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**Association Between Maternal, Birth, and Newborn Characteristics
and Neonatal Mortality in Five Asian Countries**

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ABSTRACT

Neonatal mortality rates continue to be high in the developing world and are drawing more attention worldwide as its fraction over infant and childhood mortality increases, due to the faster progress achieved in the survival of infants older than one month. Therefore, there is renewed interest in interventions believed to improve neonatal survival, such as providing thermal care to the newborn, postnatal care to the mother and newborn, and counseling on infant and maternal health care to mothers. Questions about these new interventions have recently been added to the Demographic and Health Surveys (DHS) in five Asian countries, Bangladesh, India, Indonesia, Nepal and the Philippines. The addition of these questions to the DHS surveys in these five countries provides an opportunity to analyze their associations with neonatal mortality.

The survey results indicate that associations exist between mothers' perceived size of their babies, birth weight, receipt of postpartum care, and neonatal mortality. There are also some associations between elements of newborn care—such as use of a sterilized delivery kit, wrapping of the baby immediately after birth, and giving mothers maternal and infant care advice—and reduced levels of neonatal mortality. These associations, tested in only a few countries, merit further investigation for their potential to contribute to policy and program design in this crucial public health area.

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INTRODUCTION

Neonatal mortality (NNM) accounts for one third of the nearly 11 million deaths of children under age 5 annually (Lawn et al., 2005; Black et al., 2003). Of the four million neonatal deaths that occur each year, India reports the highest number, at nearly 1.1 million neonatal deaths. Two other Asian countries, Pakistan and Bangladesh, also have high numbers of neonatal deaths, at 298,000 and 153,000, respectively. Within the first 28 days of life, three out of four deaths occur in the first week of life. The risk of a newborn dying is 24 per 1,000 live births in the first week of life, 3 per 1,000 per week during the rest of the first month, and 0.12 per 1,000 per week after the first year of life. As with maternal mortality, 99 percent of neonatal deaths occur in the lower to middle income countries, where the average NNM rate (NMR) is 33 per 1,000 live births (Lawn et al., 2006; Save the Children, 2006).

The Millennium Development Goal of reducing mortality in children under age 5 by two thirds between 1990 and 2015 (MDG 4) has been the center of attention in international forums in recent years. At the current rate of decline in under-5 mortality of less than 4 percent per annum, it is unlikely that this goal will be achieved (Hill and Choi, 2006). However, childhood mortality and postneonatal mortality have declined at a faster pace than NNM. Data from the UNICEF 2008 Countdown to 2015 report on maternal, newborn, and child health indicators suggest that reducing perinatal mortality and NNM is of paramount importance for making additional gains in child survival (Bryce and Requejo, 2008).

Causes of neonatal deaths vary by early and late neonatal periods. In addition to neonatal deaths due to prematurity, asphyxia, and congenital defects in the first week of life, infections, such as pneumonia, diarrhea, and tetanus, are a major cause of death in the next three weeks (Ngoc et al., 2006; Moss et al., 2002). Infections, which account for 36 percent of neonatal deaths, can be prevented easily even in developing health systems by following essential newborn care practices

such as cleaning, drying, and warming the infant; providing early and exclusive breastfeeding; and caring properly for the cord (Knippenberg et al., 2005). Low birth weight (LBW) is also the underlying cause of 40-80 percent of neonatal deaths (Tinker et al., 2006). A special issue of *The Lancet* series on maternal and child undernutrition underscores the risk of childhood mortality due to LBW (Black et al., 2008).

Perinatal mortality and NNM are known to be affected by contextual factors that influence maternal health, such as socioeconomic status, deprivation, gender inequity, illiteracy, and high fertility rates (Bale et al., 2003; Donnay, 2000). Studies have reported that higher maternal education levels are associated with improved perinatal and neonatal survival (Bhutta et al., 2005). Different variables linked with maternal education, such as appropriate birth spacing and health-seeking behavior, particularly for prenatal care, have also been shown to reduce maternal mortality and NNM rates (Harris et al., 1999).

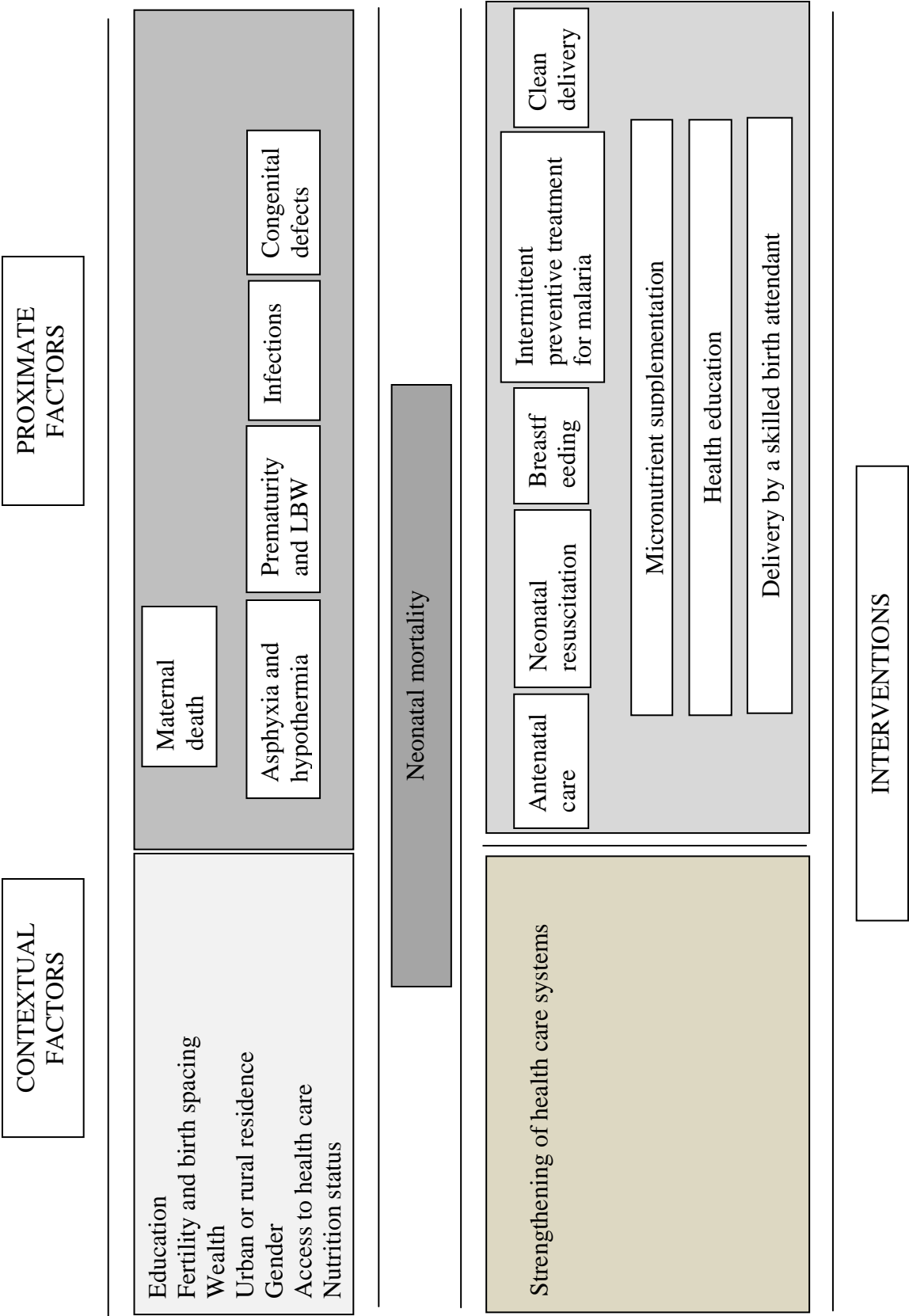
Further analysis of Tanzania Demographic and Health Surveys (DHS) data also suggests that child survival gains can be achieved by low-income countries that invest in strengthening their health care systems, in spite of the increased burden of neonatal deaths due to HIV (Masanja, 2008). However, not all interventions seem to achieve the same degree of success. Nutritional and health interventions, such as breastfeeding promotion, micronutrient supplementation, and malaria treatment, have shown mixed results in reducing NNM, based on randomized trials and other studies (Bhutta et al., 2008). Exclusive breastfeeding immediately after birth along with other recommended newborn care practices, such as appropriate cord care and thermal control, have been shown to reduce NMR by 28 percent (Leon-Cava et al., 2002; Lawn et al., 2001). NNM was reduced by 65 percent in a Chinese population with severe iodine deficiency, after being supplemented with iodine (DeLong et al., 1997). However, daily treatment with vitamin A supplementation during the third trimester of pregnancy and at delivery did not reduce rates of NNM, fetal loss, or preterm births in

intervention groups compared to control groups (Katz et al., 2000). Malaria treatment of women between 16 and 30 weeks of gestation did decrease NMR rates by up to 38 percent, depending on the stage of pregnancy (Shulman et al., 1999).

