Risk factors for neonatal mortality in rural areas of Bangladesh

Neonatal deaths account for about half of all deaths among children under 5 years of age in Bangladesh. This case-control study aimed to identify factors associated with neonatal death in rural areas served by a large NGO programme. Interviews were conducted with mothers of children born alive in 2003 who died within 28 days postpartum (142 cases) and did not die (617 controls). The main risk factors for neonatal death among singleton babies were: complications during delivery (adjusted odds ratio [AOR], 3.1[95% CIs: 1.8-5.3]), prematurity (AOR, 8.3 [95% CIs: 4.2-16.5]), care for a sick neonate from an unlicensed "traditional healer" (AOR, 5.9 [95% CIs: 1.3-26.3]), or care not sought at all (AOR, 23.3 [95% CIs: 3.9-137.4]). The study findings indicate the need for identification of babies at high risk for death, community and home-based interventions, and improved referral facilities.

Neonatal mortality accounts for about two-thirds of infant deaths and about half of deaths among children aged under 5 years in Bangladesh. The Bangladesh Demographic and Health Surveys (BDHS) indicate that the neonatal mortality rate (the number of deaths of children under 28 days of age, per 1,000 live births)declined in the early 1990s, but remained at 41-42 between 1995-1999 and 1999-2003 (1,2,3). Reducing neonatal mortality in Bangladesh will be necessary for achievement of the targets for child mortality reduction under the United Nations Millennium Development Goals (4).

There is evidence of a decline in the neonatal mortality rate of about 50% between 1996-2002 in areas of rural Bangladesh served by 27 non-governmental organizations (NGO) (5). The relatively low neonatal mortality rate of below 30 per 1000 in 2003, compared with Bangladesh as a whole, could in part be due to the high coverage of reproductive health outreach services, although there are other potential explanations, including longer birth intervals, improved standards of living or nutrition, and healthcare seeking practices. The aim of this study was to identify the factors that are predictive of neonatal death in areas where service coverage is good, with a view to maximizing the impact of targeted interventions for neonatal survival in Bangladesh.

The 27 NGOs were contracted in 2000 under an open bidding process by a managing agency, the Bangladesh Population and Health Consortium,[1] from which most had received financial and technical support for several years. In the period 2001-2005, they provided most of the government's essential services package to about 330,000 married women aged 15-49 years in 27 areas spread throughout rural Bangladesh, with funding from the UK Department for International Development. The Bangladesh Population and Health Consortium provided technical support on service delivery, and advice was given by fieldworkers and paramedics on neonatal care based on topics recommended by a World Health Organisation Technical Working Group in 1996. (6) Apart from this, the NGOs had no special interventions or focus on

[1] Now Partners in Health and Development, an independent, not-for-profit organization.

prevention of neonatal deaths.

The NGO health services were fully integrated with the government's local structure and outreach services were consistent with its current strategy (fieldworkers and satellite clinics). There were no government female fieldworkers in the areas served by the NGOs, which employed equivalent family health visitors who provided basic health and family planning counseling and contraceptives in the home, and promoted use of NGO satellite clinics and higher level facilities. In each NGO area, a paramedic conducted about 18 satellite clinics every month, providing family planning, antenatal care, postnatal care and basic curative services. Nine of the 12 study NGOs also had a static clinic at union-level (population 25,000), otherwise women and children were referred to the government sub-district hospital, the upazila health complex.

The 12 study NGOs were selected because they had been providing health services in the same areas since at least 1996. The areas had been allocated to the NGOs by local government health officials because they were remote from the sub-district hospital, or difficult for the government to reach with services. They were in 85 unions of 12 upazilas (sub-districts) spread throughout Bangladesh. The NGOs aimed to provide services to the whole population in about 105,000 households. In 2003, there were 11,253 live births among 96,642 married women of reproductive age (15-49 years) registered in the 12 study areas.

A case-control design was adopted and the study population consisted of all children born alive in 2003 who died within 28 days postpartum (cases) and their mothers, together with control children born in 2003 who survived 28 days and their mothers. In view of the difficulty of identifying separate care given to twins, the study focused on singleton births. Of the estimated 201 case mothers, 184 were identified, and 142 (71%) were interviewed (52 had migrated out, died or were absent). For each case, two children born in the same village in 2003, having the same fieldworker, were selected as neighbourhood controls. We report on interviews with the 122 mothers of singleton cases and 241 neighbourhood control mothers (3 villages with a case only had one other birth in 2003). A further two children born in 2003 were selected at random from the registers of other fieldworkers in the NGO's area (non-neighbourhood controls), and 376 mothers were interviewed. Fieldwork, including structured interviews with mothers, was conducted between May-November 2004.

