

Women focused development intervention reduces neonatal mortality in rural Bangladesh: a study of the pathways of influence

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ABSTRACT

Background: There has been a substantial reduction in hazard of childhood death in Bangladesh over the period. The reduction is statistically similar for children aged 1-4 years, irrespective of their mothers' participation in the development program. The reduction was much greater among infants whose mothers participated in the development program. However, how the development intervention does influence neonatal survival is not known.

Objective: Study the impact of BRAC's women focused development interventions on neonatal mortality in Matlab.

Methods: A case-control study, including 117 cases (died within 28 days) and 351 controls (live children and taken from the nearest door of cases) who born during the year 1999-2000 was the main method employed. Twelve case studies of both cases and controls were done to complement the quantitative data. ICDDR, B surveillance database provided the sampling frame. The risk ratio was estimated to see how BRAC program participation reduces the risk of mortality, the stratified analysis was done to see the effects of third variables over the association, and the log regression was done to see the net effect of variables on neonatal death.

Results: Neonates of BRAC non-members were at 1.9 times increased risk (CL 1.09-3.25) of dying compared to neonates of BRAC members. This association works through two intermediate variables including antenatal care and family planning. Age of mothers and occupation of fathers acted as confounders over this association. Mothers' physical violence and psychological stress, pre-maturity and low birth-weight had respectively 2.2, 1.7, 13 and 2 times increased risk of neonatal death. However, BRAC membership did not

have any influence over these factors. When simultaneously accounting for all variables in a multivariate log regression, a dose response association was maintained for antenatal care, family planning, physical violence and pre-maturity.

Conclusion: There has been a substantial reduction of neonatal mortality among mothers who participated in BRAC intervention. For an effective reduction in the number of these deaths, program planners should think about ways to address all risk factors together rather than only antenatal care and family planning.

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Key words: Neonate, Mortality, Women's development, BRAC, Bangladesh.

INTRODUCTION

Background

Around four million babies each year globally die during neonatal period (Save the Children, 2002), of which 98% are in the developing countries (id21 health, 2002). Bangladesh is one of the developing countries with very high neonatal mortality. During 1995-99 Bangladesh had 42 neonatal deaths per thousand live births (Mitra et. al., 2001). Despite slight improvement in the situation over the last decade, the contribution of neonatal mortality in the infant mortality rate has remained almost static during the period. Around 60% of the infant deaths had been among the neonates since late 1980s and this proportion has remained the same in subsequent 10 years (Mitra et al., 1998).

A recent prospective study has reported a positive impact of woman-focused development programmes on child survival in a rural area of Bangladesh. The study revealed that there had been a substantial reduction in hazard of deaths during infancy over the period 1993-97, but the reduction was much greater among infants of mothers from poor households who joined the development programme of BRAC compared to the infants from poor households whose mother did not join BRAC (Bhuiya and Chowdhury 2002). However, the mechanisms of the observed impact of the poverty alleviation programmes on neonatal survival were unclear. An understanding of the mechanisms can be helpful to find out the effective components from the development programme to adopt interventions for reducing neonatal mortality.

Conceptualizing neonatal death

Causes of neonatal death

Neonatal death is defined as death of a live-born infant who dies within 28 days after birth. In Bangladesh, little is known about causes of neonatal death (Talukder, et. al., 2001). A conceptual framework, drawn from secondary data, outlines that neonatal death is caused by a complex interplay of newborn and maternal factors (fig. 1).

Newborn factors

Newborn factors are considered as direct causes of neonatal death. In developed countries, the weightiest factor for neonatal death is congenital anomalies. Pre-maturity, newborn infection, birth asphyxia, poor perinatal and neonatal care, delivery by unskilled birth attendants were identified as major causes of neonatal death in developing countries (March of Dimes, 2003). In Bangladesh, four major causes of neonatal mortality have been identified including sepsis, peri-natal asphyxia, pre-maturity and low birth-weight (Talukder et al., 2001).

Maternal factors

Maternal factors act as aggravating factors as they increase the risk of neonatal death by enhancing newborn factors.

