

Causes of Death among Children under Five in Bangladesh: Evidence from BDHS 2011 and 2017-18 survey.

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Abstract

Background

To improve children's chances of survival, we need to understand what's causing their deaths. This study explores the factors leading to mortality among children under five in Bangladesh.

Methods

This study investigated the causes of death among children under five in Bangladesh using data from the Bangladesh Demographic and Health Survey (BDHS) of 2011 and 2017-2018. The BDHS employed a two-stage stratified cluster sampling design to achieve national representativeness. Verbal autopsy interviews were conducted to determine the cause of death based on information from family members or caregivers. The cause of death was assigned by a panel of three physicians using the ICD-10 coding system. Data from DHS survey was used to examine the number of deaths, proportional mortality ratios, and the impact of various factors on child mortality. DHS surveys employ sampling weights, adjusted for unequal selection probabilities and differential response rates, to accurately represent the population by correcting for oversampling and nonresponse bias in statistical analyses.

Findings

According to the study, Pneumonia, birth asphyxia, preterm birth, and drowning were leading causes. Disparities existed by age, gender, location, and maternal age. Neonates had the highest mortality risk. Male children and those in rural areas faced higher risks. Dhaka and Chittagong divisions had the highest prevalence of deaths. Young adult mothers and adolescents mothers were most affected. Despite increased antenatal care, significant child deaths continued to occur, indicating a deficiency in healthcare quality.

Interpretation

The study identified pneumonia, birth asphyxia, infections, and preterm birth as major causes of under-five mortality in Bangladesh, with higher risks in rural areas, densely populated regions, and the neonatal period. Improving healthcare, particularly in rural regions, addressing child marriage, and promoting child health awareness are crucial for reducing child deaths.

Funding

This study has no source of funding. We use data that is accessible to the public and obtained from the Demographic and Health Survey website. Each author accepted responsibility for the decision to submit for publication and had complete access to the study data. Several authors have verified the statistical analysis and study findings, and they all take full responsibility for the outcomes.

Keywords: Children Under Five, Bangladesh, child death, causes of death, verbal autopsy, DHS.

Introduction

The major causes of death among children under five in Bangladesh include pneumonia, birth asphyxia, prematurity, low birth weight, serious infections like sepsis, drowning, and congenital anomalies⁵⁵. An estimated 5·941 million children under the age of five died due to preventable diseases in 2015. Out of them, 2·681 million (45·1%) died during the neonatal phase, which is a child's first four weeks of life¹. Over four million (4·020 million) fewer fatalities under the age of five happened worldwide in 2015 as compared to 2000¹. Over ten million children under the age of five die each year, nearly all of them in underdeveloped countries and primarily from avoidable causes²⁶. According to the latest estimates, six conditions account for 73% of mortality in children under five worldwide: malaria, diarrhea, neonatal sepsis or pneumonia, preterm delivery, and birth asphyxia⁵. It is essential to comprehend the reasons behind the deaths of this vulnerable group, which comprises 80% of the global child population¹⁴.

Most deaths take place outside of medical facilities, where it is usually not possible to determine the reason for death and vital registration systems don't offer sufficient coverage⁴. Moreover, it does not provide up-to-date estimates on the percentage of deaths caused by specific factors. For instance, one of the leading causes of death for children under five is diarrhea²⁴. But the data analyzed only spanned from 1980 to 2009. It is crucial to have more recent estimates to guide present public health strategies, considering the ever-changing nature of health conditions and interventions. Moreover, previous studies have frequently concentrated on particular countries or regions, which restricts the applicability of the results. For instance, in rural Western Kenya, malaria was a major contributor to mortality and the leading cause of death, followed by acute respiratory infections, including pneumonia²⁵. But these findings may not be relevant to other settings. Conducting research across a wider range of countries and regions may offer a more comprehensive insight into the factors leading to death among children under the age of five in developing countries. Also, prior studies have often focused on specific countries or regions, thereby limiting the generalizability of the findings¹³. Many developing countries, like Bangladesh, have a small number of deaths that a licensed physician attends; hence, not much is known about the causes of death there¹¹. This is a primary factor contributing to the scarcity of data from developing countries such as Bangladesh.

In developing nations, pneumonia is the primary cause of death for children under the age of five²². From 1993 to 2004, pneumonia continued to be the primary cause of mortality in Bangladesh, accounting for a considerable percentage of deaths among children below the age of five²³. Pneumonia is one of the main causes of mortality for children under five in countries with low to middle incomes^{28,29}. In 2015, India had the highest rate of mortality under five worldwide in 2015, with about 60% of those deaths occurring in the newborn period⁷. In India as a whole and in its major states, the estimated under five and neonatal mortality rates declined more quickly since 2000, although they were similar between 2010 and 2015 when compared to estimates from the National Family Health Survey 4²⁷. Nevertheless, Bangladesh has shown significant progress in this regard, achieving remarkable success in reducing child mortality. In terms of achieving Millennium Development Goals (MDGs) 4 and 5, Bangladesh has achieved outstanding achievements⁹. The 2010s appeared to be a stalling point for Bangladesh's apparent two-decade significant drop in child mortality that began in the 1990s³⁰. Infant mortality rates decreased by around 6% and child

mortality rates by nearly 27% during the BDHS 1996/97 and BDHS 1993/94 surveys, according to a comparison of these two surveys' data¹¹.

Rotavirus infections are also a major cause of mortality in children under five, particularly in countries with a high burden of diarrheal diseases¹⁶. Diarrheal diseases, including those caused by rotavirus, are a significant cause of mortality in emerging nations for children under five^{18,17,16,19}. Identifying host biomarkers and proteome correlates can aid in the development of targeted interventions and treatments for infectious diseases, including pneumonia and respiratory syncytial virus infections^{20,21}. The problem of child mortality in the under-five age group is one that is being addressed in nations like Bangladesh and India. In 2015, India recorded the highest count of under-five fatalities worldwide⁷. In India, there were reportedly 25.121 million births in 2015, however 1.201 million of children died before turning five⁷.

Previous research^{1,2,5,6,10,15,16} has shed light on some of the causes of death among children under 5 in developing countries, but there are limitations to consider. Moreover, numerous studies^{1,2,5,6,10,15,16} on the causes of under-five deaths have been undertaken globally over the past few years. Additionally, some initiatives have been introduced to enhance the circumstances globally². To stop avoidable infant and child deaths, the new Sustainable Development Goals (SDGs) require all nations to work toward reducing neonatal deaths to a minimum of 12 per thousand live births and under-five mortality to a minimum of 25 per thousand live births by 2030⁶. 42 percent of mortality among children under five worldwide between 2000 and 2003 occurred in the WHO's Africa area, and another 29 percent did so in southeast Asia⁵. This indicates that Southeast Asia as well as Africa are the most affected regions. Sub-Saharan Africa and southern Asia continued to be the MDG regions with the highest rates of under-five mortality in 2015 (2.947 million and 1.891 million, respectively)^{1,10}. One of the things causing deaths among children under five in sub-Saharan Africa is the rural-urban difference¹⁵.

To ensure the effectiveness of child survival efforts, it is essential to have exact information underlying the causes of death⁵. Understanding the cause of death in children under five is crucial as it can help policymakers and the government to take necessary steps. This knowledge will be useful in the creation of effective programs and regulations meant to lower the rates of child mortality. More than 200 million children under the age of five in developing nations like Bangladesh do not develop cognitively to the fullest extent possible³. The number of impacted children is excessively large. When considering Bangladesh, a low or middle-income nation, these indicators hold significant importance in shaping child health policy formulation and making decisions about how to allocate limited resources effectively⁸. Assessing programmatic requirements, prioritizing interventions, and tracking success can all be facilitated by policymakers by analyzing patterns and trends in the causes of the child mortality rate under five⁴.

