Centre for International Health

Neonatal Deaths in a Rural Area of Bangladesh: An Assessment of Causes, Predictors and Health Care Seeking Using Verbal Autopsy

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DECLARATION

"To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university."

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ABSTRACT

Poor neonatal health is a major contributor to mortality in under-five children in developing countries, accounting for more than two thirds of all deaths in the first year of life, and for about half of all deaths in children under-five. A major constraint to effective neonatal survival programmes in developing countries, such as Bangladesh, has been the lack of accurate epidemiological data on neonatal deaths. The current study aimed to (1) describe the causes of neonatal death in a rural sub-district of Bangladesh; (2) describe associated birth and obstetric characteristics of neonatal deaths; (3) describe the patterns of care-seeking practices during the fatal neonatal illness episode; (4) compare deaths and care-seeking patterns between the Maternal and Child Health and Family Planning (MCH-FP) service area of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) and the adjoining government service area; (5) identify the predictors of neonatal deaths; and (6) assess the accuracy in assigning causes of death from verbal autopsy data by comparing physician review with medical assistant review and computer-based algorithm.

This study was carried out during 2003 and 2004 in a demographic surveillance area in the Matlab rural sub-district of eastern Bangladesh. The surveillance system covers a population of ~220,000 and is maintained by ICDDR,B. Community health workers (CHRW) visit each household monthly to record vital demographic, morbidity and health care seeking data. Half of the surveillance population receives MCH-FP services from ICDRR,B (ICDDR,B service area) and the remaining half receives standard government services (government service area).

Verbal autopsies, consisting of retrospective interviews with caregivers of recently deceased neonates about the circumstances leading to their death, were carried out by the staff trained in verbal autopsy. The interviews were held with the mothers of all deceased neonates (n=365) who had died during 2003 and 2004. The verbal autopsy data were then independently reviewed by three physicians and a medical assistant to assign a direct cause of death and an originating cause of death. A computer algorithm using evidence-based clinical signs and/or symptoms was also

used for assigning cause of death. Agreement of at least two of the three physicians was used to determine direct causes of death. Diagnostic accuracy and reliability of medical assistant and algorithm in assigning direct cause of death were evaluated by comparing with the diagnoses provided by the physicians. Linked epidemiological data on all live births in the Matlab area during 2003 and 2004 were also analysed.

There were 365 deaths among the 11,291 live births recorded during 2003 and 2004, yielding a neonatal mortality rate (NMR) of 32.3 per 1000 live births. The NMR was lower in the ICDDR,B area compared to the government area. Of all neonatal deaths, 37% occurred within 24 hours, 76% within three days, 84% within seven days, and the remaining 16% between eight and 28 days of birth.

Five causes accounted for 85% of the deaths: birth asphyxia (45%), prematurity/low birth weight (LBW) (15%), sepsis/meningitis (12%), respiratory distress syndrome (7%), and pneumonia (6%). The majority of neonatal death cases were low birth weight (56%) and singleton births (82%). There were some differences in the distribution of causes of death between the ICDDR,B and government areas, the most notable being prematurity/LBW which was twice as common in the ICDDR,B area than in government area.

Strikingly, more than a third (37%) of the deceased neonates had not been taken to any source of health care for the fatal illness episode, and another quarter (25%) sought care from traditional healers or from unqualified practitioners. Only 37% sought modern biomedical care from a doctor or paramedic.

Among the 365 neonatal deaths, a much higher proportion (48.5%) of the deliveries occurred at a health facility in the ICDDR,B area, compared to 15.3% in the government area. Vaginal delivery was the commonest mode of delivery in both areas, with a higher proportion of caesarean sections in the ICDDR,B area (9.3%) compared with the comparison government area (1.6%).

The verbal autopsy method appears to be highly effective in that agreement on a direct cause of death was reached by at least two physicians in 339 (93%) cases. Using the physician review as the gold standard, the medical assistant review of

causes of death demonstrated a sensitivity ranging from 47.7% to 83.5% depending on the cause of death, a specificity ranging from 93.0% to 97.5%, and kappa values ranging from 0.51 to 0.77. Similarly, depending on the cause of death, algorithm demonstrated a sensitivity ranging from 35.6% to 77.4%, specificity ranging from 86.8% to 95.9%, and kappa values ranging from 0.24 to 0.69.

Independent predictors of neonatal mortality included lack of maternal education, single parity, and lack of antenatal care (ANC) during the last trimester. Male sex of the neonate, multiple births, and facility-based delivery were also significantly associated with excess neonatal mortality.

In conclusion, the study highlighted the central role of birth asphyxia, prematurity/LBW, and sepsis/meningitis in neonatal deaths, indicating that the core of interventional packages to prevent neonatal deaths in rural Bangladesh should incorporate these causes. Community awareness about early care seeking, skilled attendance at delivery, and training and integration into mainstream services of traditional/unqualified care practitioners are some of the approaches needed to reduce neonatal mortality further. Improving access to female education and antenatal care would also have beneficial effects on neonatal survival.

This study revealed the value of both review by medical assistant and computer-based algorithm to reliably assign major causes of neonatal deaths from verbal autopsy data. Further research could be undertaken to develop optimal combinations of the medical assistant and hierarchical algorithm for assigning major causes of death in low-resource settings such as Matlab.

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LIST OF ACRONYMS

Acronyms	Full name
ANC	Antenatal Care
BDHS	Bangladesh Demographic and Health Survey
BDS	Bangladesh Demographic Survey
CHRW	Community Health Research Worker
CSMF	Cause-Specific Mortality Fraction
CI	Confidence Interval
DFID	Department for International Development
DSS	Demographic Surveillance System
FRA	Field Research Assistant
FWA	Family Welfare Assistant
FWV	Family Welfare Visitor
HDSS	Health and Demographic Surveillance System
ICDDR,B	International Centre for Diarrhoeal Diseases Research, Bangladesh
IMCI	Integrated Management of Childhood Illnesses
IMR	Infant Mortality Rate
INDEPTH	International Network of Field Sites with Continuous Demographic Evaluation and their Health
MA	Medical Assistant
MCH	Maternal and Child Health
MDGs	Millennium Development Goals
MHDSS	Matlab Health and Demographic Surveillance System
MMR	Maternal Mortality Ratio
NMR	Neonatal Mortality Rate
OR	Odds Ratio
PRSP	Poverty Reduction Strategy Programme
TBA	Traditional Birth Attendant
UNICEF	United Nation Children Emergency Fund
VA	Verbal Autopsy
VHW	Village Health Worker
WHO	World Health Organization

MAP OF BANGLADESH

Important Indicators of Bangladesh (NIPORT, 2003 & 2005)

- Population: 140 million
- Life Expectancy: 62
- Malnutrition: 52% of under-five children
- Infant Mortality Rate: 65/1000 live births
- Neonatal Mortality Rate: 41/1000 live births
- Under-Five Mortality Rate: 88/1000 live births
- Maternal Mortality Ratio: 320/100,000 live births
- Birth at home: 91%