Lifestyle (smoking, alcoholism, short birth interval, poor weight gain), certain diseases (hypertension, diabetes, heart and kidney disease), poor socio-economic status, stresses, and malnutrition of mothers enhance the risk of low birth weight baby and

subsequently premature delivery (Baby zone, 2003). In developing countries, malnutrition is linked to the high incidence of neonatal mortality (UNICEF, 2003).

Two important factors for newborn infection are maternal puerperal infection and tetanus non-immunization (Vintzileos, et. al., 2002 & Asih, et. al., 1997). Genetic factors, some maternal illnesses (diabetes, rubella, German measles), and maternal exposure to certain drugs and chemicals may cause birth defects and congenital heart disease of neonates (March of Dimes, 2003).

METHODS AND POPULATION

Study setting

The study was conducted in Matlab, 40 miles South-East of Dhaka, the capital of Bangladesh. As in most rural Bangladesh, the majority of the Matlab population is poor. Most people work in agriculture. Nearly half of the males and two-third of the females are illiterate. In Matlab, ICDDR, B has been operating a Demographic Surveillance System (DSS) since 1966. Half of the villages have been receiving ICDDR,B's maternal, child health and family planning (MCH-FP area) services since 1978, and the other half has been receiving government services (comparison area) (Fauveau, 1994).

Since 1992, a number of villages from both areas have been receiving inputs from BRAC. BRAC targeted women from BRAC eligible household. The criteria for BRAC eligibility is that the household owns no more than half an acre of land including homestead land and at least one member of the household sells at least 100 days of manual labor in a year to earn a livelihood. BRAC provides them the social awareness education, skill development training and loan to carry out income generating activities (BRAC, 1995).

Founded in 1972, BRAC is a large, indigenous, non-governmental organization, works in over 69,000 villages and has a total membership of over 5 million families (BRAC, 2005). With the dual goals of poverty alleviation and women empowerment, BRAC undertakes a variety of social and economic development activities including group formation in Village Organizations (VOs), vocational training and the provision of non-formal education and collateral free loans for income generating activities (Lovell, 1992).

Initiated in 1993, BRAC's Health Programme provides preventive health and nutrition education, as well as immunization, family planning, pregnancy and reproductive health related care, and basic curative services. Voluntary community health workers (*Shasthya Shebikas*), who are selected from among the women's credit group members and trained preventive health care, deliver these services by means of regular household visits. Preventive health and nutrition education is also disseminated through a 'health forum' held monthly in each VO and reinforced during household visits (BRAC, 1995).

Study design

In this case-control study, exposure was defined as BRAC eligible population who were not getting BRAC intervention. **Cases** were neonates who born alive during the year 1999-March 2002 and died on or before 28 days of life. **Controls** were live children born during the same period and taken from the nearest household. Respondents were mothers of cases and controls who were asked retrospectively about exposure risk factors for neonatal death.

We also used qualitative methods to complement quantitative data, and to know the nature and extent of factors that exposed neonates at risk of death.

Study population and sampling

The study population included all under-5 children, born during January 1999 to March 2002. Respondents were selected from the DSS registers of ICDDR,B. Once a dead neonate was identified, then 3 live children were selected from the same study base. The database maintained by the DSS provided the sampling frame.

The study was done in 27 villages where BRAC is working. Sample size for the case-control study was 117 cases and 351 controls. The qualitative interviews included 12 case studies selected purposively. The main criteria for selecting respondents were their knowledge of area and the culture.

Data collection

Before launching the quantitative survey, case studies were carried out focusing on respondents' beliefs, perceptions, understandings, awareness, and interpretations of causes for neonatal death. From the qualitative findings, indicators were sorted out to develop a structured questionnaire for the quantitative study. The questionnaire encompassed three types of variables, such as socio-economic status (SES), proximate and outcome variable. Trained female interviewers collected data during January to February 2002.