To assess the factors associated with neonatal death, multiple logistic regression analysis was conducted to control for socio-economic, demographic and other significant factors from bivariate analysis. We report on adjusted odds ratios (exposure/non-exposure to various factors) as estimates of relative risk for neonatal death based on non-neighbourhood controls, although estimates using both sets of controls are shown in Table 2.

Coverage with the main maternal health services was high for both case and

control mothers (Table 1). Women reported that the NGO health workers were the main source of advice on maternal and newborn care: 37-40% of case and control mothers mentioned the NGO fieldworker, and a similar proportion in both groups mentioned paramedics at ANC. Case and control mothers reported receiving similar advice from NGO health workers (data not shown).

Table 1: Use of maternal health services prior to giving birth in 2003, reported by case and control mothers of singleton births

Maternal health service received (reported by mothers)	Case mothers % (95% CIs) (n=122)	Neighbourhood control mothers % (95% CIs) (n=241)	Non-neighbourhood control mothers % (95% CIs) (n=376)
1+ ANC check-ups[1]	92.6 (88.0-97.2)	91.7 (88.2-95.2)	94.1 (91.7-96.5)
ANC at NGO clinic	86.9 (80.9-92.9)	82.6 (77.8-87.4)	89.1 (85.9-92.3)
3+ ANC check-ups	67.2 (58.9-75.5)	69.3 (63.5-75.1)	72.3 (67.8-76.8)
Tetanus toxoid vaccination	88.5 (82.8-94.2)	92.9 (89.7-96.1)	91.2 (88.3-94.1)
Institutional delivery[2]	12.3 (6.5-18.1)	6.3 (3.2-9.4)*	4.5 (2.4-6.6)*
Qualified attendant at home	1.9 (0.0-7.3)	2.7 (0.6-4.7)	3.9 (1.9-5.9)
PNC check-up within 3 days	11.5 (3.8-19.2)	11.2 (7.2-15.2)	13.3 (9.9-16.7)

[1] Medical antenatal care check-up by a qualified practitioner (paramedic or MBBS doctor)
[2] Delivery in government facility or private/NGO clinic
* Significantly lower than for case mothers (p<0.05); includes referrals for complications

Table 2: Estimated risk for neonatal death associated with different factors

Key factors associated with neonatal death	Adjusted odds ratios (95% confidence intervals)[1] Estimated relative risk for neonatal death	
	Neighbourhood controls	Non-neighbourhood controls
Previous child had no measles vaccination[2]	15.1* (3.5-65.4)	32.3* (7.4-142.9)
2+ previous children died/still born	1.8 (0.9-3.7)	1.6 (0.8-3.2)
Any delivery complication(s)	2.6* (1.5-4.5)	3.1* (1.8-5.3)
Pregnancy <8 months	6.7* (3.3-13.7)	7.7* (3.8-15.3)
Treatment from traditional healer (kabiraj)[3]	2.9 (0.9-9)	5.9* (1.3-26.3)
Did not seek care for sickness considered serious	**	23.3* (3.9-137.4)

[1] Controlled for all significant factors from bivariate analysis in separate models (age of mother, length of schooling of mother and father, household expenditure and size, ownership of radio/TV, number of pregnancies, number of ANC check-ups, any complication at delivery, length of gestation, and sex of baby.
[2] Mother reported that no previous child had died
[3] Treatment sought for child considered to be seriously sick: referent group was with children who sought treatment from a qualified provider/facility (paramedics and MBBS doctors at NGO, private and government clinics/hospitals)
* Statistically significant risk based on 95% confidence intervals on the odds ratio
**All control mothers sought care; 29.7% of case mothers did not.

The risk for neonatal death was double for mothers reporting that two or more of their children had died or were stillborn, although this was not significant after controlling for other factors: adjusted odds ratio [AOR] 1.6 (95% CIs: 0.8-3.2). A much higher proportion of case mothers than control mothers experienced at least one complication during delivery, which significantly

increased the risk for neonatal death: AOR, 3.1 (95% CIs: 1.8-5.3). Babies that died were more likely to have been premature with low birth weight, and reported gestation of <8 months significantly increased the risk for neonatal death: AOR, 7.7 (95% CIs: 3.8-15.3). For children born as a twin, the neonatal mortality rate was 15 times higher than for singleton babies (283 per 1000).

