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Risk Factors for Perinatal Deaths in Rural Bangladesh

Rukhsana Gazi, MBBS, M Sc, Liz Goodburn, MB, Bch, M Sc and AMR Chowdhury, Ph D

This study identified and quantified the risk factors for perinatal deaths in rural Bangladesh. The cases were mothers whose infants died in the perinatal period and the comparison mothers were those whose infants did not die in the perinatal period. The study also identified some socio-demographic factors that were associated with perinatal deaths. Logistic regression confirmed that maternal age, parity and mal-presentation were associated with perinatal dealths, — mal-presentation independently.

Key words: Bangladesh; perinatal death; risk factors; socio-demographic factors

Introduction

Seven million perinatal deaths (stillbirths and deaths in the first week of life) occur annually in the world, almost all of which are in developing countries.[1] Rates as high as 75 to 100 deaths per 1000 births have been documented in developing countries.[2-3] The three leading causes of perinatal deaths are: complications of pre-term birth, birth asphyxia/ birth trauma, and bacterial infections which are responsible for 3.3 million of the total seven million perinatal deaths.[4] The other causes of perinatal death are largely unknown due to difficulties in documenting stillbirths in the developing world. In many societies of developing countries it is not culturally acceptable to acknowledge a birth until it has survived the critical period of the first week of life. Therefore stillbirths delivered at home are frequently under-reported.[5] Often, it is very difficult to distinguish between a fresh stillbirth and a macerated stillbirth, whereas these two types are manifestations of different underlying and contributory factors.

Maternal illiteracy, poverty, poor nutrition, low pre-pregnancy weight, minimal weight gain during pregnancy, primi parity, grand multi parity, maternal age, poor outcome of prior pregnancies, infections and illness during pregnancy, mothers' smoking habit, and inadequate healthcare during pregnancy and delivery have been speculated as determinants of perinatal mortality.[6] However, most of the maternal socio-demographic factors such as maternal age, parity, and maternal education are not amenable to short-term interventions. For example, primi gravidity is a widely cited risk factor for perinatal mortality whereas all women who bear children must experience a first birth. Although special monitoring of first pregnancy is advised, very little can be done at community level.

A review of the current literature on perinatal mortality shows that our knowledge regarding perinatal mortality has been obtained primarily from hospital-based studies.[7] We know very little about perinatal mortality within the community due to the fact that it is very difficult to ascertain information on aspects of labor and delivery when these events seldom

Rukhsana Gazi, Senior Medical Officer, Research and Evaluation Division, BRAC, 75 Mohakhali, Dhaka 1212, Bangladesh • Fax: 880-2-883-542, 886448 Phone: 884180, 9881265 • E-mail: tomtkane@citechco.net

Liz Goodburn, Research Fellow, Maternal and Child Epidemiology Unit, London School of Hygiene and Tropical Medicine, Keppel Street, London, UK

AMR Chowdhury, Director, Research, BRAC, 75 Mohakhali, Dhaka 1212 Bangladesh

occur in the presence of medically trained health personnel. As in many other developing countries, determinants of perinatal deaths in rural Bangladesh are not well defined. A hospital-based study identified toxoplasmosis as a major cause of perinatal death,[8] while a population-based study reported that small size at birth (54 percent), birth asphyxia (26 percent) and tetanus (8 percent) were the most common causes of perinatal deaths.[3] Asphyxia and trauma are symptomatic of poor labor and delivery care and often arise from obstetric complications such as mal-presentation, abruptio-placentae, and prolonged labor or obstructed labor.[4] A community-based study of home deliveries in rural Tanzania reported that deliveries supervised by untrained birth attendants might have contributed to perinatal deaths.[9] In Bangladesh, particularly in rural areas, the nature and quality of labor, delivery, and post partum practices remain relatively undocumented. Thus, obstetric causes of perinatal death in our rural community warrant research attention.

The intervention literature on perinatal mortality reflects a general interest in training of formal and informal health sector providers[10,11] and essential newborn care.[12,3] Training of traditional birth attendants (TBAs) has shown some promise in combating perinatal mortality.[13,14] In order to implement the most appropriate interventions, the magnitude, nature and determinants of perinatal deaths must first be assessed. The present study aimed to identify and quantify the socio-demographic and delivery-related risk factors for perinatal deaths in a rural Bangladeshi community.