Definition of variables

The dependent variable was the neonatal death. The independent variables included SES and proximate variables. The SES variables included mothers' age at childbirth, parents' education and occupation, BRAC membership and eligibility. Proximate variable incorporated birthing place, birth attendants, low birth weight (LBW), pre-maturity, congenital anomaly, number of children, family planning history, antenatal check-up, and physical and emotional violence during pregnancy. Mothers' age at childbirth was measured in completed years. Parents' literacy was defined as the ability to read and write regardless of educational level attained. Occupation was measured as wage and non-wage labour. BRAC membership status was grouped as whether or not been a member of

BRAC. BRAC eligibility was classified as BRAC eligible (poor) and BRAC non-eligible (non-poor). Birthing care was defined by institutional delivery and home delivery by unskilled attendants. Pre-maturity was defined if delivery took place 2 weeks before the expected date. LBW was considered if birth weight was less than 2.5 kg. If birth weight was not recorded, then mothers' perception of very small or very low weight was considered. Antenatal care meant visiting at least 3 times to an antenatal care center, a medical doctor or a hospital for antenatal check-up. Family planning use was considered whether mothers used any contraceptives before the respected childbearing. Psychological stress and physical violence was considered if mothers had constant worry and physical beating during pregnancy. All the independent variables were considered as categorical variables in the logistic regression analysis. BRAC non-membership, BRAC eligibility, parents illiteracy, mothers' age less than 24 years, fathers' wage labor, LBW, pre-maturity, not seeking ANC, not using contraceptives, home delivery, physical and psychological violence against mothers, and mothers having more than 2 children was coded as 1.00 in the categorical variable coding scheme.

Data analysis

Risk ratio was estimated to study whether BRAC membership reduces risk of neonatal death, to see what proximate variables acted as potential risk factors for neonatal death and whether BRAC membership has any influence over these risk factors. Stratified analysis with different SES variables was done to identify confounders that disturbed the association between BRAC membership and neonatal death. To estimate the net effect of variables on neonatal death, logistic regression was done in three steps. One with SES

variables; another with proximate variables; and finally a combined model with significant variables from both the groups, included BRAC membership, BRAC eligibility, antenatal check-up, family planning and physical violence. The qualitative interviews were coded line by line and categories were identified. The analysis tried to correlate causal relationship of neonatal death and provided possible explanations of the quantitative findings.

RESULTS

Characteristics of respondents

A total of 468 mothers, 117 of dead neonates and 351 of live neonates were included in the case-control study. Most respondents (52%) belonged to 25-34 years of age, 30% to 17-24 years, and 18% to 35-44 years. More husbands than wives were literate. Most respondents (58.5%) were from BRAC eligible households and were housewives. Almost all husbands were involved in some income generating activities like farming and wage labour. Approximately 113 mothers were BRAC members.

Causes of neonatal death

The major causes of death were ulga (27%), LBW (23%) and pre-maturity (22%). “Ulga, is an evil spirit which comes through bad wind and attacks children in different form of illnesses.” The next common cause was pneumonia (12%). The least common causes were malnutrition, prolonged labour, jaundice, malhandling of breech presentation, etc.

Treatment seeking behavior

Most mothers (41%) did not receive any treatment for their newborns' illness. About 38% sought care from traditional healers, homeo-doctors or pharmacists. However, findings revealed that healers were not able to get cure the acute and fatal cases, instead conditions became worsen. Only a few took medical care.

The association of BRAC intervention and neonatal death

Neonatal mortality showed a significant 1.9 fold increased risk (CL 1.09, 3.25) among women who were not BRAC members compared to women who were BRAC members.

This association was analyzed in two steps as follows:

First step: risk factors of neonatal death

The study identified risk factors for neonatal death and calculated risk ratio for each of them (Table 1).

Antenatal check-up

The risk of neonatal death was roughly twice as large if a mother did not seek antenatal care compared to a mother who did. A similar significant risk was observed if the number of antenatal visits was less than three (OR=1.89; 95% CL 1.16, 3.07) (Table 1).