In this study, we aimed to find the Causes of Death among under five Children in Bangladesh by using evidence from the BDHS 2011 and BDHS 17-2018 survey. To authors best knowledge this is the first study to use data from the 2011 and 2017–18 VA (verbal autopsy) surveys in Bangladesh. Existing studies have utilized BDHS data to explore various health indicators, trends, and outcomes, yet no research has specifically addressed the evolution or changes in the causes of mortality over this seven-year interval. Furthermore, the present research endeavors to overcome the limitations and offer a thorough comprehension of the causes of death in this specific demographic in Bangladesh. By

identifying the specific factors contributing to child mortality, interventions and policies can be developed to effectively reduce child mortality rates in Bangladesh.

Methodology

Data Source

This study used data from the Bangladesh Demographic and Health Survey (BDHS) to examine the causes of death among children under five in Bangladesh. The most recent publicly accessible dataset from the standard Demographic and Health Survey (DHS), a cross-sectional survey that is nationally representative and is supported by USAID, was used in our investigation. The two-stage stratified sampling approach is used in this DHS survey. Anyone can get it on the DHS website at <https://dhsprogram.com/>. For this study, we make use of the most recent "Verbal Autopsy" Dataset. The most recent years are 2017-18 and 2011. For this study, survey data from the years 2011 and 2017-18 were used.

Study Design

A two-stage stratified cluster sampling design was used in the 2017-18 BDHS in order to attain national representativeness. The comprehensive sampling process is explained in other places^{30,31}. To put it briefly, the enumeration areas (EAs) created during the 2011 Population and Housing Census were used to generate the sampling frame. Every Enumeration Area (EA) in a primary sampling unit (PSU) had an average of about 120 households. There are eight administrative divisions in Bangladesh: Barisal, Rangpur, Rajshahi, Chattogram, Dhaka, Khulna, Mymensingh, and Sylhet. The survey uses a stratified sampling approach with two stages. Using a probability proportionate to EA size, 675 EAs 250 in urban regions and 425 in rural areas were chosen in the first round. In each selected Enumeration Area (EA), an average of thirty families were selected in the second stage.

Verbal autopsy is a technique for identifying the cause of death based on interview. By questioning family members or caregivers who were present at the time of the death or who have knowledge of the circumstances leading up to the death, this method confirms the cause of death. This approach has been widely utilized to identify the causes of death in low-resource environments when the vital record system is deficient, and most deaths take place outside of the scope of health services. The verbal autopsy method was used by the BDHS in 2011 and 2017-18 to estimate the cause of death for child under five in Bangladesh. This method was also used to conduct surveys in 2004 BDHS, 1996-97 BDHS and 1993-94 BDHS. However, computer methods utilizing a hierarchical process were used to assign causes of death in the BDHS surveys conducted in 1993–1994; 1996–1997; and 2004. Comparable instruments were used in the 2011 and 2017-18 BDHS, and physician evaluations were employed to determine the cause of death. As a result, there are similarities in the outcomes between the 2011 BDHS and the 2017-18 BDHS.

Data preprocessing

Data for this study was collected from the 2011 and 2017-18 DHS surveys. Trained personnel collected data through verbal autopsy questionnaires. Cause of death was assigned by a panel of three physicians using the ICD-10 coding system. We use STATA (Version 15.0) to clean and process the data. In order to account for variations in the likelihood

of selection and interview between instances in a sample, resulting from either random chance or design, sampling weights are adjustment factors that are applied to each case in tabulations. In DHS surveys, the sample is typically chosen with unequal probability in order to increase the number of cases available (and hence lower sample variability) for specific locations or subgroups that require data. In this instance, weights must be used in statistical tabulations in order to generate the appropriate representation. Adjustments are applied for differential response rates when calculating weights based on sample design. To adjust the weight, the weight variable is divided by 1,000,000. In addition, in order to comprehend the percentage distribution of causes of mortality for children under five years old by time period and child gender from 2011 to 2018, we integrate the two datasets (2017 and 2018).

Outcome Variable

The outcome variable “Cause of death” is a multilevel variable classified as 17 categories (Neonatal Tetanus, Congenital Abnormality, Drowning, Birth Asphyxia, Birth Injury, Measles, Diarrhea, Pneumonia, Meningitis, Respiratory Distress, Neonatal Jaundice, Premature Birth, Serious Infection, Malnutrition, Other, Undetermined and Unspecific). Physicians with the necessary training were employed to assign the cause of death in the survey. In the survey years 2011 and 2017-18, three doctors were tasked with identifying the cause of death (the outcome variable) using the verbal autopsy questionnaires. The physicians used the International Classification of Deaths (ICD-10) (both 2011 and 2017-18 survey year) to determine the cause of death (outcome variable). Two doctors independently examined each questionnaire to ascertain the reason for death (outcome variable). When both doctors concurred, the underlying cause was regarded as the definitive cause of death. If any of the physicians do not agree, a third physician conducted an additional review. The underlying cause of death was deemed to be the final cause of death if two out of the three physicians concurred. If an agreement could not be reached after the third physician review, the cause of death was recorded as "undetermined" [Figure 01].

[Insert Figure 01 Here]

Figure 1: Physician review process to determine the underline cause of death (Outcome Variable).

Figure legend: *Figure 1. Physician review process to determine the underlying cause of death (Outcome Variable). Adapted from National Institute of Population Research and Training - NIPORT, Ministry of Health and Family Welfare, and ICF. 2020. Bangladesh Demographic and Health Survey 2017-18. Dhaka, Bangladesh: NIPORT/ICF.*

Available at <https://www.dhsprogram.com/pubs/pdf/FR344/FR344.pdf>.

Explanatory variable

The following socio-demographic and categorical variables were used in the multivariate and multilevel analyses: gender, age group, place of residence, Division, Baby received any treatment for the illness, Mother received TT vaccine, Mother suffer any kind of disease and age Group of mothers when baby die. Where gender (male and female) and place of residence (urban and rural) is a dichotomy variable. Moreover, age group is calculated in month and categorized by three levels (0 – 28 days as Neonatal, 1 – 11 months as Infants, 12 – 59 months as Child). In addition, Bangladesh was split into eight division (Barisal, Chattogram, Dhaka, Khulna, Rajshahi, Rangpur, Mymensingh and

Sylhet) and age group of mothers when baby die is calculated in year and categorized by three level Adolescent Mothers (11-19), Young Adult Mothers (20-30), Adult Mothers (31-46). Moreover, we consider several factors as dichotomous variables (Yes or No), including whether the mother received antenatal care, whether the mother received the TT vaccine, whether the baby received any treatment for illness, and whether the mother suffered from any kind of disease.

Statistical analysis

STATA 15.0 was used to perform the analysis. The number of fatalities and proportional mortality ratios by age groups, the gender of the decreasing child, the time period (2011 and 2017–18), the type of residence (rural and urban), and the division were taken into consideration in order to assess the outcome variable cause of death. We determine number of deaths and proportional mortality ratios by period (2011 and 2017–18) to figure out if the death's cause structure has changed in any way. We also calculated the mortality ratios for different age groups of mothers. Furthermore, we looked into how different socio-demographic factors affected the causes of mortality, including whether the mother received antenatal care, whether the mother received the TT vaccine, whether the baby received treatment for any illness, and whether the mother suffered from any disease, by comparing data from the 2011 and 2017-18 BDHS surveys. Given the regional variation in mortality patterns across Bangladesh, a division-based analysis was deemed crucial to understanding the underlying cause of death. Cause-specific death rates were computed for both the (2017–18) period and (2011) due to the limits of comparing proportional mortality ratios (PMRs) across time periods. This approach allowed for a more robust comparison of mortality patterns across age groups, gender, and type of residence.

