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Original article

EFFECT OF TIMELY INITIATION OF BREASTFEEDING ON NEONATAL MORTALITY IN BANGLADESH: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Neonatal mortality, deaths within the first 28 days of life is a key determinant of neonatal health and well-being and is becoming a major determinant of under-five mortality. In spite of the strong evidence supporting immediate and long terms health benefits of timely initiation of breastfeeding in Bangladesh, only 51% of children receive breastfeeding within 1 h of birth. This study aims to investigate the effect of timely initiation of breastfeeding on neonatal mortality in Bangladesh.
Methods: This study utilized cross-sectional secondary data which was collected by Bangladesh Demographic and Health Survey (BDHS) 2017-18. A total number of 5,073 Bangladeshi child were considered as sample in this study. A multiple binary logistic regression model was used to find effect of timely initiation of breastfeeding on neonatal mortality in Bangladesh.
Results: The prevalence of neonatal mortality in Bangladesh was 1.6%. Multiple regression model showed that the rate of neonatal mortality was increased for the rural areas ($p<0.05$) as compared to the urban areas. Education levels of the mother also have a significant effect on neonatal mortality. A mother did not breastfeed their child within 1 hour after his or her birth then the rate of neonatal mortality is increased one-time ($p<0.05$) times compared to those neonates who have breastfeed within 1 hour of birth.
Conclusions: We found that timely initiation of breastfeeding is beneficial for child survival within the first 28 days of birth, including all causes of mortality. Therefore, efforts in formulating an effective policy focusing on early initiation of breastfeeding are needed.
Keywords: Breastfeeding, Neonatal mortality, Cross-sectional, BDHS, Binary logistic regression.

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INTRODUCTION

Worldwide, approximately 5.6 million children die before the age of 5, 2.6 million of whom die within the first 30 days of life (UNICEF, 2017). Approximately 7,000 infants die each day, most occurring within the first 7 days of life, with approximately 1 million deaths within the first day and nearly 1 million deaths within the next 6 days in 2016 (WHO, 2017). The majority of neonatal deaths took place in South Asia, with 39% of the neonatal deaths there, followed by 38% in Sub-Saharan Africa. Half of all neonatal deaths take place in the top five countries of the world: India and Pakistan, Nigeria, Congo, and Ethiopia. In the last 25 years, there's been a huge drop in the rate of under-5 deaths, which dropped from 93 deaths per 1000 live births in 1990 to just 41 deaths in 2016 (WHO, 2017).

Most of the neonatal deaths occurred in South Asia (39%), followed by sub-Saharan Africa (38%). Half of all infant deaths occur in the following five countries: India, Pakistan, Nigeria, the Democratic Republic of the Congo, and Ethiopia (UNICEF, 2017). Over the past 25 years, the under-5 mortality rate has fallen from 93 deaths per 1,000 live births in 1990 to 41 in 2016. In India, in the year 2015, infant mortality accounted for 37 infant deaths per 1000 live births, of which 67.8% of infants died in the first month of births (RGI, 2015). With approximately 0.75 million neonatal deaths in 2013, India has the greatest absolute number of neonatal deaths worldwide (Wardlaw et al., 2014). Although infant mortality has significantly decreased over the years, there hasn't been enough progress made to meet Millennium Development Goal 4 (MDG-4) (UNICEF, 2015). In 2015, the Sustainable Development Goals (SDGs) were introduced, seeking to achieve all the goals by 2030. Goal 3 of the Sustainable Development Goals (SDG 3) aims to promote MDG-4, for reducing under-five mortality by two-thirds between 1990 and 2015 and continuing past that year until neonatal mortality is at least 12 per 1000 live births and under-5 mortality is at least 25 per 1000 live births (UN, 2015). Around 20% of newborn deaths and 13% of deaths in children under the age of five are prevented by early breastfeeding initiation and exclusive breastfeeding during the first six months of life (Jones et al., 2003). It can also reduce mortality due to neonatal infections (Mullany et al., 2008) which contribute 36% in neonatal deaths from all causes, and preterm birth an additional 27% (Lawn et al., 2005). Despite the strong evidence supporting immediate and long-term health benefits, early initiation of breastfeeding in South