The qualitative data provided the villagers' perspectives of how antenatal care reduces the risk. One woman said, "If I did the regular antenatal check-up, I would then be able to know the growth rate of my foetus. If I knew that my foetus did not grow up properly and took more nutritious diet, perhaps the baby would not die from malnutrition/LBW." A BRAC member said, "If mother takes adequate diet, the baby will be healthy and there is less chance of getting disease and death. And I did that." Women not seeking antenatal care did not have enough knowledge about its importance. For instance, one woman had been identified as high-risk mother while she was pregnant and the doctor advised her to undergo regular antenatal check-up. However, she did not follow doctor's advice and her child died three days after birth.

Family planning method

A 2.4-fold increase in neonatal mortality was observed if mothers did not use any family planning methods before the relevant child was conceived (Table 1). Women perceived that family planning method helped increase birth spacing, which are necessary for good maternal and child health.

Domestic and emotional violence

Neonatal mortality showed a significant 1.7 – 2.2 fold increased risk in women having emotional stress and physical violence during pregnancy (Table 1). Women found a strong association between neonatal death and domestic violence. “There are many husbands, fathers- and mothers-in-law who beat their wives or sons’ wives while they are pregnant. A foetus might get injured at that time. Consequently, the baby may die at any time after birth. Moreover, if there is any harassment or emotional stress, how a pregnant woman can have adequate diet and rest! The fetal growth will be hampered, the baby will be low birth weight and may be affected by various diseases and complications.”

Pre-maturity and low birth weight (LBW)

Pre-maturity and LBW were associated with 13 and 2 times increased risk of neonatal mortality respectively (Table 1). A woman explained the reasons and consequences of pre-maturity as “I had swollen face, foot, hand and abdomen while I was pregnant. My daughter was delivered before the expected date of delivery. Initially, she was able to suck the breast milk but after a while she had convulsion. On the second day, frequency of convulsion increased and she could not suck breast milk. A traditional healer treated her

with sanctified water and herbs. But she died on the third day.” Women perceived that pre-term babies are usually malnourished and LBW.

Mothers having physical illnesses (OR=1.55; 95% CL 0.98, 2.46), home delivery (OR=1.6; 95% CL 0.65, 3.98), and unskilled birth attendants (OR=1.29; 95% CL 0.63, 2.70) had increased risk of neonatal mortality though the associations were insignificant.

Second step: association of BRAC membership and risk factors for neonatal death

Table 2 shows the association of the identified risk factors with BRAC membership. Seeking antenatal care and use of family planning methods were found to be significantly higher among BRAC members compared to non-members.

Effect of confounding factors over the association of BRAC membership with neonatal death

The stratified analysis identified confounders that disturbed the interpretation of the association between BRAC membership and neonatal death (table 3). Crude analysis gave OR=1.9 with confidence limits (1.09, 3.25).

Odds ratio varied in different age groups. It was only for those mothers aged less than 25 years (17-24 yrs.) that the odds ratio deviates significantly from the unity. Strongest association had also been found when fathers were wage labourer, meant neonates of BRAC non-members were more vulnerable to the effect of their fathers' occupation. Mother's occupation was not used as most mothers were housewives.

Economic condition, parents' literacy, mothers' BMI and other NGO membership did not have any influence over the association of BRAC membership and neonatal death.

Net effect of variables on neonatal death

Table 4 presents the logistic regression analysis of neonatal death on the selected socioeconomic and proximate variables. The model I imparts the effect of socioeconomic variables over neonatal death. It finds BRAC membership to be the most influential predictor of neonatal death. The odds ratio for the BRAC non-members was 2.1 indicates that BRAC non-members have had twice risk compared to BRAC members.

The model indicates a positive association between higher risk of neonatal death and poor socioeconomic status. Young mothers (<25 years) had insignificant positive association with the higher risk of neonatal death. Parents' literacy and fathers' non-wage labour were found as insignificant negative predictors of neonatal death.

Model II reveals the net effect of proximate variables on neonatal death. Pre-maturity, not seeking antenatal care and physical violence had become the influential predictors of neonatal death when only all proximate variables were adjusted for. In this model, not using contraceptives, psychological stress and LBW had become insignificant predictors whom were significant in univariate analysis in Table 2.