Result

Comparative Analysis of Causes of Death Between 2011 and 2017-18

Consistently across the survey years (2011 and 2017-18), pneumonia remained the primary cause of death in children under five. In the 2017–18 survey period, preterm birth and birth asphyxia were the second and third most common causes of mortality for children under five, respectively, but things were quite different in 2011. In the 2011 survey, possible serious infections, birth asphyxia, and respiratory distress played significant roles following pneumonia. In both 2011 and 2017-18, pneumonia and birth asphyxia contributed substantially to the mortality rates among children under five. Neonatal tetanus, neonatal jaundice, malnutrition, and diarrhea collectively contributed a minor proportion of deaths in children under five during both the 2011 and 2017-18 periods. Measles, meningitis, and respiratory distress were not included in the 2011 survey but were found to be contributory factors in the 2017–18 survey, according to the review of causes of mortality in children under the age of five [Figure 02].

[Insert Figure 02 Here]

Figure 02: Distribution of cause of deaths in 2011 and 2017- 18 survey year.

Distribution of Causes of Death Across Different Age Groups

Table 01 enable a details comparison between the cause of death of survey year 2011 and survey year 2017-18 for age group. In both 2011 and 2017-18, all cases of birth asphyxia (100%) resulted in neonatal (aged 0-28 days) mortality, with birth asphyxia defined as a condition where a neonate's brain and other vital organs receive insufficient oxygen either before, during, or immediately after birth. Diarrhea mortality rates, however, displayed variation across the two time points. In 2011, the distribution of deaths from diarrhea was 73·41% among infants (1-11 months), 26·59% among child (12-59 months), and 0% among neonates (aged 0-28 days). This pattern shifted in 2017-18, with 69·02% of deaths occurring in infants (1-11 months), 26·74% in child (12-59 months), and a notable emergence of 4·23% fatalities among neonates (aged 0-28 days). Drowning is a significant cause of child mortality. In 2011, 97·80% of drowning fatalities were among child (12-59 months), 2·20% were infants (1-11 months), and 0% were neonates (aged 0-28 days). By 2017-18, the distribution had shifted, with 100% drowning deaths occurring among children, and no fatalities reported among neonates and infants. For both survey years, pneumonia continued to be the leading cause of mortality in all age groups (children, infants, and adults). In 2011, mortality rates from pneumonia were distributed as follows: 39·39% among neonates 46·94% among infants, and 13·67% among child age group. While pneumonia continued to be a significant threat in 2017-18, the mortality rates exhibited some variation. Neonatal deaths from pneumonia increased to 47·70%, whereas infant deaths decreased slightly to 41·45%. The mortality rate among child age group also showed a modest decline, reaching 10·85%. It is noteworthy, however, that a significant proportion of deaths remain unspecific [Table 01].

[Insert Table 01 Here]

Table 01: Percentage distribution of causes of death of children aged < 5 yr by Age Group of Child.

Table legend: *Data are presented as n (%).*

Figure 03 presents the cause of death stratified by three age groups: neonatal, infant, and child. Child are classified as 12 to 59 months old, infants as 1 to 11 months old, and neonates as from birth to 28 days old. Neonates were found to have the greatest proportion of deaths compared to other age groups. Following the neonatal period, the infant and child age groups exhibited the next highest mortality rates, respectively. Among neonates (aged 0-28 days), the leading causes of death are birth asphyxia, possible serious infection, preterm birth, and pneumonia. Pneumonia and diarrhea are the leading causes of death for infants aged 1 to 11 months. In the child age group (12-59 months), drowning exhibits the highest mortality ratio, followed by pneumonia. Across all three age groups (neonatal, infant, and child), pneumonia stands out as a significant contributor to mortality in children under five. This observation underscores the pervasive threat pneumonia poses to young children's health. While other causes may predominate within specific age groups, as noted with drowning in the child category, pneumonia consistently emerges as a major influencing child mortality statistic. This widespread impact highlights the importance of focusing preventive and treatment strategies to address pneumonia effectively within all age groups under five. It is important to acknowledge that a significant proportion of causes of death remain unspecific and Undetermined [Figure 03].

[Insert Figure 03 Here]

Figure 03: Distribution of cause of deaths across different age groups from 2011 to 2018.

Gender Distribution of Causes of Death from 2011 to 2018

Table 02 shows the distribution of causes of death by gender. Gender categorized as female and male. In 2011, 26.66% of female children and 73.34% of male children died from birth asphyxia. By 2017-18, the distribution shifted to 44.14% of female children and 55.86% of male children dying from birth asphyxia. This indicates that male children are more likely to die to birth asphyxia. In 2011, diarrhea exhibited a higher prevalence among females (68.01% of deaths) compared to males (31.99%). Drowning deaths also showed a slight female predominance (54.80% female, 45.20% male). Pneumonia displayed a more balanced distribution with 52.35% of deaths in females and 47.65% in males. However, the data from 2017-18 indicated a shift in these trends. Diarrhea deaths became more evenly distributed across genders, with 47.64% in females and 52.36% in males. Drowning mortality rates neared parity as well, with 49.14% of deaths in females and 50.86% in males. Pneumonia exhibited the most significant change, with a male predominance emerging (43.72% female, 56.28% male) [Table 02].

[Insert Table 02 Here]

Table 02: Percentage distribution of causes of death of children aged < 5 yr by Gender.

Table legend: *Data are presented as n (%).*

Figure 04 illustrates the distribution of mortality rates by cause of death and gender for the period 2011-2018. According to the data, pneumonia appeared to be the most common cause of death for kids in this period. Interestingly, the figure also indicates a possible higher prevalence of female child deaths from pneumonia compared to males. Conversely, birth asphyxia appears to have exhibited a higher prevalence of male child deaths than the female child deaths. It's crucial to remember that **Figure 04** also suggests potentially higher female child mortality rates for causes including possible serious infection, drowning, diarrhea, and preterm birth. In contrast, congenital abnormalities, malnutrition, birth injuries, neonatal jaundice, and respiratory distress seem to have resulted in a higher prevalence of male child deaths [Figure 04].

[Insert Figure 04 Here]

Figure 04: Gender Distribution of Causes of Death from.

Causes of Death by Place of Residence

For both survey years (2011 and 2017–18), the data (**Table 03**) indicates a higher prevalence of drowning deaths in rural areas compared to urban areas. In 2011, a substantial proportion of drowning deaths (87.40%) occurred in rural areas, with the remaining 12.60% occurring in urban areas. This trend persisted in 2017-18, with 77.21% of drowning deaths documented in rural locations and 22.79% in urban locations. These results demonstrate that drowning occurs more frequently in rural regions than in urban regions. Data on malnutrition-related child deaths revealed a concerning trend. In 2011, rural areas appeared to have a 100% mortality rate for children attributed to malnutrition, suggesting

no child deaths from malnutrition occurred in urban areas that year. This pattern continued, although with less extreme figures, during the period of 2017-18. Rural areas still exhibited a significantly higher prevalence of malnutrition deaths (75·14%) compared to urban areas (24·86%). These findings highlight a critical disparity in malnutrition-related child mortality rates between rural and urban locations. However, both in 2011 and the period of 2017-18, rural areas consistently exhibited a significantly higher prevalence of deaths attributable to several conditions compared to urban areas. These conditions included causes of deaths such as birth asphyxia (rural: 70·70% vs. urban: 29·30% in 2011; rural: 77·27% vs. urban: 22·73% in 2017-18), pneumonia (rural: 79·02% vs. urban: 20·98% in 2011; rural: 72·29% vs. urban: 27·71% in 2017-18), and possible serious infection (rural: 87·52% vs. urban: 12·48% in 2011; rural: 84·98% vs. urban: 15·02% in 2017-18). Notably, neonatal tetanus displayed a particularly stark disparity in 2011, with a nearly exclusive prevalence in rural areas (rural: 96·97% vs. urban: 3·03%). While the prevalence of neonatal tetanus deaths in rural areas decreased by 2017-2018 (rural: 65·40% vs. urban: 34·60%), the disparity between locations persisted. These findings highlight the concerning trend of geographically concentrated child mortality for specific causes [Table 03].