Asia remains low with varying rates with 36.4% in India, 24% in Bangladesh, and 8.5% in Pakistan (Patel et al., 2013; Haider et al., 2014; Hanif et al., 2011). In India, only 65% of children are exclusively breastfed for the first 6 months and 45% of children receive breastfeeding within 1 h of birth, though breastfeeding is one of the most important interventions for child survival (MWCD, 2015). Previous research has shown that early breastfeeding is associated with reduced neonatal mortality (Debes et al., 2013; Berde and Yalcin, 2016; NEOVITA, 2016; Lassi et al., 2015). A systematic review of 25 studies from 7 countries across South Asia found that early breastfeeding is mainly related to socio-economic, health-related, and individual factors (Sharma and Byrne, 2016) and that insufficient attention is afforded to intrapartum and neonatal characteristics. Recent study showed the perinatal mortality rate was reduced from 64 to 41 per 1000 pregnancies between 2004 and 2014 (stillbirths:34 to19 and early neonatal deaths: 30 to 22) (Hossain et al., 2019), and another study analyzed data of 21,227 newborns. The neonatal mortality rate was 43.4 per 1,000 live births (Al Kibria et al., 2018). Overall, 15-year prevalence of under-5 mortality in South Asian countries was 10%, with Nepal having the highest prevalence (11.1%) and the Maldives the lowest (5%) (Sohail and Neupane, 2019).

In India, several studies have looked at the relationship between the timing of initiation of breastfeeding and neonatal mortality across different communities (Bamji et al., 2008; Garcia et al., 2011). Therefore, a national study is necessary as the relationship between timing and neonatal mortality needs to be studied at a national level.

The present study investigates the effect of timely initiation of breastfeeding on neonatal mortality in Bangladesh. To meet the SDGs within the given timeframe, we need to focus on the evidence-based conclusion on the timing of breastfeeding and reduction of neonatal mortality as there is a pressing need to enhance breastfeeding practices in Bangladesh.

MATERIALS AND METHODS

Methods: A total of 5,073 children were selected as the sample in the present study. The data used in the present study was extracted from the large scale of dataset collected by the Bangladesh Demographic and Health Survey-2017-18 and BDHS-2017-18 collected data from these children from over all Bangladesh. The BDHS-2017-18 sample is nationally

representative and includes everyone who lives in non-institutional housing units across the country. The survey's principal sampling unit is an enumeration area, which has an average of 120 households. Bangladesh was divided into eight administrative divisions. Each division is further subdivided into zilas, and each zilas is further subdivided into upazilas. An upazilas urban area is divided into wards, with Mohalla's inside each ward. The upazilas rural areas are organized into union parishads (UP) and mouzas within each UP. These division allows the country as a whole to be easily separated into rural and urban areas.

Sampling: BDHS-2017-18 utilized a two-stage stratified cluster sampling procedure for selecting the from the Bangladesh survey. In the first step, 675 enumeration areas (EAs) (250 from urban and 425 from rural areas) were randomly selected with a probability proportional to the size of the EAs. To provide a sampling frame for the second-stage selection of households, a comprehensive household listing operation was carried out in all selected EAs. In the second step of the sampling process, 30 families per EA were selected to provide statistically significant estimates of key demographics and health characteristics across the country, urban and rural separately, and across the eight divisions. A total of 20,250 residential households were chosen based on this design. About 20,100 ever-married women aged 15 to 49 were expected to complete the interviews. In addition, all ever-married women age 50 and older, never-married women age 18 and older, and men age 18 and older were weighed and their height measured in a subsample of one-fourth of the homes (about 7-8 houses per EA).

Statistical Analysis: A frequency distribution was used to determine the prevalence of neonatal mortality in Bangladeshi children. The chi-square (χ^2) test was used to find the association between neonatal mortality and independent variables. A multiple logistic regression model was used to find the effect of socioeconomic, demographic, household information, and anthropometric factors on neonatal mortality. The fitness of both selected models was tested using the Hosmer and Lemeshow test. The multicollinearity problems among independent variables were checked by standard error (SE), if the magnitude of the SE lies between 0.001 and 0.5, it is judged that there is no evidence of multicollinearity (Chan, 2004). SPSS (IBM, version 26) software is used to analyze the data in this study. All statistical significance was accepted at $p<0.05$.

Outcome variable: In the present study, the outcome variable of this study was neonatal mortality and the variable was coded as "0" for non-occurrence of neonatal death and "1" for occurrence of neonatal death.

Independent variables: Various socio-economic and demographic factors were used in this study as independent variables and they included: Division (Barisal, 1; Chittagong, 2; Dhaka, 3; Khulna, 4; Mymensingh, 5; Rajshahi, 6; Rangpur, 7; Sylhet, 8), Place of residence (Urban, 1; Rural, 2), religion (Muslim, 1; others, 2), women's educational level (no education, 0; primary education, 1; secondary education, 3; higher education, 4), wealth index (poor, 1; middle, 2; rich, 3), sex of child (male, 1; female, 2), Place of delivery (non-institutional, 1; institutional, 2), Mode of delivery (normal, 1; cesarean, 2), mothers occupation (unemployed, 1; employed,2), initiation of breastfeeding (timely, 1; delayed, 2). More detail on the definition of these variables is available in the BDHS 2017-18 survey report (NIPORT, 2020). All independent variables had been selected based on previous variables (Phukan et al., 2018).