Model III shows the combined effect of socioeconomic and proximate variable on neonatal death. When all identified risk factors from both the models act together, the final model shows that BRAC eligibility has become weaken and insignificant. Pre-maturity and not seeking antenatal care reduces, and BRAC non-membership enhances the risk of neonatal death. Regarding physical violence, the model gave the similar result as the second model. Among all influential predictors, pre-maturity was identified as the strongest predictor.

DISCUSSION

This study contributes to an understanding of the particular element of development interventions responsible for neonatal survival and the mechanisms.

Methodological lessons

Studying neonatal death in a rural setting surrounded by various cultural and traditional beliefs is a complex task. However, using both qualitative and quantitative design helped to see the issues from a different angle and facilitate better understanding of newborn health. The qualitative study has enabled a number of issues to come out clearly in the ways women are perceived by themselves. As it is a case control study, sometimes it was not possible to generate enough information to make a concrete conclusion urge to design a cohort study in future.

The reliability of the data has been studied by comparing to another community-based study done by Tobias Andersson in Ethiopia. Both studies use the longitudinal surveillance database. However, methodological differences exist. Tobias followed the cases prospectively. Thus, some important determinants for the neonatal death were not recorded, as data was not primarily collected. This study overcomes this limitation as data was collected according to the purpose of the study. But the study may suffer from recall bias. To minimize this bias, the follow-up period had been shortened and the study area was widened to get sufficient number of cases. Moreover, the patterns of relationship between the socio-demographic variables and neonatal mortality is consistent with findings of another study which found that mortality reduction was greater for those infants whose

mothers participated in the development programmes than the non-participant mothers of similar socioeconomic background (Bhuiya & Chowdhury, 2002).

Major findings

A framework has drawn from the major findings on how BRAC development interventions contributed positively on neonate survival in Matlab (Fig 2). The postulated causal web showed that the most potential risk factors for the neonatal death include not seeking antenatal care, not using contraceptives, physical violence, psychological stress, prematurity and LBW.

One of the influential predictor of neonatal death is antenatal care. Antenatal visits should be at least three to reduce the risk. This finding is consistent with the findings from other studies in Indonesia, Turkey and United States (Asih et. al., 1997; UNICEF, 2003; & Vintzileos et. al., 2002). The Turkish Ministry of Health has taken an extensive antenatal care policy to identify maternal danger signs vis-à-vis the proper antenatal care, and thus to take adequate measures prior to birth to prevent fatalities and disabilities of both mother and newborn (UNICEF, 2003). Another risk indicator for neonatal death is if a mother doesn't use family planning method before the respected childbearing. Research found that women who spaced birth less than 24 months were more likely to experience a neonatal death (Asih, et. al., 1997). More than two years of birth spacing is necessary for mothers' nutritional and health recovery. Although Bangladesh has evolved a success story in contraceptive prevalence rate, the discontinuation rate is very high (Nasreen, et. al., 1996). Thus the development programme should pay greater attention toward discontinuation rate rather than the contraceptive prevalence rate.

The conceptual framework has shown that BRAC development programme have contributed to the enhanced survival of neonate through mutually exclusive inputs of micro-credit, social, health and population development programme. The antenatal care and family planning are the important components of BARC Health Programme. However, it is interesting to know how effective the ANC service is in addressing clients' needs. As the immunization campaign is intense in Bangladesh, perhaps pregnant mothers go to the ANC centers only for the tetanus toxoid injection. Possibly there is a problem with the definition of antenatal care as it only counts number of visits rather considering adequate antenatal care and counseling. A study may therefore be needed to explore how mothers' tetanus toxoid immunization affects newborns' health. Pre-maturity has identified as the most potential risk factor for neonatal death. This finding is consistent with another study in Bangladesh where about 75% of deaths occurred in babies born pre-prematurely (Yasmin, et. al., 2001).