Community-level interventions for newborn care have shown success in the reduction of NMR in several developing countries in Asia. In India, training of village health workers to provide a package of maternal and newborn care services, including health education, clean delivery, neonatal resuscitation, and breastfeeding promotion, led to a decrease in the NMR from 62 per 1,000 at baseline to 26 per 1,000 from the first to the third year of the intervention. A drop in the rate of stillbirths and the perinatal mortality rate was also found (Bang et al., 1999). In rural Nepal, female facilitators working with women's groups to increase health-seeking behaviors and practices, expand the use of clean delivery kits, and strengthen the health care system led to a 30 percent reduction in the NMR (primarily in the late NMR, 7-28 days after birth) (Manandhar et al., 2004). In rural China, the introduction of modern resuscitation skills among grassroots maternal and child health care personnel led to an 86 percent reduction in the asphyxia-specific NMR rate by strictly applying the ABCDE (airway, breathing, circulation, drug, and evaluation) protocol (Bhutta et al., 2005).

A framework summarizing the factors that are probably associated with NNM and interventions to reduce it is presented in Figure 1.

Figure 1. Factors associated with neonatal mortality and interventions to reduce it



The conduct of population-based surveys in which women of fertile age recall the circumstances around the birth of their last-born child presents a unique opportunity to explore further some of the factors associated with NNM. Such surveys can also be used to study the potential influence of maternal-neonatal health interventions (e.g., the use of a sterile blade and kit for cord cutting) on the status of newborns. Recently, some DHS surveys in Asian countries have included new variables related to the circumstances around birth, such as whether a disposable delivery kit was used; whether there were any complications that occurred during delivery; whether the child was dried or wrapped at birth; whether the child was bathed during a specified period after birth; and whether the woman received advice on family planning, breastfeeding, or baby care after birth.

In this report, associations are explored between NNM and a number of background and birth-related characteristics, including the new NNM-related variables measured in DHS surveys, in five Asian countries—Bangladesh, India, Indonesia, Nepal and the Philippines.

METHODOLOGY

Data sets from the Bangladesh 2004, India 2005-06, Indonesia 2003, Nepal 2006, and Philippines 2003 DHS surveys are used to study the relationship between NMR and 32 variables related to maternal background (6 variables), antenatal care (4), delivery and childbirth (10), newborn (2), and postnatal (10) characteristics. For NNM estimates, mortality probabilities are used for children between birth and the first month of age (as asked in DHS surveys),¹ based on the mortality experience of children born 0-59 months before the survey. The numerators are the number of deaths in live-born children at age 0-30 days (including deaths reported at age 0 months); the denominators are the number of live-born children in the 0-59 months preceding the survey. Survival probabilities are calculated using a life-table approach by relating deaths to segments of life “exposure” for each child under age 1 month. The rate is calculated as a quotient of the number of deaths to the exposure, multiplied by 1,000. The tables present the number of deaths, exposure, NNM rate, and 95 percent confidence interval for each estimate.

¹ Strictly speaking, this is beyond the true neonatal period, which is only until day 28 of life. Because most mothers can probably recall accurately all deaths that occurred in the first 30 days of life, the DHS surveys include deaths in the first full month of life (i.e., 30 days). However, it is unlikely that NNM rates in the first 28 days and the first 30 days of life differ substantially.

RESULTS

Results for each country are presented in Appendices I to V. Table 1 presents a summary of associations between NNM and the 32 variables in the five Asian countries. In this section, findings are grouped into five categories, as described in Table 1: maternal background characteristics, antenatal care, delivery and childbirth, newborn characteristics, and postnatal care.

Maternal Background Characteristics

1. Place of Residence

In four of the five countries studied, there is no association between rural residence and increased risk of NNM. Only in India (possibly due to the large sample size) is there an association between rural area residence and higher NNM rates.

2. Education

In two of the five countries (Nepal and India), education is negatively associated with NNM. In the Philippines, women with no education have an NNM rate that is 2.6 times higher than women with secondary education. However, the very few cases of illiteracy produced large confidence intervals that overlap with the lower estimates.

3. Wealth Index

In four of the five countries, there is no association between the wealth index and NNM rates. Only in India (helped by a large sample size) is there an association between poorer households and higher NNM rates.

Table 1. Summary of associations between maternal, childbirth, and newborn characteristics and neonatal mortality rates, DHS Bangladesh, India, Indonesia, Nepal, and the Philippines, 2003-06

CHARACTERISTICS	Bangladesh 2004	India 2005-06	Indonesia 2003	Nepal 2006	Philippines 2003
MATERNAL BACKGROUND					
1. Place of residence (urban / rural)		+			
2. Education (secondary or higher / no education)		+		+	1
3. Wealth index (richest / poorest)		+ ²			
4. Sex of the child (male / female)					
5. Birth order (second or third order / first order)	+	+ ³		+	
6. Previous birth interval (2-3 years / less than 2 years)		+		1	
ANTENATAL CARE					
7. Mother received antenatal care (yes / no)		1			1
8. Mother informed about complications (yes / no)					
9. Mother given iron supplements (yes / no)					
10. Mother given tetanus injection (yes / no)		1			
DELIVERY AND CHILDBIRTH					
11. Skilled attendant at delivery (professionals / other)					
12. Place of delivery (institutional / noninstitutional)	4				
13. Use of disposable delivery kit (yes / no)				+	
14. Instrument to cut umbilical cord (new, clean, and boiled / other)		1		1	
15. Anything placed on stump (yes / no)				1	
16. Caesarean section (yes / no)		1		1	
17. Long labor (yes / no)					
18. Excessive bleeding (yes / no)					
19. Baby's hands and feet came first (yes / no)					
20. High fever or convulsions (yes / no)					
NEWBORN CHARACTERISTICS					
21. Perceived birth size by mother (average or larger / small or very small)		+	+	+	+
22. Birth weight (2.5+ kg / <2.5 kg)		+	+	1	1
POSTNATAL CARE					
23. Mother received postpartum care (yes / no)		+	+		+
24. Mother initiated breastfeeding early (yes / no)			+		
25. Child was dried prior to placenta delivery (yes / no)				1	
26. Child was wrapped immediately after birth / prior to placenta delivery (yes / no)		1		+	
27. Timing of bathing (within 1 hour of birth / more than 24 hours later)				1	
28. Mother received an abdominal, breast, or internal examination (yes / no)					

(Cont'd)

Table 1 – cont'd

CHARACTERISTICS	Bangladesh 2004	India 2005-06	Indonesia 2003	Nepal 2006	Philippines 2003
POSTNATAL CARE					
29. Mother received family planning advice (yes / no)		1			
30. Mother received breastfeeding advice (yes / no)		1			+
31. Mother received baby care advice (yes / no)					+
32. Newborn received a checkup (yes / no)	⁴	+	¹		+

Note: Characteristics with statistically significant associations are in boldface text; blank cells indicate no association.

■ Data not available

+ Positive association

¹ Although rates differ (in a positive direction) by at least 50 percent, the difference is not statistically significant due to the small number of cases.

² Includes two highest quintiles.

³ Significant (positive) differences are also found between birth intervals of two to three years versus four or more years.

⁴ Although rates differ (in a negative direction) by at least 50 percent, the differences are not statistically significant due to the small number of cases.

4. *Sex of the Child*

No associations are found between sex of the child and NNM rates.

5. *Birth Order*

First births are associated with higher NNM rates than second and third order births in Bangladesh, India and Nepal. There is no association between birth order and NNM in Indonesia and the Philippines.

6. *Previous Birth Interval*

In four of the five countries, NNM rates are not associated with a birth interval of less than two years.

In Nepal, the NNM rate in women whose previous birth occurred less than two years earlier is 73 percent higher than in women whose previous birth occurred at least four years earlier (i.e., 23

months earlier compared to 48 months or more earlier) but the confidence intervals overlap. In India, a birth interval of less than two years is associated with a higher NNM rate.

