

## The Cause of Early Neonatal Death and its Relevance to Intervention

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### Abstract

**Background and Objective:** Neonatal mortality is considered for a significant proportion of deaths in children under the age of five. Despite the decline in child mortality rates and significant improvement in neonatal medicine, neonatal mortality, particularly early neonatal death, is a major cause of infant mortality. Therefore, investigation of the causes of neonatal mortality, especially early neonatal deaths, in each geographical area is of great importance. Therefore, we decided to evaluate the rate and causes of early neonatal mortality in a reference hospital in Tehran.

**Materials and Methods:** Our study is a cross-sectional, retrospective review conducted in the neonatal and neonatal intensive care units of Shariati Hospital over an 8-year period. All neonates born during this period who experienced death within the first week of life were examined for the cause and timing of death. The recorded information was subjected to statistical analysis.

**Results:** A total of 2050 neonates were born over the 8-year period, and there were 189 cases of early neonatal mortality. More than 50% of the deceased neonates had a birth weight of less than 2500 grams, and the most common causes of death were respiratory problems, followed by congenital anomalies.

**Conclusion:** Given that the majority of deaths occurred in low-birth-weight neonates, supporting mothers during pregnancy and appropriately monitoring fetal weight play important roles in reducing early neonatal mortality. Additionally, appropriate interventions at birth to treat respiratory problems can reduce neonatal mortality.

**Keywords:** Neonate; Neonatal Mortality; Low Birth Weight

### Introduction

Neonatal mortality is one of the crucial socio-economic and health status of any society. Annually, it is estimated that approximately 4 million neonatal deaths occur worldwide, accounting for 40% of child mortality under five years [1]. In accordance with WHO statistics in 2010, two-thirds of deaths of children under one year happened in the neonatal period. In 2015, 45% of deaths under five were in the neonatal period, principally due to preterm birth [2]. In Iran, over the past 15 years, preterm birth has been the leading cause of neonatal mortality, with a rate of 10.7 per 1000 live births [3]. The most recent national study on disease burden in Iran, published in 2007, reported preterm birth complications as the fourth leading cause of disease burden [4]. Studies have shown that congenital anomalies, preterm birth complications, and respiratory infections were the leading causes of death in children under five in Iran in 2010 [5]. Neonatal mortality is a major public health concern because it occurs over 30 times more frequently than post-neonatal deaths [6].

Neonatal mortality is still a problem, especially in emerging and underdeveloped nations, despite tremendous advancements in maternal-fetal care and neonatal medicine. There is significant variability in neonatal mortality rates across different regions. In Bahrain, this rate is 2 per 1000 live births, while in Somalia, it is 46 per 1000 live births [3]. Better healthcare systems and economic development in countries with medium and high incomes have reduced neonatal mortality rates. Iran's infant death rate is still greater than that of its neighbors, including Turkey, Saudi Arabia, Bahrain, Oman, and Qatar, even though it decreased by 63% between 1990 and 2013 [6]. Iran's top health goal is to identify and address the causes of newborn mortality. Since the distribution of causes varies between both categories, it is crucial to determine the precise causes of early vs late newborn death.

Although identifying the exact causes of neonatal mortality is not always possible, focusing on the factors and conditions during pregnancy and the perinatal period that disrupt the adaptation of a newborn to life outside the womb can be illuminating. The most important causes of neonatal death are preterm birth, congenital anomalies, neonatal respiratory distress syndrome, asphyxia, and neonatal infections [7].

Determining the causes of neonatal death in any region is an effort to reduce neonatal mortality, with the goal of developing short-term and long-term health plans to reduce child mortality under the age of five, which is one of the most important health indicators.

Early neonatal death refers to the death of a newborn from birth until the end of the first week of life, accounting for 75% of all postnatal deaths [8].

Despite a significant reduction in the mortality rate of children under five years old, there has unfortunately not been a notable decrease in early neonatal mortality rates in recent decades. Therefore, we conducted this study in one of the major referral hospitals in Tehran over eight years to determine the rate of early neonatal mortality and its causes, aiming to take steps towards its reduction through coherent and appropriate planning. Understanding the causes of neonatal death allows for necessary interventions and health planning. Additionally, it is essential to distinguish the specific causes of early neonatal death from late neonatal death, as the distribution of causes differs between these two groups.

### Materials and Methods

This retrospective, cross-sectional study was conducted in the neonatal and neonatal intensive care units of Shariati Hospital in Tehran. All neonates born from 1999 to 2007 were included. Demographic data, including gender, weight, gestational age, time of death, and cause of death, were extracted from the medical records. Stillbirths were excluded. Quantitative variables were expressed as percentages and numbers. Statistical analysis was performed using chi-square and t-tests with SPSS version 18.