[Insert Table 03 Here]

Table 03: Percentage distribution of causes of death of children aged < 5 yr by Residence.

Table legend: *Data are presented as n (%)*.

Distribution of Causes of Death Across Different Divisions

The death rate distribution throughout Bangladesh's seven divisions Dhaka, Khulna, Rajshahi, Rangpur, Barisal, and Chittagong can be found in **Figure 05**. The data suggests that Dhaka exhibits the highest prevalence of deaths with (33·34%) compared to the other divisions. Chittagong (20·36%) follows Dhaka with a slightly lower mortality rate. Rajshahi (13·88%) appears to have a lower mortality rate than Chittagong. Sylhet (10·39%) and Rangpur (9·16%) seem to have comparable death ratios. Finally, Khulna (6·68%) and Barisal (6·19) display the lowest mortality rates among all Bangladeshi divisions [Figure 05].

[Insert Figure 05 Here]

Figure 05: Distribution of Causes of Death Across Different Divisions.

Trends in Maternal Antenatal Care for different Child Death Causes

In 2011, 37·94% of mothers received antenatal care for neonatal tetanus, compared to 62·06% who did not. This drastically changed by 2017, with all mothers receiving prenatal care at 100%. In 2011, 44·69% of women with congenital anomalies received prenatal treatment, while 55·31% did not. By 2017, 81·60% of people were receiving care, compared to 18·40% who were not. According to statistics on drowning, 70·21% of mothers received prenatal care in 2017, compared to 29·79% who did not. In terms of birth asphyxia, the percentage of moms who received antenatal care rose from 73·09% in 2011 to 83·65% in 2017, whereas the percentage of mothers who did not receive care fell from 26·91% to 16·35%. In 2011, 71·51% of mothers received prenatal care for delivery injuries; by 2017, that number had increased to 100%. According to data on diarrhea in 2017, 88·97% of women received prenatal care,

while 11.03% did not. About pneumonia, in 2011 49.53% of moms received prenatal treatment; by 2017, that number has risen to 75.62%, while the percentage of mothers who did not receive care fell from 50.47% to 24.38%. In 2011, 62.13% of women received prenatal care for newborn jaundice; by 2017, that number had risen to 100%. In 2011, 71.98% of pregnant women received measles prenatal care; in 2017, there were no cases reported. 84.58% case reported for respiratory distress in 2011 but no cases reported in 2017 for respiratory distress, although the percentage of people without care fell from 15.42% to 11.88%. Between 2011 and 2017, the percentage of preterm births treated increased from 35.07% to 81.88%, while the percentage of potentially dangerous infections increased from 54.02% to 94.92%. In 2017, all mothers got prenatal care for malnutrition, with no data available for 2011. From 2011 to 2017, the percentage of other causes increased 58.72%. Overall, the statistics show that, for the majority of child fatality reasons, prenatal care coverage significantly improved between 2011 and 2017 [Table 04].

[Insert Table 04 Here]

Table 04: Percentage distribution of causes of death of children aged < 5 yr by Mother receive antenatal care.

Table legend: *Data are presented as n (%).*

The rest of the variables are explained in the supplementary section.

Discussion

The study investigates the cause of death under five children in Bangladesh using data from 2011 and 2017-18 Demographic and Health Surveys. The findings reveal that pneumonia (19.36%), birth asphyxia (13.37%), preterm birth (9.45%), possible serious infections (11.15%), and drowning (6.98%) are the primary contributors to under-five mortality. Several studies align with our findings. For example, a recent study by (Halim et al. 2016) shows that birth asphyxia, serious infection, pneumonia, and prematurity were the most common causes of mortality³². Similar to this, a study carried out in 2003–2004 determined that pneumonia, respiratory distress syndrome (RDS), preterm birth, serious infection (meningitis/sepsis), and birth asphyxia were the main causes of death³⁷. According to another study done in India shows pneumonia, premature birth, serious infections (meningitis or sepsis), and diarrhea are the main causes of death for children under five³⁸. However, pneumonia consistently held the highest prevalence among all causes across both survey periods. According to earlier research, pneumonia remained Bangladesh's leading cause of death between 1993 and 2004, accounting for a significant number of deaths among children under the age of five²³.

The number of deaths from pneumonia in 2017–2018 was substantially lower compared to that in the previous years (2011) but still a primary cause of death. Recent studies show that pneumonia was a leading cause of death among children under five, with about 700,000 such deaths globally in 2015.⁵³ This could be a result of better vaccine coverage, improved access to health facilities, and increased awareness among people. According to (Oliwa & Marais, 2017) routine vaccination against common childhood illnesses is one of the most economical strategies to prevent deaths from pneumonia, the leading cause of mortality in young children⁴⁷. According to a recent comprehensive review, the incidence of child pneumonia dropped by 30% and mortality declined by 51% globally during the Millennium Development Goal period (2000 to 2015)⁴⁰. These reductions align with the decreased prevalence of major

pneumonia risk factors, such as rising socioeconomic development, preventive measures, better access to healthcare, and improved hospital care quality⁴⁰.

The second most common cause of death was birth asphyxia, which was mostly brought on by problems associated to childbirth and inadequate prenatal care. Compared to 2011, the prevalence of birth asphyxia increased by almost 5% between 2017 and 2018. Furthermore, compared to urban areas, the prevalence of birth asphyxia is significantly higher in rural areas. The differences in healthcare infrastructure between urban and rural areas exaggerate these trends, as healthcare facilities in rural regions of Bangladesh have much lower general readiness scores than those in urban areas⁴⁸. The fact that greater rates come from rural areas where there are fewer qualified birth attendants and access to emergency obstetric care further supports this aspect⁴¹. Despite improvements in other areas, deaths related to preterm births have increased in 2017-18 than 2011. This could happen because of the high fever during pregnancy, low antenatal visits by pregnant women, as well as early marriage⁴².

Drowning is a major public health concern, with a rising number of children between the ages of 12-59 months losing their lives to drowning. Comparing 2017-18 to 2011, the number of drowning-related deaths increased by nearly three percent. Unintentional drowning can occur due to various causes such as inadequate swimming skills, lack of adult supervision, daytime hours, rural location, male gender, and young age⁴⁹. The fatal drowning rate for children under five in Hunan Province, China, was 16.1/100000; children between the ages of one and two and those who played near water had the greatest rates⁴³.

Diarrheal disease-related deaths increased slightly, although as non-leading causes, they still contributed immensely to mortality, especially in infants. Diarrheal diseases-related deaths have slightly increased but were not leading causes; however, they still significantly contributed to mortality, especially among infants. Recent study shows, between 1980 and 2015, there was a significant decrease in the number of fatalities from diarrhea and all causes among children under five in low- and middle-income countries (LMIC)⁵².