Antenatal Care

7. Receipt of Antenatal Care

No associations between antenatal care and NNM rates are found in any of the five countries. In India, the NNM rate is 39 percent higher for women who did not receive antenatal care than in women who received antenatal care, but the confidence intervals overlap. In the Philippines, women who did not receive antenatal care report a rate of NNM that is three times as high as that of women who received antenatal care, but the number of cases is small.

8. Whether Woman Informed of Complications

No associations are found in any of the five countries between whether the mother was informed of pregnancy complications and NNM rates.

9. Maternal Iron Supplementation

No associations are found in any of the five countries between maternal iron supplementation and NNM rates.

10. Maternal Tetanus Injection

No associations are found in any of the five countries between maternal tetanus injections and NNM rates. In India, the NNM rate in mothers who have not been given a tetanus injection is 54 percent higher than in those who have had an injection, but the confidence intervals overlap.

Delivery and Childbirth

11. Skilled Attendant at Delivery

No associations are found in any of the five countries between NNM rates and the mother's receipt of care from a professional or "other" personnel during her last delivery.

12. Place of Delivery

In the five countries, there are no associations between place of delivery and NNM rates. In Bangladesh, the NNM rate for delivery in an institution is higher than that taking place in a noninstitutional setting (64 per 1,000 versus 39 per 1,000, respectively) — an association in the opposite direction from that in other countries² — but the confidence intervals overlap.

13. Use of a Disposable Delivery Kit

The DHS surveys only ask about use of disposable delivery kits in Nepal and India. In Nepal, deliveries without the use of a disposable delivery kit are associated with higher NNM rates. In India, there is no association.

14. Use of a Clean Blade to Cut the Umbilical Cord

Only the India and Nepal DHS surveys ask about use of a clean blade to cut the umbilical cord. The NNM rates are 72 percent higher in Indian women and 53 percent higher in Nepalese women, respectively, for whom a clean blade was not used to cut the cord, than in women for whom a clean blade was used, but in both cases the confidence intervals overlap.

² The direction of this association is also plausible. In a country with few institutional births, such as Bangladesh, women who deliver in a health care facility might do so precisely because of the complications of labor and delivery; these complications can ultimately lead to newborn deaths.

15. Anything Placed on the Umbilical Cord Stump

Only the Nepal DHS survey asks about the placement of anything on the umbilical cord stump immediately following delivery. The NNM rate is nearly twice as high when nothing was placed on the stump (which is contrary to expectations) as when anything was placed on the stump. However, the difference is not significant.

16. Caesarean Section

No associations are found between having a Caesarean section and NNM rates in any of the five countries. In Nepal, women who did not have a Caesarean section have an NNM rate that is 94 percent higher than women who had a Caesarean section, but very few women surveyed had a Caesarean section. In India, not having a Caesarean section is associated with a 48 percent increase in NNM rates but the confidence intervals overlap.

17. Long Labor

Only the Indonesia and Bangladesh DHS surveys ask women about labor duration. No associations are found between duration of labor and NNM rates.

18. Excessive Bleeding

Women are asked about excessive bleeding during labor and delivery only in Indonesia and Bangladesh. No associations are found between excessive bleeding during labor and delivery and NNM rates.

19. Whether the Baby's Hands and Feet Came Out First

A question concerning whether the baby's head or feet were delivered first is asked only in Bangladesh. No association is found between this variable and the NNM rate.

20. High Fever or Convulsions

Only the Indonesia and Bangladesh DHS surveys ask about mothers' experiences of high fever or convulsions during labor and delivery. No associations are found between this variable and NNM rates.

Newborn Characteristics

21. Perceived Birth Size

Mothers' perceptions that their babies were small or very small at birth are associated with higher NNM rates than mothers' perceptions that their babies are of average or larger size at birth in the four countries with data on perceived infant size (these data are not available for Bangladesh).

22. Birth Weight

Birth weight under 2.5 kg is associated with higher NNM rates than birth weight higher than 2.5 kg in India and Indonesia. In Nepal and the Philippines, the rates are also substantially higher in LBW babies, 2.3 and 3.2 times higher, respectively. However, the confidence intervals overlap, possibly due to the small number of cases and of deaths in babies born weighing less than 2.5 kg. Data on birth weight are unavailable for Bangladesh.

Postnatal Care

23. Postpartum Care of Mothers

Not having received postpartum care (for mothers) is associated with higher NNM rates compared with having received such care in India, Indonesia, and the Philippines. No association is found in Nepal and Bangladesh.

24. Early initiation of Breastfeeding

In four of the five countries studied, there is no association between lack of early initiation of breastfeeding (i.e., breastfeeding within one hour of birth) and increased NNM rates. In Indonesia, an association is found between lack of early breastfeeding initiation and higher NNM.

25. Drying the Newborn Prior to Placenta Delivery

Only the Nepal DHS survey asks mothers whether their newborns had been dried before the placenta was delivered. The NNM rate is more than twice as high in infants who were not dried than in those who were dried. However, the confidence intervals overlap.

26. Wrapping the Newborn

Only the Nepal DHS survey asks whether newborns were wrapped (in a blanket) immediately after delivery. In Nepal, not wrapping newborns is associated with higher NNM rates.

In India, the DHS survey asks a combined question about whether the child was dried prior to placenta delivery and then wrapped. Not drying or wrapping babies is associated with an NMR rate that is 30 percent higher, but the confidence intervals overlap.

27. Timing of First Bath

Only the Nepal DHS survey asks about the timing of bathing for newborns. Bathing the newborn 24 hours or more after birth is associated with a rate of NNM that is 50% lower than the rate associated with bathing the infant less than an hour after birth. However, very few respondents report that their newborns were bathed more than 24 hours after birth and the difference is not significant.

28. Abdominal, Breast, or Internal Postpartum Examinations

Only the Nepal and Philippines DHS surveys ask about postpartum abdominal, breast, or internal examinations. No associations are found between these examinations and NNM rates.

29. Family Planning Advice

Only the India and Philippines DHS surveys ask whether new mothers had received family planning advice.³ In India, not receiving family planning advice is associated with an NNM rate that is 63 percent higher than receiving such advice, but the confidence intervals overlap. In the Philippines, there is no association between receipt of family planning advice and NNM rates.

30. Breastfeeding Advice

Only the India and Philippines DHS surveys ask whether mothers received breastfeeding advice after giving birth. In India, not receiving advice about breastfeeding is associated with an NNM rate that is 53 percent higher than receiving this advice, but the confidence intervals overlap. In the Philippines, not receiving the advice is associated with a higher NNM rate.

³ In India, this question referred to advice received in the last trimester of pregnancy, while in Philippines it referred to advice received after delivery.

31. Baby Care Advice

Only the India and Philippines DHS surveys ask whether new mothers have received baby care advice. In India, there is no association between receiving this advice and the NNM rate. In the Philippines, not receiving the advice is associated with a higher NNM rate.

32. Newborn Checkup

In India and the Philippines, not receiving a checkup is associated with a higher NNM rate. In Indonesia, not receiving a checkup is associated with an NNM rate that is twice as high as that associated with receiving a checkup, but the confidence intervals overlap (by two points). In Bangladesh, the NNM rate is 60 percent higher in infants who received a checkup than in those who did not (representing a reverse association), but the confidence intervals overlap (by 4 points).

CONCLUSIONS

This study of five Asian countries with DHS data found associations between several maternal, newborn, and childbirth characteristics and NNM.

The clearest association is between mothers' perceptions of the size of their newborn and the NNM rate. Mothers who say that their babies were "smaller than average" or "very small" at birth consistently report a significantly higher NNM rate than those responding that their babies were of average or larger size in all the countries with data. Interpretation of this finding is difficult because it is unclear whether the mothers perceived their babies as small as a rationalization after the newborns failed to thrive and died. A similar variable, actual birth weight reported by mothers, yields associations between babies weighing less than 2.5 Kg and higher NNM rates in two of the four countries with data; differences in the other two countries fail to reach significance due to the small number of cases and deaths.

Another characteristic associated with NNM is birth order. In three of the five countries, first births are associated with increased mortality rates compared with second and third births. In India, fourth order births are also associated with increased NNM rates compared with second and third order births.

The third characteristic associated with increased NNM rates is non-receipt of postpartum care at a health care institution or at home. In three of the five countries studied, NNM rates among mothers who did not receive postpartum care are higher than among those who did receive such care. Given that in these countries, the vast majority of births occur outside a health care institution, this finding is of particular importance.