Methods and Materials

This study formed a part of a longitudinal study on maternal morbidity undertaken jointly by BRAC and London School of Hygiene and Tropical Medicine (UK) on maternal morbidity[15] in three unions* of Manikganj district of rural Bangladesh. Although most women in this area go to live with their husbands after marriage, many pregnant women prefer to return to their own parents' home for delivery, particularly for their first child. Because of this pattern of migration, it was apparent that a proportion of women initially identified as part of the study population might be lost to follow up at the time of delivery, if their own parents live outside the study area, even though they might move back into the area after the birth and thus re-enter the study later in the follow-up period. For this reason, it was decided to include in the study not only women permanently resident in the area, but also women migrating in for delivery, so long as they could be contacted before they actually gave birth.

The population of the three unions in Manikganj district in 1989 was as follows:

Population	Betila	Jagir	Baliakhora	Total
Total	18,086	17,410	16,248	51,744
Females aged 15-49	4,721	4,994	4,628	14,343
Deliveries per annum	577	616	519	1,712

Sampling

The required sample size for estimating maternal morbidity was 1,473 (with a confidence level of 95 percent). Allowing for 20 percent dropouts, the target for registrations became 1841. In order to achieve this sample size, and allowing a six-month period from registration to completion of follow-up, all women detected as being pregnant in the study area within an 18 month period were included in the study. A total of 2,099 pregnant mothers were identified through home visits. The field workers made rounds of all the households in the union on regular basis to detect pregnant women. Pregnancy was diagnosed on the women's own verbal report. At the beginning of the study rounds were made monthly, but this created an excessive workload. So the interval was extended to two months. All pregnant women under consideration were eligible for inclusion in the study, regardless of the stage of gestation. The present investigation also included the pregnant women with pregnancies surviving to at least 28 weeks of gestation and delivering in the study areas, irrespective of the final outcome of the pregnancy. After recruitment in the study they were followed up until three months post partum. The mothers in their first and second trimesters were interviewed every month. At the seventh month of pregnancy, a detailed interview and selected clinical examinations were conducted. Another detailed interview took place just after childbirth (within 48 hours), covering the events of labor and childbirth. The newborn and the mothers were followed up until the third month after delivery, and all infant deaths within this period were recorded.

Data were collected prospectively by five trained female

* Union is the lowest administrative unit of the local Government with a population of about 20,000.

interviewers from each of the three research areas during July 1991 to June 1993. In this study, the cases were mothers whose infants died in the perinatal period. The comparison group consisted of mothers whose infants did not die in the perinatal period. Of the total 186 infant deaths under three months of age recorded in the study period, 130 were perinatal deaths. Eight mothers gave birth to 16 twins, all of whom died in the perinatal period; therefore, 122 mothers were included in the analysis. There were 1,977 mothers in the comparison group whose infants did not die in their perinatal period of life. The two groups were compared on various reproductive, socio-demographic and delivery related risk factors. The proportions in respect of different characteristics were compared between the cases and the comparison group, and Chi-square tests were performed to see the associations between perinatal deaths and different risk factors. Maternal age was grouped as <20 years and ≥20 years. Ownership of land was used as a proxy indicator for socioeconomic status. Since the educational status of mothers was poor and only a few had gone to school, we grouped them on the basis of literacy. Labor pain was considered as prolonged if it continued for more than 24 hours. The second stage of labor (time of pushing) was categorized as prolonged, when it took more than one hour.

A logistic regression analysis was performed to quantify the influence of socio-demographic and delivery risk factors on perinatal death. This analysis was done in two steps. In the first step, the independent variable was perinatal death and the co-variates were selected socio-demographic and delivery factors. The selected socio-demographic factors were maternal age, mid upper arm circumference (MUAC), height, pervious stillbirth, parity, husbands' schooling, and ownership of a radio by the family (proxy indicator for socioeconomic status). The delivery related factors considered were prolonged labor, mal-presentation, plural pregnancy and leaking membrane. The second step was demonstrating the influences of the selected socio-demographic factors on delivery condition (mal-presentation) to see whether the influence of socio-demographic factors mediates through such a delivery condition.