Gender-based violence usually continues during pregnancy and is associated with increased neonatal mortality. Psychological stress has become insignificant in the multivariate logistic regression analysis, we would consider it as a risk factor of neonatal death as some African studies found it as the same (Jewkes, et. al., 1999). Domestic violence is associated with foetal distress and foetal death at all stages of development including stillbirth, perinatal and neonatal mortality (Dey, at. al., 1995). If a woman is abused physically or psychologically, she might not take adequate rest and diet due to fear or psychological disturbance that may lead to LBW and pre-mature labour. Abusive spouses often prevent women from using family planning methods and antenatal care (IPPF, 2003). Many organizations in Bangladesh have addressed the issue of women

empowerment by introducing micro-credit as well as social awareness programme. However, it was observed that domestic violence has been increased immediately after becoming a BRAC member (Ahmed, et. al., 2002) though the violence against women is gradually decreasing with the length of membership. Any development programme in the world may take this experience into account, as it is hazardous for the health of both mothers and newborns.

The association of BRAC membership and neonatal death is confounded by mother's age and fathers' occupation. Greater risk was found if mothers were less than 24 years and fathers' were wage labourer, indicate that BRAC is providing less/no attention to adolescents and poorer households that might have important policy implications.

Findings revealed that parental socioeconomic factors do not have any effect over neonatal mortality. Other studies also show that neonatal mortality is independent of the level of bio-demographic, socioeconomic and health-related factors (Asih, et. al., 1997; Cabigon, 1997).

Improving newborn health

As the mother and the newborn are inseparable units, most problems affecting the women have a strong negative impact on the neonatal health. Thus, interventions to reduce neonatal mortality should be closely linked to improve women's health and making motherhood safe (Koblinsky, 1995) and should have two components: care for mothers and care for newborns.

Mothers' care should include:

To reduce neonatal death by LBW and pre-maturity, mothers' care should pay attention on maternal nutrition in both pregnant and non-pregnant state (Koblinsky, 1995), and in gender inequality of intra-household food distribution. The family planning component of the programme should emphasize on clients' effective knowledge, informed choice, side-effect management and counseling to attain a desired level of contraceptive prevalence as well as to lower the discontinuation rate. The antenatal care component of the programme should provide attention on regular antenatal check-up with at least 3 visits; maternal nutrition; tetanus immunization; screening, caring and referral of high-risk mothers; safe delivery; newborn care; and exclusive breastfeeding. The development program should set off a new wing of preventing violence against women and reproductive rights that may help women in decision-making of marriage at appropriate age, using contraceptives, and seeking antenatal care. Involvement of men and in-laws in the process may help to sensitize and reduce incidence of violence against women.

Newborns care should include:

The MCH-FP component of the development programme should integrate newborn care component and train the frontline workers on newborn care, exclusive breastfeeding and immunization. Immediate and exclusive breast-feeding is important for caring malnourished, LBW and pre-mature baby as it provides immune defense, nutrients and warmth for their survive. Appropriate care for the sick newborn is necessary, as many deaths were untreated or treated by traditional healers. Thus the newborn care component of MCH-FP programme should train the community health workers, parents and other caregivers on identification of sick newborns and referral.

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Tables

Table 1: Crude odds ratio and confidence limits for six potential risk factors of neonatal death.

Risk factors	Category	Cases (%)	Control (%)	OR	95% CL	X ²
Antenatal care	Yes	85 (21.9)	303 (78.1)	1.0		
	No	32 (40.0)	48 (60.0)	2.38	1.43-3.95	<i>P</i> <0.001
Family planning	Yes	10 (13.3)	65 (86.7)	1.0		
	No	107 (27.2)	286 (72.8)	2.43	1.21-4.91	<i>P</i> <0.05
Physical violence	No	99 (23.4)	324 (76.6)	1.0		
	Yes	18 (40.0)	27 (60.0)	2.18	1.15-4.13	<i>P</i> <0.05
Mental abuse	No	55 (20.8)	209 (79.2)	1.0		
	Yes	62 (30.4)	142 (69.6)	1.66	1.09-2.53	<i>P</i> <0.05
Pre-maturity	No	68 (17.0)	331 (83.0)	1.0		
	Yes	49 (73.1)	18 (26.9)	13.25	7.27-24.14	<i>P</i> <0.001
LBW	No	51 (36.2)	90 (63.8)	1.0		
	Yes	66 (20.2)	260 (79.8)	2.23	1.44-3.46	<i>P</i> <0.001

Table 2: Distribution of risk factors with respect to exposure to BRAC membership.