In this study conducted in Bangladesh, the greater prevalence of mortality from pneumonia, premature birth, and serious infections is indicative of the common causes of death in underdeveloped nations. However, the number of deaths associated with preterm birth saw a significant increase in 2017-18 compared to 2011. According to (Blencowe et al.) Preterm birth rates increased in the majority of nations with consistent trend data, accounting for 14.9 million of all livebirths worldwide in 2010 with an estimated 11.1% of all births⁵⁴. Similarly, deaths related to birth asphyxia and drowning also showed a significant rise in 2017-18. But deaths associated with possible serious infections significantly decreased in 2017 compared to 2011. Less death is classified as Unspecific and undetermined deaths in 2017-18 than in 2011. Improved diagnostic tools and training of health personnel have contributed to more accurate diagnosis⁴⁴.

The results of the study show that infants (1-11 months) and children (12-59 months) have lower mortality rates than children in the neonatal period (0-28 days) (68.6%). Studies show that newborns had an exceptionally high chance of dying during this time. This study findings align with 2011 and 2017-18 BDHS report which shows that neonates have a higher prevalence of mortality compared to infants and child^{30,31}. Additionally, another study conducted by (Abir et

al., 2015) using 2004 – 2011 BDHS survey finds no significant reduction in neonatal deaths³⁶. Notably, deaths in the neonatal period are predominantly due to birth asphyxia, possible serious infections, pneumonia, and preterm birth, with birth asphyxia having the highest prevalence. Birth asphyxia and infections are the primary cause of death among neonates, while pneumonia is among infants, and drowning is predominant among children. According to a study conducted in 2010, almost 80% of neonatal deaths worldwide are attributed to three primary causes: infections, difficulties arising from preterm birth, and intrapartum-related neonatal deaths, sometimes known as birth asphyxia⁴⁵.

It's interesting to note that the study indicates that male children are more likely than female children to die. This disparity extends to the major causes identified, with pneumonia, Birth asphyxia, preterm birth, possible serious infections, and drowning exhibiting a greater male mortality ratio. This shows that compared to female children, male children are more susceptible to child mortality. This disparity can be attributed to differences in genetic and biological factors, along with environmental influences, with boys being inherently more vulnerable to diseases and early mortality due to their biological makeup⁵¹. Our observation that male children are more susceptible to child mortality than female children has been supported by earlier research. For example, a recent study reports that the death rate among children was higher for males than for females (59% vs. 41%, respectively)³². According to (Lawn et al.) In societies in which care is equal for boys and girls, newborn girls have a lower death rate compared to male child: the ratio of neonatal mortality for boys to girls is typically at least 1.2⁵⁰. Males were responsible for a greater percentage (54.8%) of child deaths than females, according to another study³⁷. Male children are more likely to die than female children, according to the BDHS reports from 2011 and 2017–18^{30,31}.

This study indicates that a majority of children who died received some form of treatment in both the survey years 2011 and 2017-18. In 2011, 52.71% of children who died had received treatment, while 46.69% had not received any treatment. This ratio improved in the subsequent survey year 2017-18, with 69.81% of children receiving treatment and 30.19% not receiving any treatment. The results suggest that the uptake of healthcare during childhood illness increased from 2011 to 2018. Additionally, this study findings suggest that birth asphyxia, possible serious infection, and pneumonia were the major causes for child deaths even though they receive treatment during their illness. However, a significant percentage of child deaths still occurred despite receiving treatment. Furthermore, a recent study that was carried out in four regions of Bangladesh discovered that the majority of parents (68.3%) went to the doctor when their child was sick³². These results show that even though the number of healthcare services rose between 2011 and 2018, the standard of care remained low.

According to the current study, child mortality is more common in rural than in urban settings. A different study that used data from the 2011 DHS survey found that child mortality was considerably greater in rural than in urban areas, which is consistent with our findings³⁴. Children from rural regions are more likely to die than children from urban areas, according to the BDHS statistics from 2011 and 2017-18^{30,31}. Rural areas exhibited higher mortality rates in most causes of death, including major illnesses, pneumonia, and asphyxia at birth. This evidently shows a difference in access to health care or its quality between urban and rural settings. Children who live in rural areas experience delayed treatment with less access to preventive care⁴⁶. Current research indicates that children die more frequently from pneumonia in urban settings than in rural ones. On the other hand, rural locations see a much higher frequency

of drowning-related fatalities than do metropolitan ones. This study observed that the number of drowning-related deaths is much higher in rural than in urban settings has been supported by other investigations. Drowning appears to be less common in urban areas than in rural areas, according to a study done in Bangladesh based on the BDHS 1993/94 and BDHS 1996/97 surveys³³. Comparably, another study reveals that the prevalence of drowning among children aged 12-59 months in rural areas is about twice as high as in urban areas (22 percent vs. 12 percent)³⁵. Additionally, birth asphyxia shows a higher prevalence in urban areas. Preterm birth also contributes to a higher mortality rate in urban areas compared to rural regions.

According to this study findings, 33.34% of all deaths in the survey years 2011 and 2017–18 occurred in the Dhaka division, which includes both the Dhaka and Mymensingh divisions. This suggests that the Dhaka division has the greatest rate of mortality among children under five. This signifies that one-third of all child deaths during these survey periods occurred in the Dhaka division. Chittagong division follows with 20.36% of the total prevalence of child deaths in the same survey years. Rajshahi division is next, contributing 13.88% of the total deaths. Sylhet division accounts for 10.39% of child deaths, while Rangpur division accounts for 9.16%. Khulna and Barisal divisions have the lowest percentages, with 6.68% and 6.19% of total child deaths, respectively, in the survey years 2011 and 2017-18. Thus, in the formation of regional differences, there could be the influence of variations on health infrastructure and socioeconomic status, together with public health initiatives. The 2011 and 2017-18 BDHS reports confirm our findings that Dhaka and Chittagong division have the highest prevalence of deaths in both 2011 and 2017-18 survey year than the other division^{30,31}.

This study suggests a significant majority of child deaths occur among mothers who are either young adults (20-30 years) or adolescents (11-19 years), with young adult mothers being the most affected group. The data shows 46% of child deaths occur among young adults (20-30 years) mothers and 42.79% among adolescents (11-19 years) mothers. However, only 11.06% child deaths occur among mothers who are adults' mother (31-46 years). Young and adolescent maternal age conventionally is a factor that correlates with higher risks of complications during pregnancy and childbirth. According to Khan and Awan's (2017) study, children born to mothers between the ages of 25 and 34 had a lower death risk than children born to moms under the age of 25 across all models³⁹. And, at the same time, a marker for lower socioeconomic status and education level both associated with lower access and quality of healthcare. The study conducted by Khan and Awan's (2017) suggests that social factors are involved to the child health, but mother biological maturity also affects the health of her children³⁹.

This study shows that most mothers whose children died had received some form of antenatal care in both 2011 and 2017-18. In 2011, 57.75% of children who died had received treatment, while 42.25% had not. This ratio improved significantly by the 2017-18 survey, with 82.41% of children receiving treatment and 17.59% not receiving any. The findings suggest that the uptake of antenatal care during pregnancy increased from 2011 to 2018. However, a significant percentage of child deaths still occurred despite receiving antenatal care. Birth asphyxia, possible serious infection, and pneumonia were the major causes for which mothers received antenatal care during pregnancy. This could be due to the lack of quality healthcare systems, even though the number of mothers receiving antenatal care increased from 2011 to 2018.