RESULTS

Prevalence of neonatal mortality among Bangladeshi child: A total of 5,073 Bangladeshi child were considered as a sample in the study. The prevalence of neonatal mortality among Bangladeshi child was 1.6%. Of the child, 67.9% came from rural area and 32.1% came from urban area.

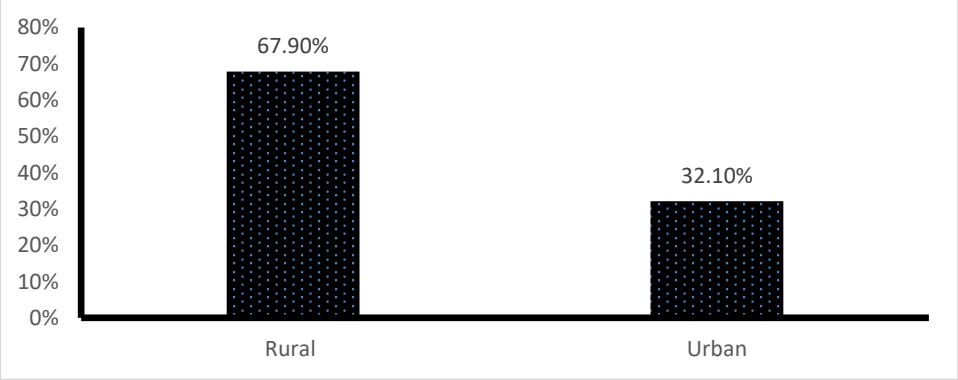

Fig. 1: Regional variation of neonatal mortality in Bangladesh.

Association between neonatal mortality, socio-economic and demographic factors: Associations between neonatal mortality and socio-demographic variables were shown in Table1. There was a significant ($p<0.05$) association between neonatal mortality and division. The highest percentages of neonatal mortality were observed in Rangpur (4.8%), Mymensingh (4.3%), Barisal (3.9%), Rajshahi (3.8%), Dhaka (3.5%), Chittagong (3.5%) and Khulna (3.4%), while the lowest percentage is in Sylhet (2.8%). Neonatal mortality was also significantly ($p<0.05$) varied due to place of residence. Neonatal mortality was more prevalent in rural areas (3.9%) compared to urban areas (3.2%). In Muslim population, the prevalence of neonatal mortality was 3.7%, while among individuals of other religions, the prevalence was 4.2%; however, the differences are not significant at $p<0.05$ level. Women with no education have a significant ($p<0.01$) higher prevalence of neonatal mortality (4.6%) compared to women with primary education (4.3%), secondary education (3.6%) and higher education (2.1%). Neonatal mortality was significantly ($p<0.05$) associated with the wealth index. Respondents classified as rich have a notably high prevalence of neonatal mortality (4.2%). In the middle wealth index category, the prevalence of neonatal mortality slightly decreases to 3.5%. Interestingly, individuals classified as poor demonstrate a significantly lower prevalence of neonatal mortality. Again, neonatal mortality was more prevalent in male people (4.4%) compared to female people (3.0%). There was a significant ($p<0.05$) association between neonatal mortality and place of delivery. The highest percentages of neonatal mortality were non-institutional (1.7%) and institutional (1.6%). Employed mothers (4.4%) have a significant ($p<0.01$) higher prevalence of neonatal mortality compared to mothers with unemployed (3.1%) mothers. Also, mothers who initiated breastfeeding timely have a significant ($p<0.01$) higher prevalence of neonatal mortality (3.7%) compared to delayed mothers (3.1%).

Table-1: Association between socio-economic & demographic factors on neonatal mortality

Variables	**Total**	**Neonatal mortality**		χ^2-**value**	**p-value**
		Yes N (%)	**No** N (%)		
	N (%)				