Because of the low rates of NNM and the statistical methods used, several associations do not reach statistical significance. However, analyses for India, with a sample size 3 to 10 times higher than that of other countries, yield significant associations with such variables as place of residence,

education, wealth and previous birth interval.

In addition, variables that have only recently been added to some DHS surveys (such as use of a delivery kit during labor and delivery; drying the newborn prior to placenta delivery; wrapping the newborn prior to placenta delivery; timing of the newborn's first bath; and mother's receipt of advice on family planning, breastfeeding, and baby care) yield some associations with NNM rates in the few countries whose DHS surveys include these variables.

IMPLICATIONS FOR POLICY, RESEARCH, AND FUTURE SURVEYS

This study yielded a few associations with policy implications. A first and previously known association is that between NNM rates and birth order. The association between higher NMR rates and first order birth demonstrates the need for countries to ensure that first-born neonates receive extra care and attention, especially during the postnatal period.

The association between NMR rates and mothers' perceptions that their newborns were small could be used for early interventions. For example, through health education, mothers who perceive their newborn babies as too small or whose babies weigh less than 2.5 kg. could be encouraged to take their baby promptly to a health care facility for further examination. Also, babies born in noninstitutional settings should receive at least one early postpartum or postnatal care visit, preferably at a health care institution or, if at home, by a health care professional.

Observed associations between NMR rates and responses to several questions pertaining to specific interventions, such as the use of a disposable delivery kit, newborn thermal care, and advice on maternal and newborn care, merit further investigation. The reliability of questions on such topics as skin-to-skin care, the components of postnatal care for mothers and babies, and mothers' recognition of danger signs in their newborns, also needs to be investigated. Additional studies exploring the background characteristics of mothers who receive the recommended care during and after birth and follow the recommended practices of newborn care would be useful in identifying target populations for various program interventions in this arena.

These positive initial findings have important potential for immediate policy applications and are thus worth studying further. In particular, quantitative and qualitative studies could be designed to explore mothers' knowledge and understanding of these interventions, as well as to validate their recall of selected interventions through observational studies. Multivariate analysis, in particular, could shed light on the most critical factors affecting NNM when all of these factors are considered

simultaneously. The ultimate objectives of these studies would be to determine which questions are worth including in future surveys and to better formulate such questions. An ultimate goal is to develop a neonatal health module using questions proven to be reliable that could be used and adapted as necessary in countries with particular interventions designed to lower their NNM rates.

LIMITATIONS

A study of this nature has inherent limitations. One of the most important limitations is that produced by small sample sizes or small numbers of responses regarding specific characteristics. For example, because most mothers in the five countries studied do not know the birth weight of their newborns, comparisons of low and normal birth weights can only be made for a small number of cases.

As with any study based on cross-sectional surveys, this study is limited by its dependence on the recall of mothers. Mothers may underreport deaths in their newborns, especially those that occurred a few days after birth; in addition, mothers may also underreport deaths for births that occurred several years before the survey.

Several associations explored here may be obscuring the presence of a confounding variable. Multivariate analysis would help identify the most critical factors that independently and strongly affect the differing levels of mortality found.

Given that the confidence interval rates are derived from the same sample and not from independent samples, a more appropriate statistical test would include the covariate term in the equation. Including the covariate could yield significant associations in a few of the borderline analyses in which no associations are found. With that in mind, the significant associations found using these data should be interpreted as the “minimum set” of associations.

In addition, associations cannot determine directions of causality. In particular, several variables might suffer from “reverse causality,” or mothers’ rationalizations or adjustments. Such rationalizations might have occurred in mothers who perceive their baby’s birth weight as low; mothers whose neonate died might be more likely to revise their perception and answer that their newborn was “small” or “very small” than mothers of healthy newborns. Similar phenomena may have occurred in mothers who report receiving postpartum care, and this may be the case with other variables investigated.

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APPENDIX I. Neonatal Mortality in Bangladesh

Number of neonatal deaths and exposures, neonatal mortality rates, and confidence intervals for the five years preceding the survey by background, prenatal, childbirth, and newborn characteristics, Bangladesh, 2004

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence interval
<u>BACKGROUND CHARACTERISTICS</u>				
Type of place of residence				
Urban	55	1,407	39	29-49
Rural	237	5,658	42	35-49
Region				
Barisal	11	415	28	15-40
Chittagong	55	1,549	35	24-46
Dhaka	98	2,200	44	33-56
Khulna	26	735	36	22-50
Rajshahi	67	1,563	43	29-57
Sylhet	35	602	58	42-74
Education				
No education	129	2,738	47	37-57
Primary	87	2,178	40	30-49
Secondary	76	2,149	36	26-45
Wealth index				
Poorest	86	1,814	48	34-62
Poorer	47	1,459	32	21-43
Middle	71	1,383	51	37-65
Richer	43	1,246	35	23-47
Richest	44	1,162	38	26-50
Sex of the child				
Male	153	3,593	43	34-51
Female	140	3,472	40	32-48
Birth order				
1	121	2,067	58	47-70
2-3	96	3,043	32	24-39
4+	76	1,955	39	29-49
Previous birth interval				
<2 years	39	759	51	24-78
2-3 years	72	2,343	31	23-39
4+ years	55	1,886	29	20-38

(Cont'd)

APPENDIX I – cont'd

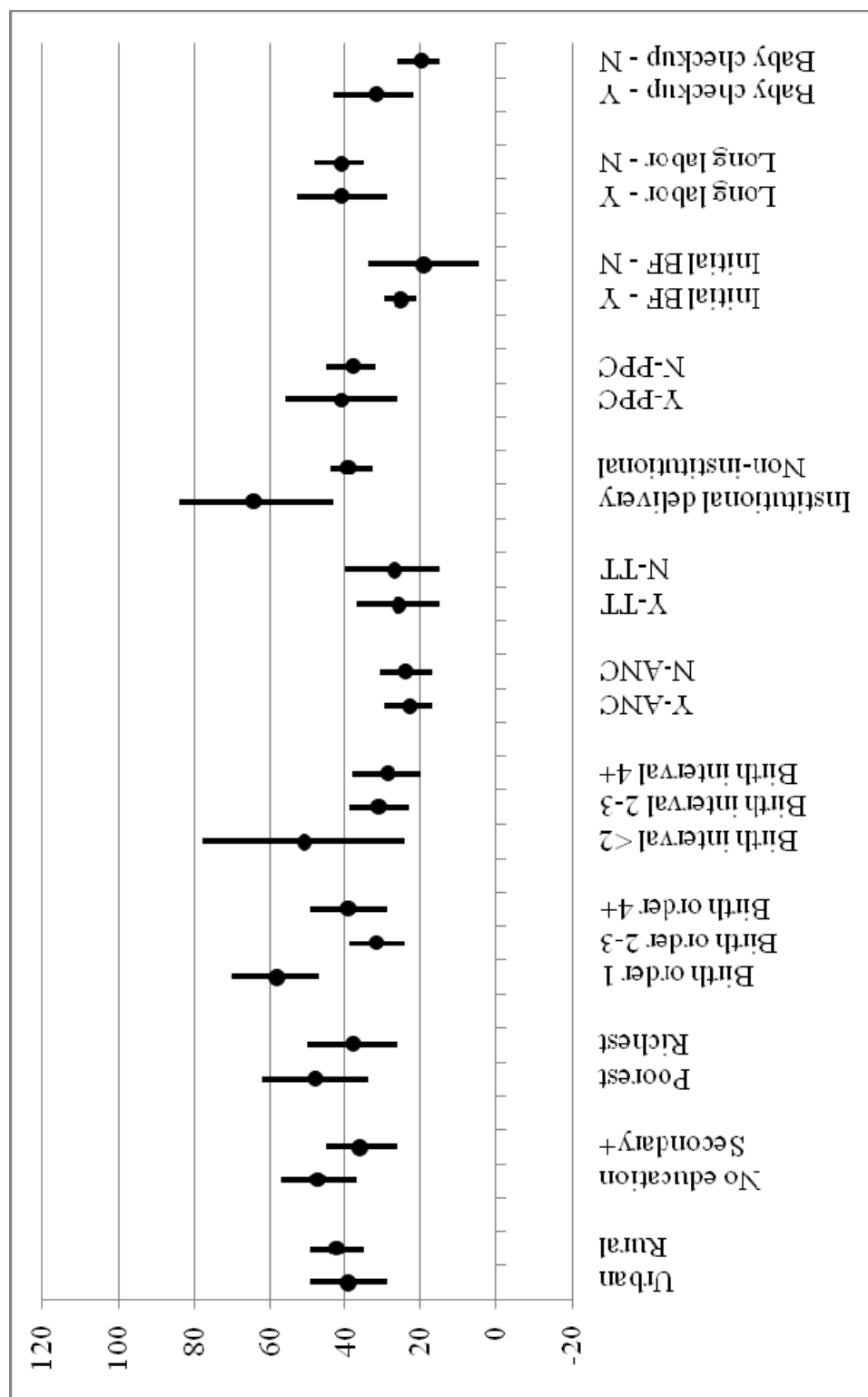
	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence interval
<u>BEFORE CHILDBIRTH</u>				
Antenatal care				
Yes	69	2,959	23	17-30
No	57	2,335	24	17-31
Told about complications				
Yes	39	1,614	24	16-33
No	87	3,680	24	18-29
Mother took supplemental iron				
Yes	64	2,642	24	18-31
No	62	2,650	23	17-30
Mother had a tetanus injection				
Yes	29	1,095	26	15-37
No	22	791	27	15-40
DK/Missing	76	3,410	22	17-28
<u>CHILDBIRTH</u>				
Skilled attendant at delivery				
Doctor, nurse, or midwife	55	2,169	25	19-32
Other	14	790	18	7-30
Place of delivery				
Institutional	43	679	64	43-84
Noninstitutional	239	6,199	39	33-44
Caesarean section				
Yes	8	237	35	13-57
No	273	6,634	41	35-47
Long labor				
Yes	61	1,483	41	29-53
No	231	5,582	41	35-48
Mother had excessive bleeding				
Yes	63	1,534	41	28-54
No	230	5,531	42	35-48
Mother had convulsions				
Yes	72	1,998	36	27-45
No	220	5,066	43	36-50