Results

Of the 186 infant deaths under three months of age recorded in the study, 130 (69.9 percent) were in the perinatal period, and they included 53 stillbirths. The perinatal death rate was 68.4 per 1000 births. Among perinatal deaths the male-female ratio was 1.29:1. About 84 percent of the stillbirths were fresh in appearance.

Table 1 *Socio-demographic Risk Factors Associated with Perinatal Deaths*

Characteristics of mothers	Mothers with perinatal deaths (%)	Mothers without perinatal deaths (%)	Odds Ratio	CI	p
Parity					
Primi	56 (45.9)	625 (31.6)	1.83	1.25-2.69	0.00
Multi	66 (54.1)	1351 (68.4)			
Previous stillbirth					
Yes	19 (32.8)	161(15.6)	2.64	1.42-4.87	0.00
No	39 (67.2)	873 (84.4)			
Previous child death					
Yes	36 (62.1)	450 (41.0)	2.36	1.32-4.23	0.00
No	22 (37.9)	648 (59.0)			
Age in years					
<20	42 (35.0)	510 (26.1)	1.53	1.02-2.29	0.04
≥20	78 (65.0)	1447 (73.9)			
Multiple marriages					
Yes	12 (9.9)	70 (3.5)	3.0	1.48-5.93	0.00
No	109 (90.1)	1905 (96.5)			
Husbands' education					
No schooling	80 (66.1)	1072 (54.6)	1.62	1.08-2.44	0.01
Been to school	41 (33.9)	892 (45.4)			
Education					
Illiterate	82 (67.2)	1298 (65.8)	1.07	0.71-1.61	0.81
Literate	40 (32.8)	676 (34.2)			
Religion					
Hindu	10 (8.2)	246 (12.4)	0.63	0.30-1.26	0.21
Muslim	112 (91.8)	1730 (87.6)			
Land ownership of family					
Landless	71 (60.7)	1107 (57.8)	1.13	0.76-1.68	0.6
Owners	46 (39.3)	809 (42.2)			

Note : CI: 95% confidence intervals

Table 1 shows the relationship between perinatal deaths and maternal socio-demographic risk factors. Primi parity, history of previous stillbirths (one or more), and history of previous child death (one or more) were significantly associated with increased risk of perinatal deaths. Maternal age less than 20 years and multiple marriage of the mother (if the mother had married more than once) and lack of paternal schooling were also associated with an increased risk of perinatal deaths. Interestingly, maternal illiteracy and ownership of land were not associated with perinatal deaths.

Table 2 shows the relationship between delivery factors and perinatal deaths. Prolonged labor (more than 24 hours), including prolonged second stage of labor (more than one hour), difficult delivery, plural pregnancy (twins), mal-presentation and leaking membrane were significantly associated with increased risk of perinatal death. Use of an unsterile instrument for cutting the umbilical cord was also significantly associated with increased risk of perinatal death.

Table 2 *Delivery related Risk Factors Associated with Perinatal Deaths*

Delivery events	Mothers with perinatal deaths (%)	Mothers without perinatal deaths (%)	Odds Ratio	CI	p
Prolonged labor pain					
Yes	26 (22.8)	205 (11.8)	2.21	1.36-3.59	0.00
No	88 (77.2)	1536 (88.2)			
Prolonged second stage of labor					
Yes	21 (18.9)	128 (7.4)	2.93	1.71-5.0	0.00
No	90 (81.1)	1609 (92.6)			
Difficult delivery					
Yes	67 (56.8)	559 (31.8)	2.82	1.90-4.18	0.00
No	51 (43.2)	1199 (68.2)			
Plural pregnancy					
Yes	8 (6.8)	11 (0.6)	11.55	4.11-31.9	0.00
No	110 (93.2)	1747 (99.4)			
Mal-presentation					
Yes	30 (26.3)	56 (3.2)	10.76	6.34-18.2	0.00
No	84 (73.7)	1687 (96.8)			
Leaking membrane					
Yes	12 (15.2)	48 (3.8)	4.51	2.16-9.27	0.00
No	67 (84.8)	1209 (96.2)			
Cord cutting instrument					
Unclean	29 (37.7)	295 (17.2)	2.91	1.76-4.81	0.00
Clean	48 (62.3)	1422 (82.8)			
Tetanus toxoid					
Yes	18 (62.1)	532 (73.6)			
No	11 (37.9)	191 (26.4)	1.7	0.74-3.88	0.24