Policy Recommendation

This study highlights the critical need to prioritize interventions targeting neonatal mortality. Healthcare systems should be restructured to address leading causes of child death, including pneumonia, birth asphyxia, severe infections, preterm birth and other. Given the disproportionate burden on major divisions with highly dense population like Dhaka and Chittagong, strengthening healthcare infrastructure in these urban centers is crucial. Furthermore, given the higher rates of child mortality in rural areas, it is imperative to extend and improve the quality of healthcare services available in these areas. Multifaceted, community-based strategies are required to avoid drowning. These strategies should include child monitoring, education about water safety, and improved infrastructure to reduce the risk of accidents. The study further emphasizes the significant association between child death and adolescent motherhood (ages 11-19 years), underlining the necessity of stopping child marriage practices. This increase in deaths due to preterm birth and birth asphyxia reflects a specific need to accelerate efforts on maternal health issues and strengthen neonatal care services. Attention should therefore be paid to the promotion of pre-natal care, management of infections in mothers, and specialized support for preterm babies. The period from 2011 to 2018 witnessed an increase in the quantity of healthcare services, there was no corresponding improvement in quality. To prevent child deaths, it is recommended to increase access to healthcare services while concentrating on raising the standard of care provided in both community and facility settings. Raising public awareness at the local level is imperative for achieving a noteworthy decrease in child mortality.

Strength

To the best of the author's knowledge, no studies have specifically investigated the changes or evolution in the causes of child mortality between the DHS 2011 and DHS 2017-18 surveys. Additionally, this is the first study utilizing data from both the DHS 2011 and DHS 2017-18 surveys. This study fills this gap by providing a comprehensive analysis of the changes in mortality causes over these periods. Additionally, we consider several factors, such as maternal antenatal care, TT vaccination, infant illness treatment, mother ages and maternal health conditions, to identify the causes behind child mortality, making our study multidimensional.

Limitations

This study relies solely on data from the 2011 and 2017-18 Bangladesh Demographic and Health Surveys (DHS). While DHS data is valuable, it might not capture all factors such as wealth index, mother education influencing child mortality. Furthermore, the study focuses on Bangladesh and may not be generalizable to other countries with different healthcare systems, demographics, and socioeconomic factors.

Conclusion

This study examined the primary causes of death for children under five in Bangladesh using data from the Demographic and Health Surveys (DHS) conducted in 2011 and 2017–18. The findings of the study revealed that pneumonia, birth asphyxia, severe infections, and preterm birth were the primary contributors to child death. Notably, the neonatal period (0-28 days) has the highest mortality. In addition, a discrepancy between children in rural and

urban areas was found in the study; the former had a greater fatality rate. Additionally, a major burden of child mortality was borne by highly populous divisions like Dhaka and Chittagong. Considering these results, the study underscores that healthcare systems, particularly in rural areas and densely populated regions, must be strengthened to ensure the delivery of high-quality care. Concerted efforts are required to address the root causes of child death, including the eradication of child marriage practices. Finally, fostering public awareness at the community level is crucial to empower families with the knowledge and resources necessary to promote child health, well-being and antenatal care.

Acknowledgement

The authors express gratitude to the DHS program for generously providing all the data at no cost.

Declaration of interests

The author declares no conflict of interest.

Data Sharing

All data are freely accessible on the DHS official website and can also be obtained upon request from the corresponding authors. DHS official website: <https://dhsprogram.com/>

Authors Contributions

The study was designed by MRH, MBA, and MSH. Together, MRH, MBA, DA and NC wrote the report. MRH organizes the report as a complete. MBA creates virtualization and cleans the data for the study. MRH analyzes the data. The analysis result is tabulated by DA and NC. MSH and MJU provided important intellectual input at different stages of the work. MSH and MJU also commented on the drafts of the report.

Ethical Approval

This study utilizes publicly available secondary data from the Demographic and Health Survey (DHS). The data is freely accessible to all researchers, and the DHS program has granted explicit authorization for its use in this research. As such, no ethical approval was required for this study.

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Table 01: Percentage distribution of causes of death of children aged < 5 yr by Age Group of Child.

Age Group									
	2011				2017				(2011 -17)
Cause of deaths	Neonatal (0-28 days)	Infant (1-11 Months)	Child (12-59 Months)	Total	Neonatal (0-28 days)	Infant (1-11 Months)	Child (12-59 Months)	Total	Total
Birth asphyxia	51·37(100)	NA	NA	51·37(100)	73·96(100)	NA	NA	73·96(100)	125·33
Birth injury	13·3(100)	NA	NA	13·3(100)	20·38(100)	NA	NA	20·38(100)	33·68
Congenital Abnormality	3·39(100)	NA	NA	3·39(100)	21·19(73·03)	4·42(15·22)	3·41(11·75)	29·02(100)	32·41
Diarrhea	NA	6·47(73·41)	2·34(26·59)	8·81(100)	0·61(4·23)	10·01(69·02)	3·88(26·74)	14·5(100)	23·31
Drowning	NA	0·56(2·20)	24·96(97·80)	25·52(100)	NA	NA	39·86(100)	39·86(100)	65·38
Malnutrition	NA	1·95(100)	NA	1·95(100)	4·3(81·66)	NA	0·97(18·34)	5·27(100)	7·22
Measles	2·13(42·39)	2·89(57·61)	NA	5·02(100)	NA	NA	NA	NA	5·02
Meningitis	0·52(6·21)	7·81(93·79)	NA	8·33(100)	NA	NA	NA	NA	8·33
Neonatal jaundice	8·9(100)	NA	NA	8·9(100)	8·34(92·43)	0·68(7·57)	NA	9·02(100)	17·92
Neonatal tetanus	8·88(100)	NA	NA	8·88(100)	4·74(100)	NA	NA	4·74(100)	13·62
Other causes	NA	8·27(63·79)	4·7(36·21)	12·97(100)	15·24(45·71)	8·67(26·00)	9·43(28·29)	33·34(100)	46·31
Pneumonia	38·75(39·39)	46·18(46·94)	13·45(13·67)	98·38(100)	39·58(47·70)	34·39(41·45)	9·01(10·85)	82·98(100)	181·36
Possible Serious infection	65·59(100)	NA	NA	65·59(100)	36·68(94·27)	2·23(5·73)	NA	38·91(100)	104·5
Premature birth	28·34(100)	NA	NA	28·34(100)	59·01(98·01)	1·2(1·99)	NA	60·21(100)	88·55
Respiratory distress	25·79(100)	NA	NA	25·79(100)	NA	NA	NA	NA	25·79
Undetermined	22·66(74·51)	5·61(18·44)	2·14(7·05)	30·41(100)	6·44(74·63)	2·19(25·37)	NA	8·63(100)	39·04
Unspecific	58·98(71·21)	11·81(14·26)	12·03(14·52)	82·82(100)	23·92(65·65)	10·86(29·81)	1·65(4·53)	36·43(100)	119·25

Table 02: Percentage distribution of causes of death of children aged < 5 yr by Gender.

Gender							
	2011			2017			(2011-17)
Cause of deaths	Female	Male	Total	Female	Male	Total	Total
Birth asphyxia	13·7(26·66)	37·67(73·34)	51·37(100)	32·64(44·14)	41·31(55·86)	73·95(100)	125·32
Birth injury	6·13(46·08)	7·17(53·92)	13·3(100)	8·1(39·77)	12·28(60·23)	20·38(100)	33·68
Congenital Abnormality	2·84(83·69)	0·55(16·31)	3·39(100)	11·38(39·21)	17·64(60·79)	29·02(100)	32·41
Diarrhea	5·99(68·01)	2·82(31·99)	8·81(100)	6·91(47·64)	7·59(52·36)	14·5(100)	23·31
Drowning	13·99(54·80)	11·54(45·20)	25·53(100)	19·59(49·14)	20·27(50·86)	39·86(100)	65·39
Malnutrition	NA	1·95(100)	1·95(100)	2·72(51·72)	2·54(48·28)	5·26(100)	7·21
Measles	2·13(42·39)	2·89(57·61)	5·02(100)	NA	NA	NA	5·02
Meningitis	4·78(57·44)	3·54(42·56)	8·32(100))	NAs	NA	NA	8·32
Neonatal jaundice	1·24(13·96)	7·66(86·04)	8·9(100)	0·72(7·96)	8·3(92·04)	9·02(100)	17·92
Neonatal tetanus	2·78(31·30)	6·1(68·70)	8·88(100)	3·64(76·82)	1·1(23·18)	4·74(100)	13·62
Other causes	7·43(57·31)	5·54(42·69)	12·97(100)	17·47(52·39)	15·88(47·61)	33·35(100)	46·32
Pneumonia	51·5(52·35)	46·88(47·65)	98·38(100)	36·28(43·72)	46·71(56·28)	82·99(100)	181·37
Possible Serious infection	30·94(47·17)	34·65(52·83)	65·59(100)	21·81(56·05)	17·1(43·95)	38·91(100)	104·5
Premature birth	14·09(49·70)	14·26(50·30)	28·35(100)	28·54(47·40)	31·67(52·60)	60·21(100)	88·56
Respiratory distress	9·91(38·43)	15·88(61·57)	25·79(100)	NA	NA	NA	25·79
Undetermined	11·9(39·14)	18·51(60·86)	30·41(100)	2·68(31·08)	5·95(68·92)	8·63(100)	39·04
Unspecific	36·5(44·08)	46·32(55·92)	82·82(100)	16·95(46·52)	19·48(53·48)	36·43(100)	119·25