(Cont'd)

APPENDIX I – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence interval
Baby's hands and feet came out first				
Yes	118	2,465	48	38-58
No	174	4,599	38	31-45
Other complications				
Yes	10	293	33	12-55
No	282	6,771	42	36-48
<u>AFTER CHILDBIRTH</u>				
Mother received postpartum care				
Yes	30	743	41	26-56
No	209	5,456	38	32-45
Early initiation of breastfeeding				
Yes	158	6,257	25	21-30
No	9	488	19	5-34
Infant received a checkup				
Yes	48	1,481	32	22-43
No	78	3,815	20	15-26
Total	292	7,065	41	36-47

APPENDIX FIGURE I. Neonatal Mortality Rates by Background Characteristics – Bangladesh 2004



APPENDIX II. Neonatal Mortality in India

Number of neonatal deaths and exposures, neonatal mortality rates, and confidence intervals for the five years preceding the survey by background, prenatal, childbirth, and newborn characteristics, India, 2005-06

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rates per 1,000 live births	Confidence intervals
<u>BACKGROUND CHARACTERISTICS</u>				
Type of place of residence				
Urban	413	14,476	29	22-35
Rural	1,805	42,416	43	37-48
Region				
<u>North</u>				
Delhi	16	532	29	24-35
Haryana	24	1,036	24	-40-87
Himachal Pradesh	7	252	27	-38-93
Jammu and Kashmir	14	474	30	*
Punjab	31	1,123	28	2-54
Rajasthan	155	3,541	44	*
Uttaranchal	12	417	28	15-70
<u>Central</u>				
Chhatisgarh	62	1,215	51	2-100
Madhya Pradesh	174	3,868	45	-17-107
Uttar Pradesh	563	11,819	48	3-93
<u>East</u>				
Bihar	249	6,264	40	2-78
Jharkhand	92	1,897	49	-25-123
Orissa	90	1,973	45	-22-113
West Bengal	157	4,183	38	-9-84
<u>Northeast</u>				
Arunachal Pradesh	2	66	34	*
Assam	66	1,446	45	*
Manipur	2	119	19	*
Meghalaya	4	182	24	7-40
Mizoram	1	51	16	7-26
Nagaland	2	96	20	*
Sikkim	0.4	26	19	*
Tripura	5	162	33	-34-100
<u>West</u>				
Goa	0.5	56	9	*
Gujarat	88	2,626	33	24-43
Maharashtra	142	4,448	32	-2-65

(Cont'd)

APPENDIX II – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rates per 1,000 live births	Confidence intervals
<u>South</u>				
Andhra Pradesh	128	3,165	40	-20-100
Karnataka	79	2,721	29	17-41
Kerala	12	1,041	12	*
Tamil Nadu	40	2,092	19	-4-42
Education				
No education	1,303	28,492	46	41-51
Primary	358	7,982	45	37-53
Secondary +	557	20,417	27	23-32
Wealth index				
Poorest	701	14,494	48	40-56
Poorer	568	12,747	45	40-49
Middle	441	11,241	39	31-48
Richer	327	10,245	32	27-37
Richest	180	8,165	22	17-27
Sex of the child				
Male	1,214	29,638	41	36-46
Female	1,004	27,254	37	31-43
Birth order				
1	826	17,290	48	39-57
2-3	746	24,593	30	27-34
4+	646	15,009	43	36-50
Previous birth interval				
<2 years	582	10,402	56	47-65
2-3 years	554	20,794	27	23-31
4+ years	241	8,289	29	24-35
<u>BEFORE CHILDBIRTH</u>				
Antenatal care				
Yes	674	29,948	23	19-27
No	282	8,830	32	24-40
Told about complications				
Yes	149	7,376	20	15-25
No	525	22,566	23	19-28
Mother took supplemental iron				
Yes	551	25,271	22	18-26
No	401	13,352	30	24-36

(Cont'd)

APPENDIX II – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rates per 1,000 live births	Confidence intervals
Mother had a tetanus injection				
Yes	68	2,560	26	18-35
No	251	6,255	40	31-49
Don't know or missing	1,842	46,741	39	34-45
<u>CHILDBIRTH</u>				
Skilled attendant at delivery				
Doctor, nurse, or midwife	643	28,414	23	19-27
Other	31	1,535	20	12-29
Place of delivery				
Institutional	764	21,483	36	27-44
Noninstitutional	1,358	34,006	40	36-44
Caesarean section				
Yes	129	4,711	27	19-36
No	2,029	50,821	40	35-45
Disposable delivery kit used				
Yes	98	4,693	21	15-27
No	458	16,087	28	24-33
Don't know or missing	47	1,903	24	17-32
Clean blade used to cut the umbilical cord				
Yes	528	20,861	25	21-30
No	46	1,090	43	24-62
Don't know or missing	28	733	38	15-61
<u>NEWBORN CHARACTERISTICS</u>				
Birth size				
Small or very small	651	11,548	56	46-67
Average or larger	1,398	43,213	32	27-38
Don't know or missing	112	794	141	95-188
Birth weight				
< 2.5 kg	176	4,086	43	33-53
2.5+ kg	206	14,887	14	10-17
Don't know or missing	1,779	36,583	49	45-52
<u>AFTER CHILDBIRTH</u>				
Mother received postpartum care				
Yes	18	1,096	17	5-28
No	1,340	32,909	41	37-44

