a higher number of visits during pregnancy than is currently recommended by the Indonesian government.

Our findings are consistent with previous studies that reported poorer outcomes for mothers who had

a small number of antenatal visits [9, 10]. Our finding that antenatal care in the last trimester was particularly important may be explained by the number of complications in the third trimester: obstetric and medical problems can develop and become apparent in the final stages of pregnancy. These findings

TABLE 4
Antenatal care in second trimester and neonatal mortality ($n = 13\,055$)

	0 visit ($n = 605$)	1 visit ($n = 2126$)	2 visits ($n = 2230$)	3 visits or more ($n = 8094$)	<i>p</i> -value for trend
Neonatal Mortality (1/100)	8	10	12	8	
Crude OR (95% CI)	1	1.31 (0.45–3.47)	1.53 (0.59–3.97)	1.06 (0.43–2.64)	0.419
Adjusted OR (95% CI) ^a	1	1.36 (0.51–3.59)	1.59 (0.61–4.15)	1.15 (0.46–2.89)	0.622

^aAdjusted for 5-year maternal age groups, area of residence, highest educational level and birth order.

TABLE 5
Antenatal care in the last trimester and neonatal mortality ($n = 13\,055$)

	0–1 visit ($n = 1637$)	2 visits ($n = 2425$)	3 visits ($n = 5460$)	4 visits or more ($n = 3533$)	<i>p</i> -value for trend
Neonatal Mortality (1/100)	16	12	9	5	
Crude OR (95% CI)	1	0.77 (0.46–1.30)	0.51 (0.34–0.81)	0.31 (0.18–0.59)	< 0.01
Adjusted OR (95% CI) ^a	1	0.76 (0.45–1.29)	0.54 (0.33–0.87)	0.31 (0.17–0.57)	< 0.01

^aAdjusted for 5-year maternal age groups, area of residence, highest educational level and birth order.

provide evidence for recommending that pregnant women should have frequent antenatal care visits, particularly in the third trimester.

An important strength of this study is that we used a nationally representative sample of mothers in Indonesia covering more than 33 provinces. IDHS data, based on the mothers' reports, can provide a valuable starting point for understanding the behavior of providers in both public and private settings [16]. In addition, IDHS data are of high quality relative to many data sources in developing countries, although it is important to recognize that newborn deaths are likely to be underreported [17]. Furthermore, IDHS data are based on standardized questionnaires, manuals and field procedures [18].

The most critical limitation of the present study is potential confounding by preterm birth. Since pregnant women who experienced preterm births did not have many opportunities for antenatal care visits, confounding could have had a bearing on the observed association. Although we could neither obtain information on the month of delivery nor analyze the data by restricting to low birth weight infants because of the small numbers, the proportion of preterm births in Indonesia is not too large (14.2% of live-births) [19], thus the possibility of confounding would be minimal. Another potential confounding by socio-economic status is also possible. We adjusted for maternal education, and the residual confounding could not explain the present finding. Furthermore, all the information on antenatal care was collected from the mothers and not from official

records, thus information bias may exist. However, such nondifferential misclassification would only move the point estimates toward the null. In addition, since the IDHS targeted live mothers, there may be mothers who died during or after pregnancy and their neonate would likely experience a worse outcome. Such selection bias may underestimate the OR.

In conclusion, the present study showed a significant relationship between frequency of antenatal care visits, especially in the third trimester, and neonatal mortality. The Indonesian maternal health program recommends that pregnant women have at least four antenatal care visits during pregnancy, but the results of this study indicate that more frequent visits (e.g. more than seven) may be required. Furthermore, this study strongly suggests that effective intervention especially in the third semester should be conducted. The results may provide a valuable recommendation for the care of pregnant women in Indonesia.

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