Division					
Barisal	1089	43(3.9%)	1046 (96.1%)		
Chittagong	1823	64(3.5%)	1759 (96.5%)		
Dhaka	1327	47(3.5)	1280 (96.5%)		
Khulna	920	31(3.4%)	889 (96.6%)	12.801	0.045
Mymensingh	1299	58(4.3%)	1243 (95.7%)		
Rajshahi	957	36(3.8%)	921 (96.2%)		
Rangpur	1127	54(4.8%)	1073 (95.2%)		
Sylhet	1629	46(2.8%)	1583 (97.2%)		
Place of residence					
Urban	3113	100(3.2%)	3013 (96.8%)	13.164	0.031
Rural	7058	277(3.9%)	6781 (96.1%)		
Religion					
Muslim	9449	347(3.7%)	9102 (96.3%)	0.438	0.508
Others	722	30(4.2%)	692 (95.8%)		
Women's education level					
No education	1029	47(4.6%)	982 (95.4%)		
Primary	3325	142(4.3%)	3183 (95.7%)	14.652	0.002
Secondary	4498	160(3.6%)	4338 (96.4%)		
Higher	1319	28(2.1%)	1291 (97.9%)		
Wealth index					
Poor	3449	108(3.1%)	3341 (96.9%)	6.414	0.040
Middle	1763	62(3.5%)	1701 (96.5%)		
Rich	4959	207(4.2%)	4752 (95.8%)		
Sex of child					
Male	5085	224(4.4%)	4861 (95.6%)	12.902	0.006
Female	5086	153(3.0%)	4933 (97.0%)		
Place of delivery				5.603	0.023
Non-institutional	2542	40(1.7%)	2502 (98.3%)		

Institutional	2536	40(1.6%)	2496 (98.4%)		
Mode of delivery					
Normal	3408	69(2.0%)	3339 (98.0%)	0.407	0.504
Caesarean	1665	11(0.7%)	1654 (99.3%)		
Mother's occupation					
Unemployed	5662	177(3.1%)	5485 (96.9%)	12.059	0.001
Employed	4509	200(4.4%)	4309 (95.6%)		
Initiation of breastfeeding					
Timely	6414	240(3.7%)	6174 (96.3%)	9.060	0.046
Delayed	3757	137(3.6%)	3620 (96.4%)		

Effects of socio-economic and demographic factors on neonatal mortality among Bangladeshi children: The multilevel logistic regression model was found to be an appropriate approach to analyze the data by removing the clustering effect to ensure a higher accuracy of the results. All the factors that demonstrated a significant association with the rate of neonatal mortality were included as independent variables in the multiple binary logistic regression model. Since the standard error of each independent variable were laid between the magnitude value 0.001 and 0.5, so there was no evidence of multicollinearity problem among independent variables. After removing clustering effects and controlling for the effect of other variables, the model showed that division wise prevalence of breastfeeding within 1 h of birth. The spatial variation showed less than 1.6% of women were practicing their babies within 1 h of birth, in some divisions of Barisal, Sylhet, Khulna, Rajshahi, Chittagong, Mymensingh, Dhaka and Rangpur. The rate of neonatal mortality was decreased for the Sylhet division as compared to the Barisal ($p<0.01$). Also, the rate of neonatal mortality was increased for the Sylhet division as compared to the Khulna ($p<0.05$), Rajshahi (AOR: $p<0.01$), Chittagong ($p<0.01$), Mymensingh ($p<0.01$), Dhaka ($p<0.01$), Rangpur ($p<0.01$) divisions. The rate of neonatal mortality was increased for the rural areas ($p<0.05$) as compared to the urban areas. Education levels of the mother also have a significant effect

on neonatal mortality. Higher educated mothers have experienced more neonatal deaths than no education uneducated (AOR: 1.95; 95% CI: 0.62-6.14), primary educated (AOR: 1.8 5; 95% CI: 0.77–4.47; $p<0.05$) and secondary educated (AOR: 1.94; 95% CI: 0.88–4.27; $p<0.05$) mothers.

In the case of wealth index, neonates who belonged to rich family has ($p<0.01$) lower risk than those from the poor family ($p<0.01$) and middle family ($p<0.01$). Initial breastfeeding was one of the predictors of neonatal mortality ($p<0.05$) times compared to those neonates who have breastfeed within 1 hour of birth. In our study, Hosmer-Lemeshow test for neonatal mortality (Chi-square value= 12.8, p-value= 0.119) showed that the selected multiple binary logistic regression model was well fitted for the data.