### Results

In this eight-year study, 2050 neonates were born, and 189 experienced early neonatal death (7.5% of births). Among these deaths, 117 (61.9%) were male, and 72 (38.1%) were female, with a higher mortality rate in males, although not statistically significant. Of the early neonatal deaths, 113 (58.5%) were delivered by cesarean section, and 80 (41.5%) by natural birth. About 10% of early neonatal deaths occurred in neonates with a gestational age of less than 37 weeks, and more than 50% of deceased neonates weighed less than 2500 grams at birth. The average weight of deceased neonates was  $1522.03 \pm 1608.31$  grams, with males averaging  $1583.04 \pm 1954.48$  grams and females  $1452.78 \pm 929.90$  grams. Early neonatal deaths occurred in 84 neonates (43.1%) within the first 6 hours of birth and in 111 neonates (56.9%) after 6 hours up to 7 days. The causes of early neonatal death and the timing of these deaths are detailed in table 1.

This table shows information on the different causes of early neonatal deaths and the timing of these deaths. The data is broken down by the sex of the neonates (boys and girls) and the percentage of deaths for each cause. Additionally, the statistical p-value for some of the causes of death is provided.

Cause of Death	Total (Count)	Total (%)	Boys (Count)	Boys (%)	Girls (Count)	Girls (%)	p-value
Congenital anomalies	27	14%	13	18.6%	14	12%	0.468
Low birth weight	93	50.3%	36	48.7%	36	51.4%	
Respiratory problems	46	23.9%	30	25.6%	16	21.4%	
Cardiac problems	5	2.6%	5	4.3%	0	0.0%	
Brain problems	1	0.5%	0	0.0%	1	1.4%	
Prematurity	10	5.2%	7	6.0%	3	4.3%	
Infectious diseases	3	1.6%	2	1.7%	1	1.4%	
Apnea of prematurity	3	1.6%	2	1.7%	1	1.4%	
Death before 6 hours	86	43.1%	58	47.9%	26	36.1%	0.113
Death after 6 hours until the end of the first week	111	56.9%	53	52.1%	58	63.9%	

**Table 1:** Different causes of early neonatal deaths and timing of neonatal deaths.

### Discussion and Conclusion

Lowering mortality rates is the main objective of research on infant death causes. Similar research has been done in Iran and other countries, and it should be done again on a regular basis because the outcomes can change depending on the location and time period. Males made up the majority of deaths in our study (61.9% vs. 38.1%). Males also had greater rates of neonatal mortality, according to other studies, including one on neonates in Pakistan and another on the health of newborns in Nepal. Males are more likely to give birth prematurely and to experience respiratory issues. Other studies, such as one on Pakistani neonates and another on neonatal health in Nepal, also found higher neonatal mortality rates in males. The likelihood of preterm birth is higher in males, and they are at greater risk of respiratory problems. Considering that respiratory distress syndrome was a leading cause of early neonatal death, the higher mortality rate in males in this study is justifiable [9,10]. The predominant mode of delivery among deceased neonates was cesarean section. This rate exceeded the national average in our analysis, most likely because the hospital under investigation had to do cesarean deliveries for high-risk pregnancies. 48% of deliveries in Iran between 2000 and 2012 occurred via cesarean section, according to a thorough review of statistics. In a systematic review of data from 2000 to 2012, cesarean sections accounted for 48% of deliveries in Iran [11]. The average weight of deceased neonates in our study was 1522.03 grams, indicating that, on average, the neonates who died had a birth weight of less than 2500 grams. A 2017 study in Pakistan found an inverse relationship between birth weight and neonatal mortality, with low birth weight neonates having a neonatal mortality rate four times higher than the overall neonatal mortality rate [12]. Approximately half of the deceased neonates in our study were low birth weight. In the current study, 43% of early neonatal deaths occurred within the first 6 hours of life, and 57% occurred after the first 6 hours up to 7 days. A 2010 study in Bangladesh reported that 84% of neonatal deaths occurred in the first week of life, with only 16% occurring after the first week. Birth asphyxia was the leading cause of early neonatal death in that study, attributed to the lack of skilled personnel for delivery and neonatal resuscitation [13].

The most common cause of early neonatal death in our study was low birth weight, followed by respiratory problems and congenital anomalies, while prematurity accounted for only 5.2% of early neonatal deaths. In centers with advanced neonatal care and efforts to prevent preterm births, prematurity is not the leading cause of neonatal death. However, the most frequent reason for early neonatal death in underdeveloped nations is preterm. According to a 2016 Babaii study, sepsis (22.6%) and respiratory disorders (33%) were the most frequent causes of neonatal fatalities in NICUs, accounting for 81% of all deaths in low birth weight neonates. Eighty percent of newborn deaths happened during the first week of life [14]. The results of this study, which was carried out at a Kermanshah NICU, are comparable

in a number of ways. Due to a shortage of trained people for delivery and newborn resuscitation, a study on the causes of neonatal death in three countries-Bangladesh, Nepal, and India-identified birth asphyxia as the most common cause of neonatal death [15].

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