Risk factors	Category	BRAC non-member (%)	BRAC member (%)	X ²
Antenatal care	Yes	287 (80.8)	101 (89.4)	
	No	68 (19.2)	12 (10.6)	<i>P</i> = 0.036
Family planning	Yes	49 (13.8)	26 (23.0)	
	No	306 (86.2)	87 (77.0)	<i>P</i> = 0.020
Physical violence	Yes	36 (10.1)	9 (8.0)	
	No	319 (89.9)	104 (92.0)	<i>P</i> = 0.494
Mental abuse	Yes	157 (44.2)	47 (41.6)	
	No	198 (55.8)	66 (58.4)	<i>P</i> = 0.623
Pre-maturity	Yes	51 (14.4)	16 (14.2)	
	No	302 (85.6)	97 (85.8)	<i>P</i> = 0.939
LBW	Yes	105 (29.6)	36 (32.1)	
	No	250 (70.4)	76 (67.9)	<i>P</i> = 0.606

Table 3: Association between BRAC membership and neonatal death. Stratification with regard to mother's age, BRAC eligibility and literacy, and father's literacy and occupation.

Variable	Category	Exposure		Relative risk estimate		
Age (yr)		BRAC non-member	BRAC member	OR	95% CL	
<25 25-34 35 and above	Case	37	4	3.42	1.11-10.51	
	Control	73	27			
	Case	46	10	1.74	0.82-3.70	
	Control	135	51			
	Case	15	5	0.98	0.31-3.12	
	Control	49	16			
BRAC eligibility	Eligible	Case	60	15	2.03	1.07-3.84
	Control	132	67			
	Non-eligible	Case	38	4	2.05	0.68-6.23
	Control	125	27			
Mother's literacy	Illiterate	Case	41	12	1.69	0.83-3.46
	Control	121	60			
	Literate	Case	57	7	2.04	0.85-4.86
	Control	136	34			
Father's literacy	Illiterate	Case	44	10	2.00	0.94-4.29
	Control	112	51			
	Literate	Case	54	9	1.78	0.81-3.90
	Control	145	43			
Father's occupation	Wage labour	Case	35	5	3.46	1.26-9.51
	Control	79	39			
	Non-wage	Case	61	13	1.45	0.74-2.84
	Control	172	53			
Total	Case	98	19	1.89	1.09-3.25	
	Control	257	94			

Table 4: Odds ratio and *P*-values for the multivariate logistic regression analysis of neonatal mortality with the selected socio-economic and proximate variables. (All independent variables are included in the analysis).

	Model I SES variable		Model II Proximate variables		Model III Combined variables	
	OR	<i>P</i> -value	OR	<i>P</i> -value	OR	<i>P</i> -value
SES variable						
BRAC membership						
No	2.06	<0.05	-	-	2.32	<0.05
Age						
<25 years	1.29	0.279	-	-	-	-
Economics status						
BRAC eligible	1.94	<0.05	-	-	1.62	0.066
Education						
Illiterate	0.726	0.225	-	-	-	-
Husband's education						
Illiterate	0.953	0.852	-	-	-	-
Occupation						
Wage labour	0.853	0.560	-	-	-	-
Proximate variable						
Seeking ANC						
No	-	-	2.61	<0.01	2.27	<0.01
Utilizing FP						
No	-	-	1.94	0.096	-	-
Place of birth						
Home	-	-	2.71	0.259	-	-
Birth assistance						
Unskilled	-	-	0.82	0.781	-	-
Mental abuse						
Yes	-	-	1.53	0.094	-	-
Physical violence						
Yes	-	-	2.38	<0.05	2.49	<0.05
No. of children						
>2	-	-	1.12	0.655	-	-
Pre-maturity						
Yes	-	-	18.89	<0.001	15.04	<0.001
LBW						
Yes	-	-	0.70	0.265	-	-

