1. Background
Although the world has seen accelerated progress in reducing the under-five mortality rate, many children continue to die soon after their birth [1]. Globally during 2019, on average there were 17 deaths per 1000 live births during the neonatal period (first month after birth) [2]. South Asian countries experienced the highest proportion of neonatal deaths (62%) and Bangladesh is no exception [3]. Although Bangladesh has made substantial progress by lowering its neonatal death rate from 64 per live births in 1990 to 20 per 1000 live births in 2018 [4]. Each of these deaths today can be counted as a tragedy because most of them are due to preventable causes.

Extant research has shown that neonatal deaths are mostly associated with premature birth, maternal biological characteristics, complications during labour and delivery, infections like pneumonia, sepsis, meningitis and socio-environmental [5–7]. Despite considerable research and vast knowledge of determinants, the majority of children do not survive till their first birth month. Abundant evidence shows that the risk of dying is never shared equally among the population and some families may get exposed to higher child mortality than others. Possible explanations of some families losing a considerably larger share of children are scaring effect (effect of the death of one child on the survival chances of later siblings) and observed or unobserved characteristics of the mother, family or community. Several studies have shown the higher risk of infant-child mortality among the sibling considering the unobserved heterogeneity [8–12].

In Bangladesh, research shows that the risk of neonatal mortality is higher among children whose preceding sibling had died before their birth [13,14]. However, there is limited evidence regarding the survival risk of neonates that can be attributed to community-level characteristics in Bangladesh. While mother or family level characteristics are frequently used to understand the phenomenon of death clustering, substantial evidence shows that community plays a significant role in infant and child mortality [15]. Therefore, using the latest round of the Bangladesh Demographic and Health Survey, the present study examines the phenomenon of neonatal deaths clustering among children belonging to the same family and same community. Further, we examine the role of death scarring behind this phenomenon.

2. Data, Variables and Methods
2.1 Data source
We used the recent round of the Bangladesh Demographic and Health Survey 2017-18 (to be referred to as BDHS 2017-18) conducted by the National Institute for Population Research and Training (NIPORT) under the stewardship of the Ministry of Health and Family Welfare (MoHFW) of Bangladesh. This survey implemented a two-stage stratified sample design and further details regarding the survey are available elsewhere [16]. The current study will utilize the full retrospective birth histories (till the date of interview) of Bangladeshi women in the reproductive age group (15-49 years). This information on birth histories was available for 18,134 women and their 47,828 children belonging to 672 communities, in BDHS 2017-18. Our study uses the mother as a measure of the family interchangeably as information was collected from a single woman of each household. Further, by the community, our study refers to the census enumeration areas of Bangladesh. Only singleton births were used for analysis. Therefore, the analytical sample size of this study is 47,095 children born to 18,092 mothers.
2.2 Explanatory variables
Existing studies have found the death scarring factor to be associated with the clustering of neonatal deaths within families [7,9,17]. Scarring occurs when the death of the previous sibling decreases the survival chances of the index child [10,18]. This study measured death scarring among siblings by a binary indicator such that – if the preceding sibling was alive during the time of conception of the index child, then the records were coded as “Alive”; otherwise, they were coded as “Dead”. Taking the survival status of the previous sibling at the time of conception of the index child allows us to understand whether the index child was conceived because of the loss of the preceding child [7,18]. In line with the Mosley-Chen framework of child survival, we also included other child-specific, mother-specific and socio-economic covariates as the control variables.

2.3 Statistical methods
We performed bivariate and multivariate analysis to fulfil the objectives of the paper. The bivariate analysis will help us to examine the distribution of the mothers (or families) by the number of births and number of neonatal and post-neonatal deaths occurring under those mothers respectively. The multivariate analysis involved estimating random-intercept survival regression models accounting for variation in the risk of mortality due to characteristics at the family-level (mother-level) and community-level. Survival regression models are useful for utilizing the information from censored records in the retrospective birth histories, thereby curtailing the loss of crucial information [18–20]. In the survival models, our event of interest is the survival status of the index child during the neonatal period, i.e., within one month from births. All children who died during the neonatal period were coded as “Yes”; otherwise, they were coded as “No”.

Survival regression models allow us to choose the underlying distribution of time-to-event i.e., the time to neonatal mortality. Based on theoretical knowledge and statistical evidence we use the Weibull proportional hazard model in our study. The Weibull regression model is appropriate when the hazard of the failure event (here risk of mortality) is either monotonically increasing or decreasing [19]. Based on existing knowledge of human mortality, we know that the risk of mortality is highest in the first month of life and thereafter it decreases until the twelfth month [9].

In the random intercept Weibull hazard model, we included three levels – child (level 1), mother/family (level 2), and community (level 3). In our study sample, 47,095 children were nested within 18,092 mothers who in turn were nested within 672 communities thereby forming a hierarchical structure. The random-intercept model estimates the risk of mortality as a function of observed (fixed) characteristics and unobserved (random) characteristics that are shared by children belonging to the same families in the same communities respectively. Therefore, the use of a three-level random intercept model allows us to take into account unexplained inter-mother (family) and inter-community variation in the risk of mortality during the neonatal period [21,22].

3. Expected Findings
From the bivariate analysis, a substantial clustering of neonatal deaths was observed among mothers. About 1.1% of mothers experienced two or more neonatal deaths and cumulatively they accounted for 15% of all neonatal deaths in the study. The results from preliminary analysis found that those children whose previous sibling was not alive at the time of conception had a significantly higher hazard of dying during the neonatal period. Further, there was mortality clustering among children residing in the same community.

Moreover, lower birth interval increased the risk of neonatal mortality in Bangladeshi children [23,24]. Older birth cohorts of index child may have a higher hazard ratio for neonatal mortality because with the advent of a better maternal and child health care system the risk of neonatal and mortality had significantly declined in
Bangladesh [7,25]. We expect to find an advantage in survival probabilities among babies born in households with high socioeconomic status [26]. It has been argued that mother’s from higher socio-economic strata had the advantage of using institutional health facility for birth which in turn appears to increase the survival probability of the babies [27].

Thus, focusing on expected findings interventions are needed to increase the preceding birth intervals even if the previous child is dead. This may be done with proper counselling of the mother which will also help her to recover from the trauma of her child loss. Further, this study reiterates the undeniable role of the community in improving child survival especially during the first month of child’s life.

4. References