Note : CI: 95% confidence intervals

Table 3 *Influence of Selected Socio-demographic and Delivery related Factors on Perinatal Death (Results from Logistic Regression Analysis)*

Variables in the equation	B	S.E	Wald	df	sig	R
Maternal age (<20 years)	0.0394	0.0153	6.662	1	0.0098	0.1667
Mal-presentation	1.713	0.6332	7.319	1	0.0068	0.1780
Husbands' no schooling	0.0460	0.2901	0.0252	1	0.8740	0.0000
Maternal height	-0.0735	0.0488	2.265	1	0.1323	-0.0397
MUAC	-0.0019	0.0141	0.0174	1	0.8952	0.0000
Plural pregnancy	-8.087	84.06	0.0093	1	0.9234	0.0000
Parity	-1.213	0.5203	5.441	1	0.0197	-0.1432
Prolonged labor	-6.796	20.67	0.1081	1	0.7424	0.0000
Family had no radio	1.5149	0.8349	3.292	1	0.0696	0.0877
History of previous stillbirth	-0.0054	0.0077	0.4945	1	0.4819	0.0000
Leaking membrane	-5.9634	37.14	0.0258	1	0.8725	0.0000
Constant	13.7967	84.395	0.0267	1	0.8701	-

Table 3.1 *Tests for Overall Effect of Socio-demographic and Delivery Factors on Perinatal Death*

Tests	Chi-square	df	sig
-2 Log Likelihood	144.519	10	<0.0
Model	23.317	11	0.01
Block	23.317	11	0.01
Step	23.317	11	0.01

Goodness of fit 569.81

Cox & Snell-R^2 .032

Negelkerke-R^2 .153

Table 3 shows the results of the logistic regression analysis demonstrating the influences of selected socio-demographic and delivery risk factors on perinatal deaths (the outcome variable). It confirmed that maternal age, parity, and mal-presentation were significantly associated with increased risk of perinatal death. Other socio-demographic factors such as maternal height, MUAC, previous bad obstetric history (stillbirth), husbands' schooling, and ownership of a radio by the family showed insignificant influence on perinatal death. Influence of delivery conditions such as prolonged labor, plural pregnancy, and leaking membrane became insignificant.

Table 4 *Influence of Socio-demographic Factors on Mal-presentation*

Variables in the equation	B	S.E	Wald	df	sig	R
Maternal age(<20 years)	0.0031	0.0118	0.0682	1	0.7940	0.0000
Husbands' no schooling	0.0261	0.1063	0.0604	1	0.8059	0.0000
Maternal height	0.0161	0.0188	0.7303	1	0.3928	0.0000
MUAC	0.0025	0.0052	0.2398	1	0.6243	0.0000
Parity	0.1408	0.1926	0.5347	1	0.4646	0.0000
Family had no radio	-0.1653	0.2164	0.5836	1	0.4449	0.0000
Previous stillbirth	-0.0020	0.0028	0.4812	1	0.4879	0.0000
Constant	-04.563	2.906	2.464	1	0.1164	0.0000

Table 4 shows the influences of socio-demographic factors on mal-presentation. It found no influence of selected socio-demographic factors such as age, parity, maternal height, MUAC, previous bad obstetric history (stillbirth), husbands' schooling, and ownership of a radio by the family on mal-presentation. This means mal-presentation was independently associated with an increased risk of perinatal death.