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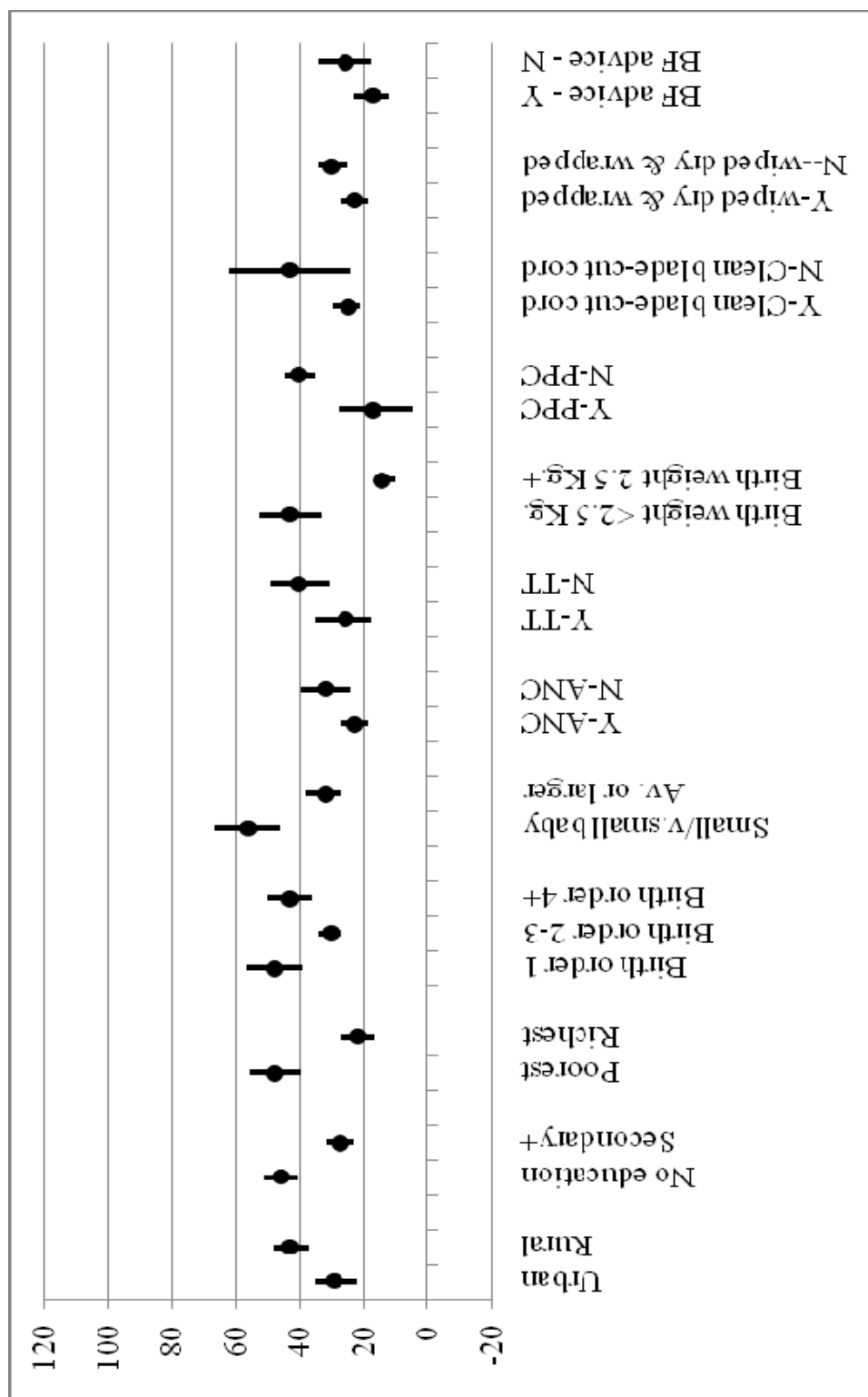
APPENDIX II – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rates per 1,000 live births	Confidence intervals
Early initiation of breastfeeding				
Yes	298	28,805	10	8-13
No	86	8,933	10	7-12
Child dried and then wrapped before delivery of placenta				
Yes	236	10,284	23	19-27
No	344	11,640	30	25-34
Don't know or missing	23	759	30	11-48
Mother given family planning advice				
Yes	80	5,122	16	9-22
No	202	7,831	26	18-33
Mother given breastfeeding advice				
Yes	106	6,155	17	12-23
No	176	6,799	26	18-34
Mother given baby care advice				
Yes	95	4,979	19	13-26
No	186	7,975	23	16-31
Need for cleanliness advice				
Yes	113	6,150	18	13-24
No	168	6,804	25	16-33
Infant received a checkup				
Yes	19	1588	12	4-20
No	539	17,940	30	27-33
Total	2,218	56,892	39	34-44

* Not calculated because of insufficient numbers.

Note: The month of the interview is excluded from analysis.

APPENDIX FIGURE II. Neonatal Mortality Rates by Background Characteristics – India 2006



APPENDIX III. Neonatal Mortality in Indonesia

Number of neonatal deaths and exposures, neonatal mortality rates, and confidence intervals for the five years preceding the survey by background, prenatal, childbirth, and newborn characteristics, Indonesia, 2003

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence interval
<u>BACKGROUND CHARACTERISTICS</u>				
Type of place of residence				
Urban	132	7,027	19	13-24
Rural	165	8,119	20	15-25
Region				
<u>Sumatera</u>				
North Sumatra	25	1,380	18	4-31
West Sumatra	9	463	20	6-34
Riau	9	428	21	11-31
Jambi	2	200	11	3-20
South Sumatra	10	382	25	7-43
Bengkulu	2	91	21	7-35
Lampung	12	523	23	8-38
Bangka Belitung	2	71	33	13-54
<u>Java</u>				
DKI Jakarta	9	508	18	4-33
West Java	66	3,084	21	10-33
Central Java	25	1,795	14	5-23
DI Yogyakarta	1	145	9	0-17
East Java	55	2,138	26	11-40
Banten	13	743	17	7-28
<u>Baliand Nusa Tenggara</u>				
Bali	1	198	7	0-14
West Nusa Tenggara	5	329	15	5-25
East Nusa Tenggara	7	377	20	8-32
<u>Kalimantan</u>				
West Kalimantan	5	299	16	4-28
Central Kalimantan	5	177	26	13-40
South Kalimantan	5	253	20	7-33
East Kalimantan	6	261	21	5-38
<u>Sulawest</u>				
North Sulawesi	3	155	21	8-33
Cenrtal Sulawesi	4	214	17	4-31
South Sulawesi	7	659	10	1-19
Southeast Sulawesi	6	179	34	13-56
Gorontalo	2	92	25	7-42

(Cont'd)

APPENDIX III – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence interval
Education				
No education	13	732	18	5-30
Primary	138	7,316	19	13-24
Secondary	146	7,098	21	15-26
Wealth index				
Poorest	67	3,584	19	14-24
Poorer	75	2,960	25	15-36
Middle	53	2,982	18	10-25
Richer	58	2,868	20	10-31
Richest	44	2,752	16	8-24
Sex of the child				
Male	167	7,833	21	16-26
Female	130	7,312	18	13-23
Birth order				
1	113	5,265	22	16-28
2-3	115	6,757	17	12-22
4+	69	3,124	22	14-30
Previous birth interval				
<2 years	34	1,211	28	12-44
2-3 years	50	3,003	17	9-25
4+ years	94	5,625	17	11-22
<u>BEFORE CHILDBIRTH</u>				
Antenatal care				
Yes	139	11,893	12	8-15
No	13	548	23	-4-51
Told about complications				
Yes	32	3,422	9	4-14
No	103	8,366	12	8-16
Don't know or missing	19	137	140	55-225
Mother took supplemental iron				
Yes	108	9,774	11	8-15
No	41	2,511	16	7-26
Don't know or missing	18	187	94	38-149
Mother had a tetanus injection				
Yes	46	2,688	17	8-26
No	40	3,253	12	6-19
Don't know or missing	80	6,530	12	8-17

(Cont'd)

APPENDIX III – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence interval
<u>CHILDBIRTH</u>				
Skilled attendant at delivery				
Doctor, nurse, or midwife	70	6,623	11	7-14
Other	69	5,269	13	7-19
Place of delivery				
Institutional	96	5,933	16	10-22
Noninstitutional	135	8,742	15	11-20
Don't know or missing	60	120	498	346-650
Caesarean section				
Yes	10	599	16	-8-41
No	282	14,107	20	16-24
Long labor				
Yes	17	1,063	16	8-24
No	94	5,096	18	12-24
Don't know or missing	0	5	0	
Excessive bleeding in mother				
Yes	48	2,761	18	11-24
No	248	12,374	20	18-24
High fever in mother				
Yes	7	560	13	2-24
No	289	14,575	20	16-24
Convulsions in mother				
Yes	4	240	18	-6-42
No	292	14,895	20	16-23
Other complications in mother				
Yes	19	866	22	8-35
No	278	14,269	19	16-23
<u>NEWBORN CHARACTERISTICS</u>				
Birth size				
Small or very small	79	2,021	39	25-54
Average or larger	140	12,110	12	8-15
Don't know or missing	71	665	108	69-146
Birth weight				
< 2.5 kg	60	825	72	39-106
2.5+ kg	85	10,647	8	5-11
Don't know or missing	146	3,324	44	33-55