Table 03: Percentage distribution of causes of death of children aged < 5 yr by Residence.

Cause of deaths	Residence						
	2011			2017			(2011-17)
	Rural	Urban	Total	Rural	Urban	Total	Total
Birth asphyxia	36.32(70.70)	15.05(29.30)	51.37(100)	57.15(77.27)	16.81(22.73)	73.96(100)	125.33
Birth injury	9.78(73.55)	3.52(26.45)	13.3(100)	12.32(60.46)	8.06(39.54)	20.38(100)	33.68
Congenital Abnormality	2.84(83.69)	0.55(16.31)	3.39(100)	16.76(57.77)	12.25(42.23)	29.01(100)	32.4
Diarrhea	5.76(65.38)	3.05(34.62)	8.81(100)	10.72(73.96)	3.78(26.04)	14.5(100)	23.31
Drowning	22.31(87.40)	3.22(12.60)	25.53(100)	30.78(77.21)	9.08(22.79)	39.86(100)	65.39
Malnutrition	1.95(100)	NA	1.95(100)	3.96(75.14)	1.31(24.86)	5.27(100)	7.22
Measles	3.17(63.22)	1.85(36.78)	5.02(100)	NA	NA	NA	5.02
Meningitis	6.98(83.84)	1.34(16.16)	8.32(100)	NA	NA	NA	8.32
Neonatal jaundice	8.1(90.97)	0.8(9.03)	8.9(100)	9.02(100)	0(0.00)	9.02(100)	17.92
Neonatal tetanus	8.61(96.97)	0.27(3.03)	8.88(100)	3.1(65.40)	1.64(34.60)	4.74(100)	13.62
Other causes	9.78(75.38)	3.19(24.62)	12.97(100)	28.25(84.73)	5.09(15.27)	33.34(100)	46.31
Pneumonia	77.74(79.02)	20.64(20.98)	98.38(100)	59.99(72.29)	22.99(27.71)	82.98(100)	181.36
Possible Serious infection	57.41(87.52)	8.19(12.48)	65.6(100)	33.07(84.98)	5.84(15.02)	38.91(100)	104.51
Premature birth	22.64(79.88)	5.7(20.12)	28.34(100)	43.2(71.75)	17.01(28.25)	60.21(100)	88.55
Respiratory distress	19.94(77.32)	5.85(22.68)	25.79(100)	NA	NA	NA	25.79
Undetermined	25.17(82.77)	5.24(17.23)	30.41(100)	8.63(100)	NA	8.63(100)	39.04
Unspecific	62.93(75.99)	19.89(24.01)	82.82(100)	29.45(80.83)	6.99(19.17)	36.44(100)	119.26

Table 04: Percentage distribution of causes of death of children aged < 5 yr by Mother receive antenatal care.

Mother receive antenatal care							
	2011			2017			
Cause of deaths	Yes	No	Total	Yes	No	Total	Total (2011-17)
Neonatal tetanus	3·37 (37·94)	5·51(62·06)	8·88(100)	0·90(100)	NA	0·90(100)	9·78
Congenital abnormality	1·52(44·69)	1·87(55·31)	3·39(100)	14·66(81·60)	3·30(18·40)	17·96(100)	21·35
Drowning	NA	NA	NA	22·38(70·21)	9·50(29·79)	31·87(100)	31·87
Birth asphyxia	36·98(73·09)	13·61(26·91)	50·59(100)	38·97(83·65)	7·62(16·35)	46·59(100)	97·18
Birth injury	9·50(71·51)	3·78(28·49)	13·3(100)	13·47(100)	NA	13·47(100)	26·77
Diarrhea	NA	NA	NA	10·65(88·97)	1·32(11·03)	11·97(100)	11·97
Pneumonia	17·47(49·53)	17·80(50·47)	35·28(100)	46·56(75·62)	15·01(24·38)	61·56(100)	96·84
Neonatal jaundice	5·53(62·13)	3·37(37·87)	8·9(100)	4·75(100)	0·00	4·75(100)	13·65
Measles	1·53(71·98)	·59(28·02)	2·13(100)	NA	NA	NA	2·13
Meningitis	NA	·52(100·00)	0·52(100)	NA	NA	NA	0·52
Respiratory distress	21·30(84·58)	3·88(15·42)	25·19(100)	NA	NA	NA	25·19
Preterm birth	9·941(35·07)	18·40(64·93)	28·34(100)	29·09(81·88)	6·44(18·12)	35·53(100)	63·87
Possible serious infection	35·43(54·02)	30·16(45·98)	65·59(100)	23·76(94·92)	1·27(5·08)	25·03(100)	90·62
Malnutrition	NA	NA	NA	4·30(100)	NA	4·30(100)	4·3
Other causes	NA	NA	NA	11·05(58·72)	7·77(41·28)	18·82(100)	18·82
Unspecific	26·06(44·19)	32·91(55·81)	58·98(100)	19·28(97·69)	0·46(2·31)	19·73(100)	78·71
Undetermined	11·70(51·63)	10·96(48·37)	22·66(100)	0·80(55·95)	0·63(44·05)	1·43(100)	24·09