Table-2: Effects of socio-economic and demographic factors on neonatal mortality among Bangladeshi child

Variables	**B**	**S.E.**	**Wald**	**p-value**	**AOR**	**95% CI for AOR**	
						Lower	Upper
Division			3.12	0.001			
Barisal vs Sylhet^R	0.16	0.41	0.15	0.001	1.17	1.52	2.64
Chittagong vs Sylhet^R	-0.16	0.40	0.15	0.001	0.86	0.39	0.88
Dhaka vs Sylhet^R	-0.41	0.46	0.77	0.001	0.66	0.27	0.68
Khulna vs Sylhet^R	-0.10	0.45	0.05	0.006	0.56	0.37	0.78
Mymensingh vs Sylhet^R	-0.17	0.43	0.16	0.001	0.84	0.36	0.96
Rajshahi vs Sylhet^R	-0.11	0.45	0.06	0.001	0.80	0.37	0.98
Rangpur vs Sylhet^R	-0.60	0.51	1.40	0.001	0.55	0.20	0.79
Place of residence							
Urban vs Rural^R	0.03	0.26	0.35	0.031	1.03	1.01	1.70
Women's education level			2.74	0.040			
No education vs Higher^R	0.67	0.59	1.31	0.001	1.95	1.62	6.14
Primary vs Higher^R	0.62	0.45	1.88	0.021	1.85	1.77	4.47
Secondary vs Higher^R	0.66	0.40	2.72	0.009	1.94	1.88	4.27

Wealth index			0.58	0.004			
Poor vs Rich[R]	0.21	0.30	0.47	0.001	1.23	1.11	2.22
Middle vs Rich[R]	0.22	0.34	0.43	0.003	1.25	1.20	2.41
Place of delivery							
Non-institutional vs Institutional[R]	-0.17	0.25	0.46	0.490	0.84	0.52	1.38
Mothers occupation							
Unemployed vs Employed[R]	-0.18	0.24	0.56	0.056	0.84	0.52	1.34
Initiation of breastfeeding							
Timely vs Delayed[R]	-0.14	0.23	0.38	0.045	0.87	0.55	0.95
Model Summary	Hosmer and Lemeshow Test, χ^2-value = 12.8, p-value = 0.119						

N.B: AOR=Adjusted odds ratio, CI=Confidence interval, R= Reference category.

DISCUSSION

In this study, early breastfeeding initiation was associated with a reduced risk of death within 28 days, including all-cause mortality. Extensive regional and intrastate differences exist in neonatal mortality across the country (Saikia et al., 2016). The present study also represents that there is a divisional dissimilarity seen in neonatal deaths. It is clear from the Barisal division of Bangladesh is more vulnerable to neonatal mortality than the Sylhet division of Bangladesh. Neonatal deaths can be prevented or reduced by early initiation of breastfeeding and exclusive breastfeeding (WHO, 2010; Islam et al., 2019). There is a significant difference across the divisions in the number of children who breastfeed within 1 hour of birth. The babies of the Barisal divisions are more exposed to early initiation of breastfeeding, while babies from the divisions of Sylhet, Khulna, Rajshahi, Chittagong, Mymensingh, Dhaka, and Rangpur are more exposed to delayed initiation of breastfeeding, where the rate of neonatal deaths are also high. Newborn care immediately after birth is vital since 40% of all neonatal deaths occur on the first day of life and 56% during the first 3 days (ICMR, 2008). The timing of exclusive breastfeeding is the most important risk factor for neonatal death (WHO, 2010). When exclusive breastfeeding is started early, it sets the stage for a mother-child

continuum of care that can impact health and development for years to come (ICMR, 2008). The results of this study are similar to the previous one. There was an abnormal rate of increase in the risk of neonatal deaths if there was a delay in the initiation of breastfeeding (Begum and Dewey, 2010). In India, there are wide disparities in mortality by caste, region, place of residence, and economic status, among other characteristics (Ram et al., 2013). These variations are related to differences in wealth, nutrition, education, availability of health services, culture, and gender equality status (Bang et al., 2005). The literature suggests that infant mortality rates have been inversely related to socioeconomic status, and child mortality is higher among low-income families than non-poor families (Edeme et al., 2014), which is consistent with our study. Maternal and child-level determinants such as the weight of the neonate, gestational age, and age of the mother play a major role in the neonate's survival (Kozuki et al., 2013; Phukan et al., 2018). Also, consistent with the earlier findings, maternal factors like the mother's occupation and education were prominent factors in neonatal mortality. Delayed breastfeeding is one of the primary causes of neonatal mortality, out of the entire population, 1.6% of babies die within 1 month of birth due to not being breastfed within 1 hour. This has major policy implications, as we could significantly reduce the number of neonatal deaths by providing timely breastfeeding.

CONCLUSION

Though Bangladesh has witnessed momentous changes in the infant health scenario over the years, the changes have not been uniform. The risk of neonatal death is affected by a variety of factors, including community, household, infant level factors. Therefore, early initiation of breastfeeding is recommended as an intervention to prevent neonatal mortality. These findings support the recommendations for early initiation of breastfeeding. Implementing policies and pro breastfeeding routines are the main recommended interventions to achieve the SDGs to prevent newborn mortality.

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