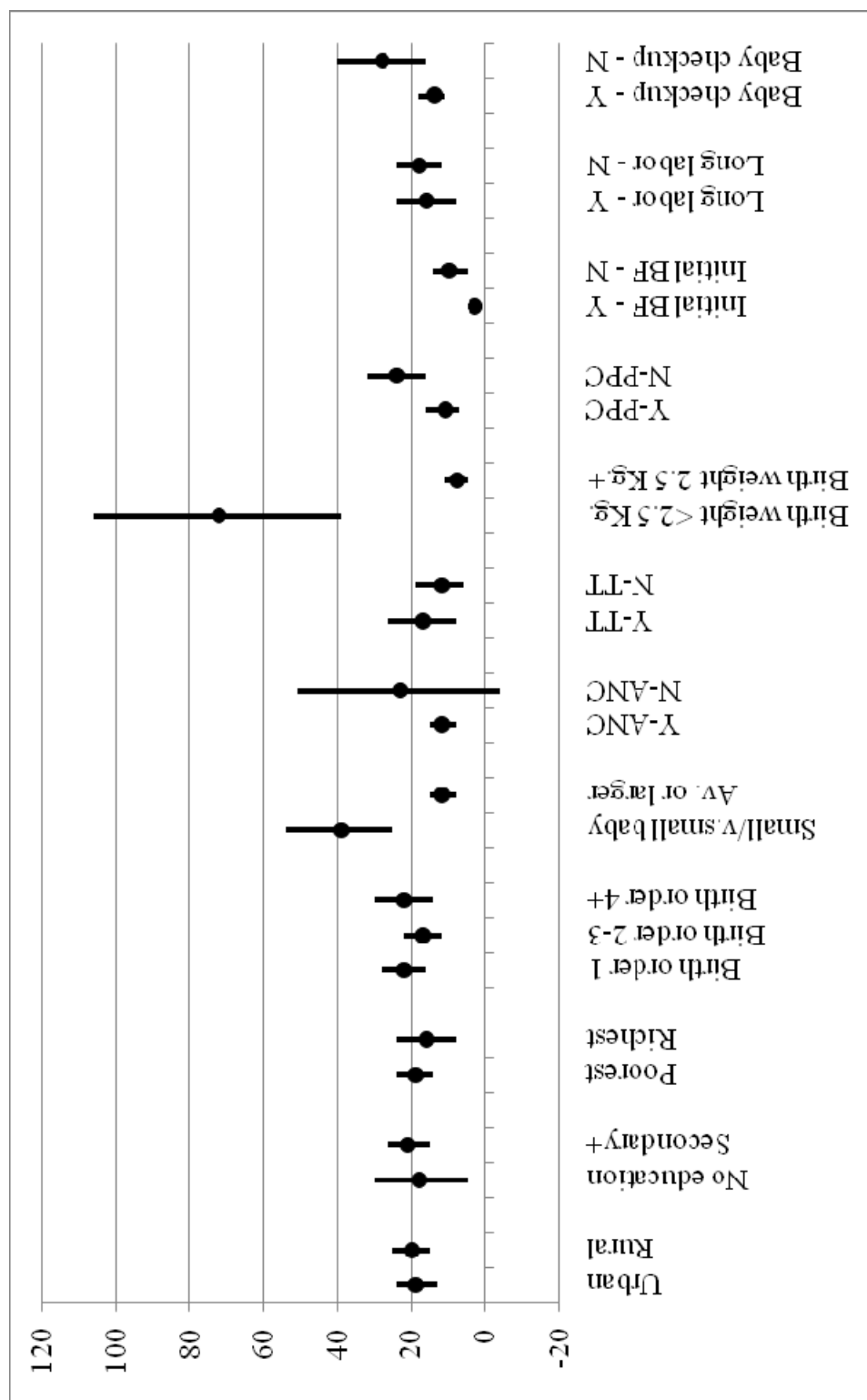
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APPENDIX III – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence interval
<u>AFTER CHILDBIRTH</u>				
Mother received postpartum care				
Yes	69	6,001	11	7-16
No	66	2,741	24	16-32
Don't know or missing	60	120	498	346-650
Early initiation of breastfeeding				
Yes	30	9,047	3	2-5
No	48	4,990	10	5-14
Infant received a checkup				
Yes	185	12,819	14	11-18
No	51	1,832	28	16-40
Don't know or missing	55	145	383	256-509
Total	297	15,145	20	16-23

Note: The month of the interview is excluded from analysis.

APPENDIX FIGURE III. Neonatal Mortality Rates by Background Characteristics – Indonesia 2003



APPENDIX IV. Neonatal mortality in Nepal

Number of neonatal deaths and exposures, neonatal mortality rates, and confidence intervals for the five years preceding the survey by background, prenatal, childbirth, and newborn characteristics, Nepal, 2006

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence interval
<u>BACKGROUND CHARACTERISTICS</u>				
Type of place of residence				
Urban	18	687	26	16-36
Rural	165	4,913	34	26-41
Region				
Eastern	40	1,197	33	21-45
Central	52	1,835	28	16-41
Western	35	1,034	33	18-49
Midwestern	34	716	48	28-67
Far-western	23	818	28	11-45
Education				
No education	133	3,392	39	30-48
Primary	31	1,009	31	18-44
Secondary	19	1,199	16	8-24
Wealth index				
Poorest	46	1,430	32	23-42
Poorer	41	1,194	34	20-48
Middle	53	1,139	46	29-64
Richer	25	990	25	14-37
Richest	18	847	22	11-33
Sex of the child				
Male	89	2,839	31	23-40
Female	94	2,762	34	25-43
Birth order				
1	75	1,693	44	32-57
2-3	49	2,364	21	14-28
4+	58	1,543	38	25-51
Previous birth interval				
<2 years	32	837	38	23-53
2-3 years	53	2,116	25	16-33
4+ years	21	946	22	10-33
<u>BEFORE CHILDBIRTH</u>				
Antenatal care				
Yes	47	2,930	16	10-22
No	25	1,048	24	14-34

(Cont'd)

APPENDIX IV – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence interval
Mother told about pregnancy complications				
Yes	27	1,685	16	9-24
No	19	1,243	15	7-24
Don't know or missing	0	2	0	
Mother took supplemental iron				
Yes	33	2,350	14	8-20
No	38	1,627	23	16-31
Mother had a tetanus injection				
Yes	10	403	24	4-45
No	34	1,054	32	20-45
Don't know or missing	28	2,521	11	6-16
<u>CHILDBIRTH</u>				
Skilled attendant at delivery				
Doctor, nurse, or midwife	29	1,738	16	9-24
Other	18	1,192	15	7-24
Place of delivery				
Institutional	28	966	29	15-43
Noninstitutional	150	4,490	33	26-40
Caesarean section				
Yes	3	146	17	-15-49
No	176	5,310	33	26-40
Disposable delivery kit used				
Yes	4	562	6	-1-14
No	55	2,635	21	14-27
Instrument used to cut the umbilical cord				
New or boiled blade	33	1,944	17	10-24
Other	18	679	26	14-39
Anything placed on the umbilical cord stump				
Yes	8	814	10	3-18
No	45	2,357	19	12-26
Child cried at birth				
Yes	3	3	1,000	*
No	5	34	137	7-267
<u>NEWBORN CHARACTERISTICS</u>				
Birth size				
Small or very small	59	1,043	56	39-73
Average or larger	118	4,408	27	20-33