Figure 01: Physician review process

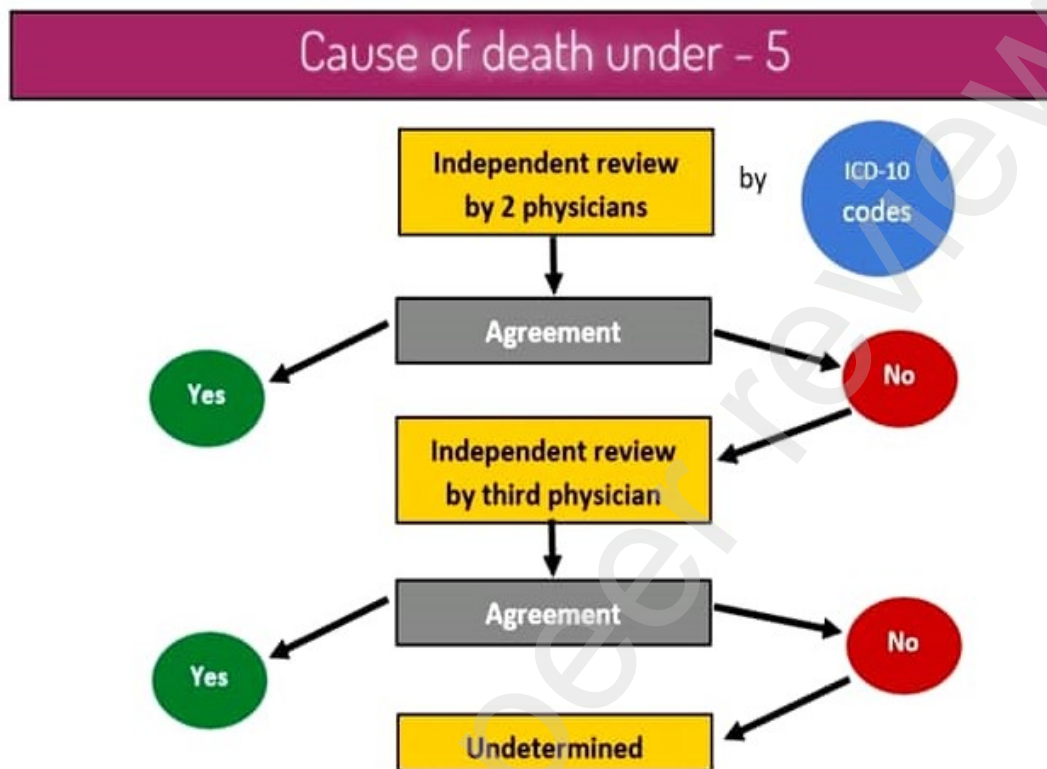


Figure 02: Distribution of cause of deaths between 2011 to 2018

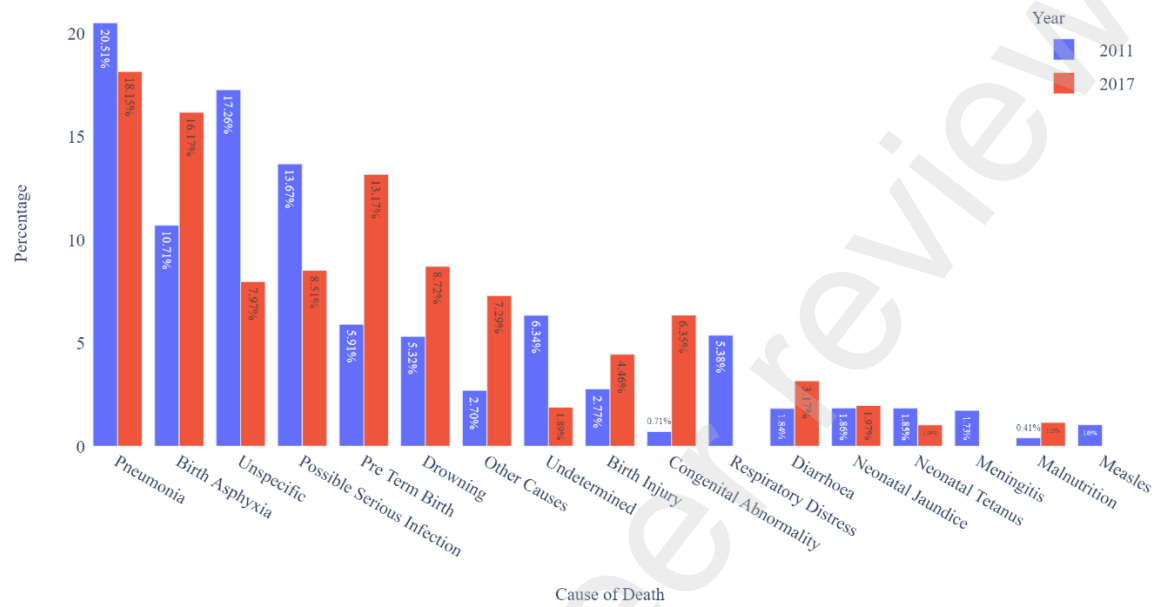


Figure 03: Distribution of cause of deaths across different age groups from 2011 to 2018.

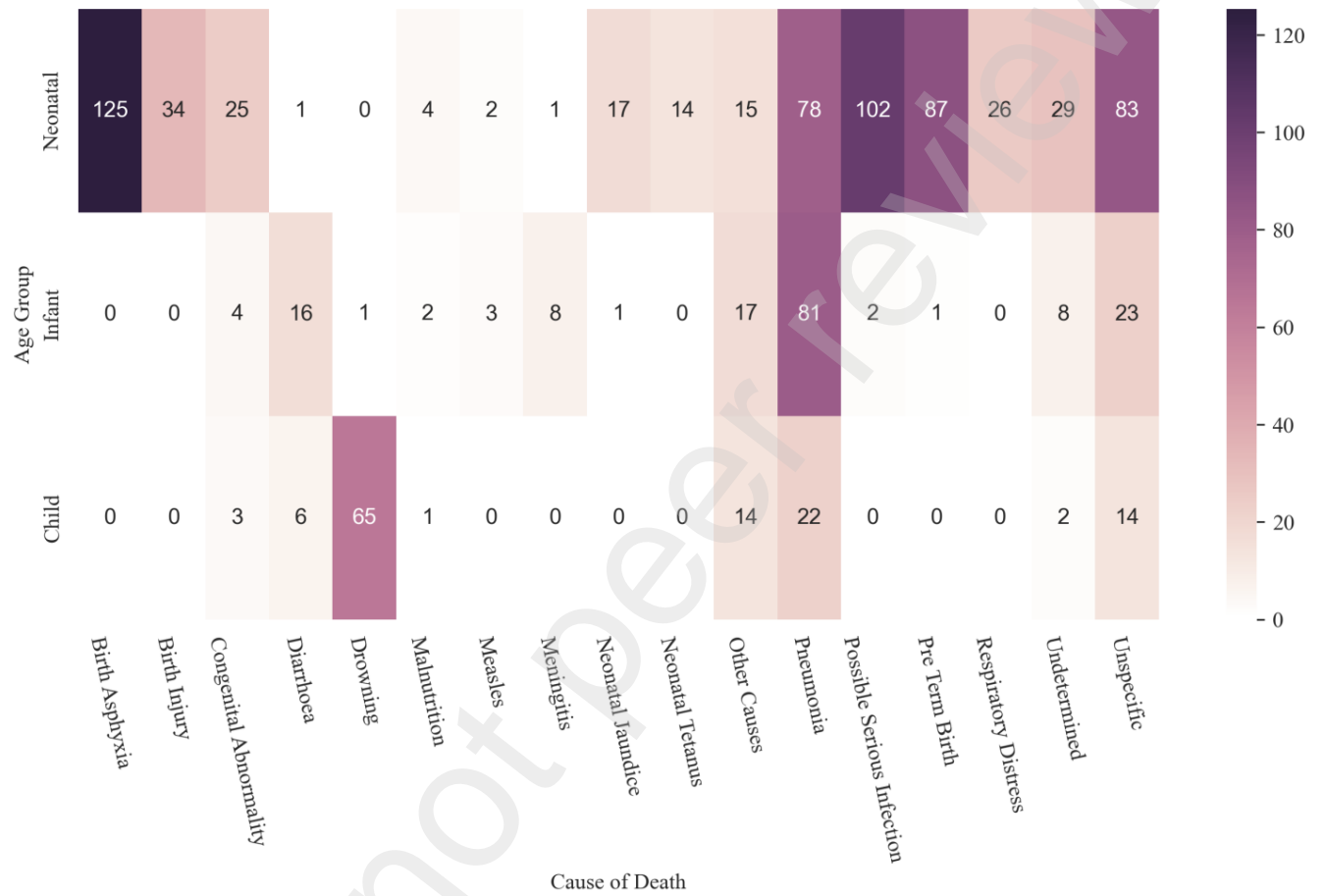


Figure 04: Gender Distribution of Causes of Death from.



Figure 05: Distribution of Causes of Death Across Different Divisions.