Figures

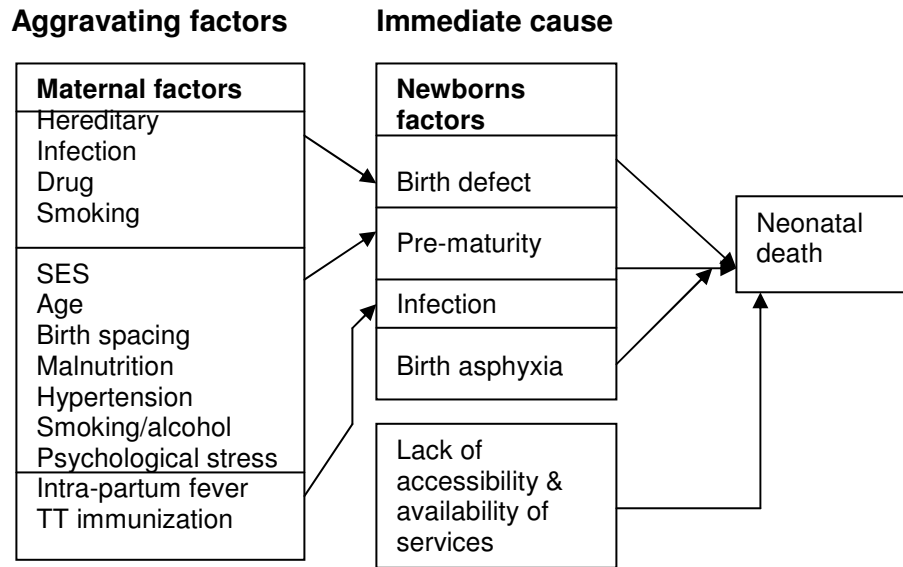


Figure 1: Conceptual framework for neonatal death

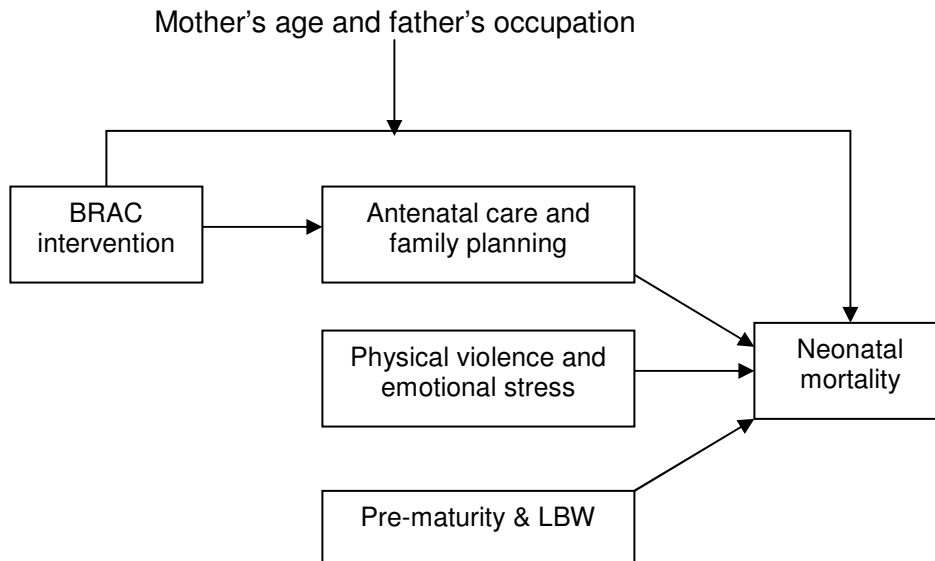


Figure 2: Factors postulated to determine neonatal mortality