The onset of reported sickness was much earlier among children who died (55.9% on the first day; 87.3% in the first 7 days), which was reflected in the day of death (40.2% in the first 24 hours; 72.1% in the first 7 days). Breathing difficulty was the problem most frequently reported by case mothers (46.6%) and control mothers (30.3%). Verbal autopsy reports were completed by only some of the 27 NGOs in the Bangladesh Population and Health Consortium programme, for 381 of the 662 deaths in 2003. The main causes of neonatal death recorded were birth asphyxia (38.6%), low birth weight (27.8%) and infectious diseases (14.7%), including acute respiratory infection (6.8%), jaundice (3.4%), diarrhoeal disease (1.6%), sepsis (1.6%) and tetanus (1.3%). A major difference in the reporting by mothers themselves in the 12 study areas was the attribution of serious sickness and death to 'evil spirits' in some cases. All 24 of the mothers who mentioned 'evil spirits' as being responsible for the death of their baby had lost at least one previous child, and in some cases two or three.

Mothers were asked about treatment sought when their baby got sick, and they considered it serious. Case mothers (21%) were significantly more likely to have consulted an unlicensed 'traditional healer' (kabiraj), compared with control mothers (8%). The risk for neonatal death was significantly higher for those who sought care from a 'traditional healer' rather than a qualified practitioner: AOR, 5.9 (95% CIs: 1.3-26.3). Although nearly all control mothers (98-100%) sought care for a sickness considered serious, 35 (30%) case mothers did not. The risk associated with not seeking care was high: AOR, 23.3 (95% CIs: 3.9-137.4). Most of these children died very soon after birth (21/35 in the first 24 hours), and in many cases mothers reported there was little time to seek care.

The strongest antenatal predictor of neonatal death was not having the previous child vaccinated against measles: 53% of case mothers, compared with 9% of controls. The risk for neonatal death was extremely high: AOR, 32.3 (95% CIs: 7.4-142.9). The estimated neonatal mortality rate was 54 per 1000 for children whose previous sibling had not been vaccinated, compared with 9 per 1000 for other children. Many factors have probably contributed to the higher death rate, although special counseling for these mothers during pregnancy could help to improve their child healthcare seeking practice, generally. Similarly, the estimated neonatal mortality rate for seriously sick children was 75 per 1000 when care was sought care from a traditional healer or not at all, compared with 36 per 1000 when a qualified practitioner was consulted. Clearly, not all sickness considered to be serious would be life threatening, but potentially up to 33% of neonatal deaths in the study areas might be averted if mothers of all these children were able to seek care from a qualified doctor or paramedic (18

mothers to change practice to avert one death). However, in many cases a qualified doctor or paramedic may not be immediately accessible.

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Comment

This study found scope for prevention of neonatal deaths in areas that already have relatively low neonatal mortality and high coverage of reproductive health outreach services. Some babies likely to be at high risk can be identified during antenatal care visits and given special counseling (mothers who have lost a previous child, or did not have it vaccinated against measles). Attendants at delivery could have a role in identifying babies at high risk (multiple births, premature/small babies, delivery complications). The mothers could be given immediate postnatal check-ups in the home by paramedics, which may be feasible in NGO-served areas. Training in resuscitation could help attendants to prevent some deaths due to asphyxia. Improving knowledge among mothers about danger signs and home-based newborn care, and encouraging them to seek care for a seriously sick baby from a qualified doctor or paramedic, could also contribute to further prevention of deaths. Increasing the number of institutional deliveries would be a relevant strategy, together with improvement of the capacity of government sub-district hospitals to provide emergency obstetric and newborn care.

Although improving coverage of reproductive health outreach services in rural Bangladesh as a whole could contribute to neonatal mortality reduction, additional home and community-based strategies would enhance the impact. New strategies are currently being developed in Bangladesh by ICDDR,B (Projahnmo project) and Save the Children (Saving Newborn Lives Initiative). These can be implemented in NGO areas that have high coverage of outreach services, with a view to assessing the potential for maximum impact on neonatal mortality.

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Surveillance updates

With each issue of the HSB, updates of surveillance data described in earlier issues are provided. These updated tables and figures represent the most recent observation period available at the time of publication. We hope these updates will be helpful to health professionals who are interested in current patterns of disease and drug resistance.

Proportion of diarrhoeal pathogens susceptible to antimicrobial drugs: March 2005-February 2006

Antimicrobial agent	*Shigella* (n=205)	*V. cholerae* O1 (n=851)
Nalidixic acid	34.1	NT
Mecillinam	99.5	NT
Ampicillin	55.6	NT
TMP-SMX	41.5	1.8
Ciprofloxacin	100.0	100.0
Tetracycline	NT	22.9
Erythromycin	NT	36.2
Furazolidone	NT	0.4

NT=Not Tested

Monthly isolation of V. cholerae *O1,* Shigella *and Rotavirus: March 2005-February 2006*