Discussion

The perinatal death rate of 64.5 per 1000 births found in the study population in the present study, is similar to the findings of another study (66.4 per 1000 births) done in rural Bangladesh.[16] However, several studies done in developing countries identified asphyxia and birth trauma as important causes for perinatal and early neonatal deaths.[17-19] Fetal asphyxia, trauma, and in some cases, infection are frequently associated with complications of labor.[20] The present study also reported that complications of delivery such as prolonged labor (more than 24 hours), prolonged second stage of labor (more than one hour), difficult delivery, plural pregnancy, mal-presentation and leaking membrane had significant association with an increased risk of perinatal death. The logistic regression analysis revealed that mal-presentation was independently associated with increased risk of perinatal death. Similar findings are reported in several other studies.[21-22] Bartlett and co-investigators[20] emphasized that the occurrence of labor and delivery complications, especially fetal mal-presentation and prolonged labor, were much stronger predictors of early neonatal deaths than were maternal risk screening characteristics; and, of these complications, fetal mal-presentation had the highest case fatality rates. Health facility-based case control studies on stillbirths in Zambia[23] and Northeast Brazil[24] also reported similar results. Again, in this study, more than 80 percent of stillbirths were fresh in appearance which means that the fetuses probably died due to complications arising during labor and delivery. It seems that interventions based on improved detection, management, and referral of complicated labors and deliveries might be effective strategies preventing perinatal deaths in such a setting. On the other hand, selected socioeconomic factors (represented by ownership of land, maternal illiteracy, ownership of a radio by the family) were found to be not associated with perinatal deaths. This is important because improving the socioeconomic status is generally not within the scope of the health sector, while modification of proximate factors such as case management during delivery might be possible. However, paternal education was found to be associated with perinatal deaths, which is consistent with the findings of others.[25] Possibly, paternal education is related with other socioeconomic determinants such as family income and better care.

The findings of this study suggest that young age of the mother (<20 years) was significantly associated with increased risk of perinatal death. This finding is consistent with the findings of another study.[26] Other studies also found that old age of mother (≥34) is also a risk factor for perinatal death.[21, 27] But, we could not check this relationship because the number of mothers in that age group was small. Our findings of increased perinatal mortality risk associated with poor obstetric history and maternal age are similar to the findings of other studies.[28-29] The finding that the history of multiple marriage of the mother is significantly associated with increased risk of perinatal death is interesting and new. However, it needs further investigation. A higher death rate among the male infants during perinatal period, as found in the present study, is physiological[30,31] and has also been reported by others.[17, 32]

The use of unsterile instruments for cutting the umbilical cord increased the risk of perinatal death. Our data, however, could not show the relationship between immunization of the mothers with tetanus toxoid and a low risk of perinatal deaths. It seems that cord sepsis might contribute to perinatal death. In fact, deaths caused by tetanus might also be appearing after perinatal period due to the long incubation period of the disease. However, Bennett and co-investigators tested the protective effects of tropical antimicrobials against neonatal tetanus and it has been suggested that these tropical antimicrobials could usefully complement maternal immunization with tetanus toxoid.[33]

Recommendations

In many countries decrease in perinatal mortality is generally attributed to improvement in socioeconomic conditions and development of medical technology.[34] But, in a country like Bangladesh where poverty is widespread and where most of the births take place at home in the rural areas, we need to think about short-term and simple but effective interventions. The two main determinants of successful

perinatal healthcare seem to be motivated community- based workers such as traditional birth attendants (TBAs) with basic training in the management of safe delivery including newborn care and an effective system of referral. The TBA training program should lay more emphasis on clear operational definitions of complications to be detected, their appropriate and immediate management, non-interference during delivery, and definite indications for referral. Such a program should give particular attention to effective training in detection of fetal mal-presentation as the mother approaches term. This training would not have to create expertise in complete diagnosis of fetal position, but could focus simply on location of fetal head at term. One effective training program in India emphasized resuscitation methods for newborn babies such as physical stimulation, cleaning of mouth, mouth-to-mouth breathing, and prevention of heat loss.[13] However, a successful referral system must also be economically accessible and culturally acceptable. The TBAs must be supported by increased participation and cooperation by the community and they must obtain the referral level attention. The health workers must also make people aware about the need for special care during pregnancy and childbirth. It is important to educate mothers, their spouses, and family members about this issue and to have a plan for referral, so that they are mentally prepared to seek referral care if needed. The role of the husband in this issue is most important because his approval and financial support are mandatory. BRAC is providing ante and postnatal care for mothers and trying to promote safe delivery through training of TBAs. BRAC has also introduced maternity waiting homes and rural health centers with trained staff available at all times as a case management strategy for preventing maternal and perinatal deaths.

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