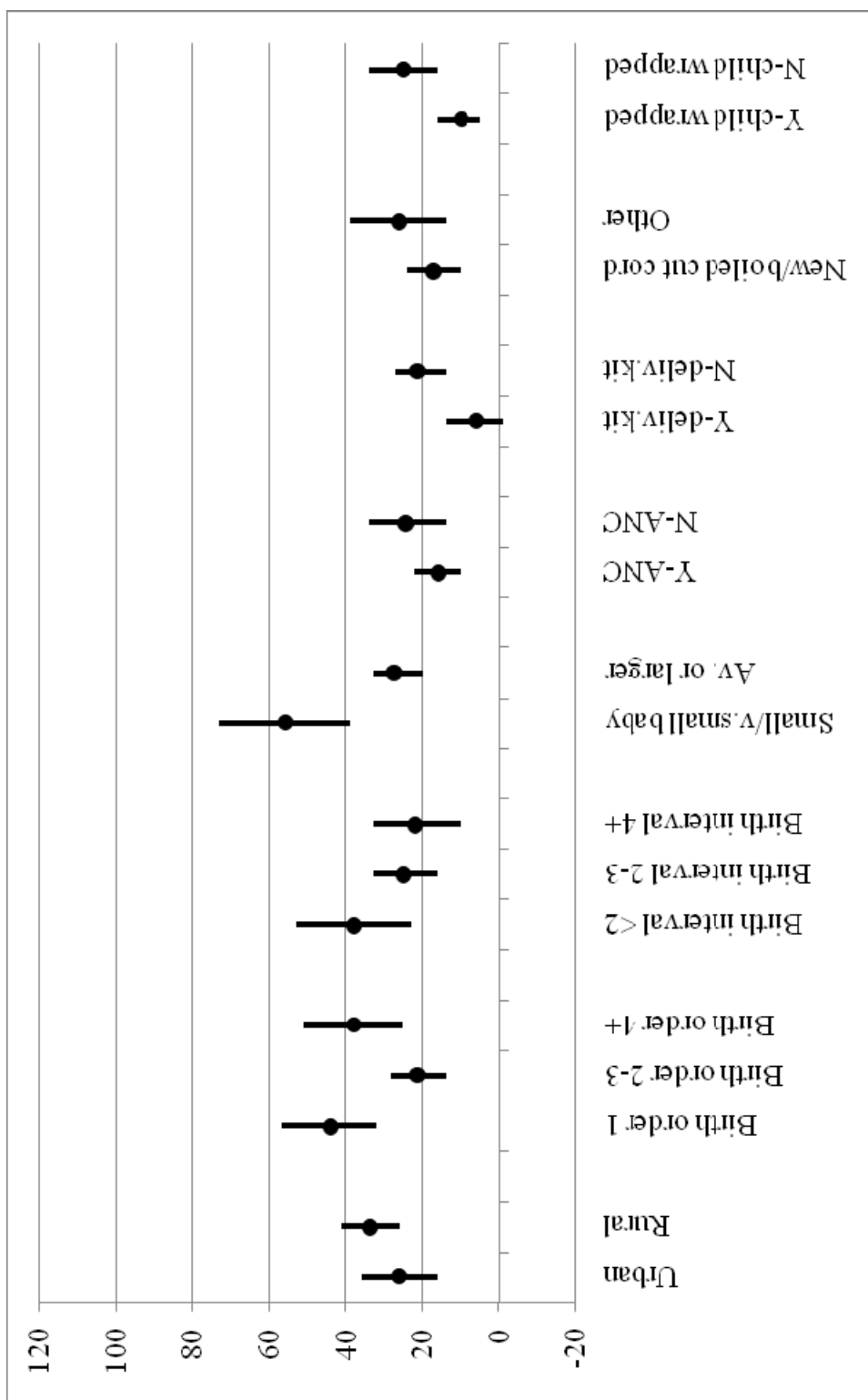
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APPENDIX IV – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence interval
Birth weight				
< 2.5 kg	5	135	35	-2-71
2.5+ kg	12	810	15	3-27
Don't know or missing	161	4,512	36	28-43
<u>AFTER CHILDBIRTH</u>				
Mother received postpartum care				
Yes	8	275	30	5-55
No	142	4,215	34	26-41
Early initiation of breastfeeding				
Yes	32	2,885	11	6-16
No	7	1,052	7	1-13
Child dried before delivery of placenta				
Yes	15	1,365	11	5-17
No	43	1,817	24	15-33
Child wrapped before delivery of placenta				
Yes	14	1,423	10	5-16
No	44	1,762	25	16-34
Timing of infant's first bath				
<1 hour after birth	26	1,667	16	9-23
1-23 hours after birth	10	998	10	2-19
24+hours after birth	4	515	8	0-15
Mother examined for pelvic discharge				
Yes	8	596	14	2-26
No	1	71	16	-17-49
Infant received a checkup				
Yes	8	358	23	4-42
No	50	2840	18	11-24
Total	183	5,600	33	26-39

Note: The month of the interview is excluded from analysis.

APPENDIX FIGURE IV. Neonatal Mortality Rates by Background Characteristics – Nepal 2006



APPENDIX V. Neonatal Mortality in the Philippines

Number of neonatal deaths and exposures, neonatal mortality rates, and confidence intervals for the five years preceding the survey by background, prenatal, childbirth, and newborn characteristics, Philippines, 2003

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence Interval
<u>BACKGROUND CHARACTERISTICS</u>				
Type of place of residence				
Urban	55	3,500	16	11-20
Rural	65	3,525	18	14-23
Region				
National capital region	19	1,058	18	8-28
Cordillera administrative region	1	116	12	-1-25
I - Ilocos	8	311	26	6-47
II - Cagayan Valley	2	227	7	-7-21
III - Central Luzon	12	690	18	6-30
IVA - CALABARZON	9	835	11	2-20
IVB - MIMAROPA	5	243	20	3-38
V - Bicol	7	445	15	4-26
VI - Western Visayas	11	478	24	4-43
VII - Central Visayas	7	537	12	1-24
VIII - Eastern Visayas	9	362	24	9-38
IX - Zamboanga Peninsula	3	275	13	1-24
X - Northern Mindanao	7	302	24	6-43
XI - Davao	5	303	15	3-28
XII - SOCCSKSARGEN	5	323	15	4-27
XIII - Caraga	4	203	18	5-32
ARMM	6	316	20	4-37
Education				
No education	5	134	39	4-74
Primary	43	2,060	21	14-27
Secondary	72	4,831	15	11-19
Wealth index				
Poorest	37	1,867	20	13-27
Poorer	28	1,606	17	11-24
Middle	21	1,367	15	8-23
Richer	24	1,176	21	10-31
Richest	10	1,010	10	3-16
Sex of the child				
Male	71	3,582	20	15-25
Female	49	3,443	14	10-19

(Cont'd)

APPENDIX V – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence Interval
Birth order				
1	40	1,956	20	13-28
2-3	34	2,697	13	8-17
4+	46	2,372	19	13-26
Previous birth interval				
<2 years	29	1,559	19	12-26
2-3 years	23	2,103	11	6-16
4+ years	28	1,394	20	12-28
<u>BEFORE CHILDBIRTH</u>				
Antenatal care				
Yes	50	4,420	11	8-15
No	9	260	33	10-56
Told about complications				
Yes	22	2,166	10	6-15
No	28	2,244	12	8-17
Mother took supplemental iron				
Yes	43	3,608	12	8-15
No	15	1,068	14	6-22
Given tetanus injection				
Yes	18	1,565	12	6-17
No	22	1,304	17	9-24
Don't know or missing	24	1,825	13	7-19
<u>CHILDBIRTH</u>				
Skilled attendant at delivery				
Doctor, nurse, or midwife	46	4,115	11	8-15
Other	4	305	12	0-23
Place of delivery				
Institutional	43	2,589	17	11-23
Noninstitutional	60	4,220	14	10-18
Caesarean section				
Yes	8	495	16	4-27
No	112	6,336	18	14-21
<u>NEWBORN CHARACTERISTICS</u>				
Birth size				
Small or very small	38	1,295	29	19-40
Average or larger	62	5,479	11	8-14

(Cont'd)

APPENDIX V – cont'd

	Neonatal deaths (N)	Exposure (N)	Neonatal mortality rate per 1,000 live births	Confidence Interval
Birth weight				
< 2.5 kg	17	893	19	8-29
2.5+ kg	22	3,756	6	3-9
Don't know or missing	81	2,196	37	28-46
<u>AFTER CHILDBIRTH</u>				
Mother received postpartum care				
Yes	14	1,807	8	3-12
No	46	2,412	19	13-25
Early initiation of breastfeeding				
Yes	14	2,785	5	3-8
No	20	3,087	6	3-9
Abdominal examination conducted				
Yes	19	2,473	8	4-11
No	12	891	13	5-22
Breast examination conducted				
Yes	13	1,575	8	4-13
No	18	1,790	10	5-15
Internal examination conducted				
Yes	16	1,214	13	7-20
No	15	2,146	7	3-11
Mother given family planning advice				
Yes	14	1,645	9	4-14
No	16	1,718	10	5-15
Mother given breastfeeding advice				
Yes	13	2,514	5	2-8
No	18	849	21	10-32
Mother given baby care advice				
Yes	15	2,601	6	3-9
No	16	763	21	10-32
Infant received a checkup				
Yes	17	2,874	6	3-9
No	14	494	28	13-43
Total	120	7,025	17	14-20

The month of the interview is excluded from analysis.

APPENDIX FIGURE V. Neonatal Mortality Rates by Background Characteristics – Philippines 2003

