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## Causes of under five-year mortality in the central child teaching hospital

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### Abstract

**Background:** Under-five mortality (U5M) is a significant public health concern that reflects the overall strength and development of a healthcare system. The leading causes of U5M include prematurity and its complications, pneumonia, and diarrheal diseases.

**Objectives:** This study aims to identify the most common causes of U5M and analyze the effects of various factors on mortality rates.

**Patients and Methods:** A retrospective study was conducted at the Central Child Teaching Hospital in Baghdad, reviewing all under-five mortality cases admitted in 2015. Data were collected from medical records and analyzed.

**Results:** Out of 11,884 admissions, there were 654 under-five deaths, with a mortality rate of 55 per 1,000 admissions. Neonatal mortality accounted for 40.2% of U5 deaths. The primary causes of neonatal mortality were prematurity, congenital anomalies, and sepsis. In early childhood, pneumonia, gastroenteritis, and malignancy were the most common causes. Identified risk factors included male gender, low birth weight, lack of breastfeeding, and consanguineous families. Additional neonatal risk factors were preterm birth, cesarean delivery, maternal age (20-30 years), and maternal gestational diseases.

**Conclusions:** Prematurity remains the leading cause of neonatal mortality, while pneumonia is the most common cause in early childhood. Neonatal mortality constitutes a major portion of U5 deaths, with congenital anomalies and malignancies playing an increasing role in overall mortality.

**Keywords:** U5 mortality, neonatal period, early childhood period

### Introduction

Child mortality is a crucial health issue and an indicator of a country's overall health status [1]. In the early 17th century, life expectancy in England was around 35 years due to high child mortality rates. However, during the Industrial Revolution, child survival improved significantly [2]. Under-five mortality (U5M) remains a major global health challenge, necessitating accurate measurement of mortality levels and causes in this population.

### Measures of Child Mortality

The key indicators include:

- Under-five mortality rate (U5MR): Probability of a child dying before the age of five [3].
- Infant mortality rate (IMR): Probability of death before the first birthday [3].
- Neonatal mortality rate (NMR): Probability of death within the first 28 days of life [3].

Neonatal deaths account for 45% of U5M, primarily due to complications such as preterm birth, birth asphyxia, trauma, and sepsis [4, 5]. Beyond the neonatal period, infectious diseases are the leading causes of death, including pneumonia (22%), diarrheal diseases (15%), malaria (12%), and HIV/AIDS (3%) [3].

### Risk Factors

Neonatal deaths are linked to maternal complications such as bleeding, hypertension, obstructed labor, infections, and lack of skilled care during childbirth [6]. For children aged one month to five years, key risk factors include low birth weight, lack of breastfeeding, undernutrition, overcrowded living conditions, indoor air pollution, unsafe drinking water, and poor hygiene [6].

## Global Trends in U5M

Since the 1990s, child mortality has significantly declined. In 1990, 12.6 million under-five children died annually, decreasing to 6.6 million by 2012. The U5M rate dropped from 90 per 1,000 live births in 1990 to 48 in 2012, with the highest rates in Sub-Saharan Africa (98 per 1,000 live births) [7]. In 2015, an estimated 5.9 million children died before their fifth birthday, with 45% of deaths occurring in the neonatal period [5].

## Prevention and Treatment

Most causes of U5M are preventable with cost-effective interventions, including immunization, adequate nutrition, reducing indoor air pollution, exclusive breastfeeding for six months, and improved hygiene [8]. Treatment strategies include antibiotic therapy and oxygen for pneumonia, as well as hydration and zinc supplementation for diarrhea. Universal coverage of these interventions could prevent 95% of diarrhea deaths, 67% of pneumonia deaths, and reduce total U5M by over 1.4 million by 2025 [9].

## Aims of the Study

1. To identify the causes of mortality in children under five years.
2. To examine the relationship between U5M and various factors, including gender, body weight, feeding type, and consanguinity. For neonates, additional variables include maternal age, gestational diseases, gestational age, and mode of delivery.

## Method

This retrospective study was conducted over three months at the Central Child Teaching Hospital in Baghdad. It included all under-five mortality cases from 2015, totaling 654 reports.

## Inclusion and Exclusion Criteria

### Inclusion criteria

1. Children under five years old.
2. Inpatient deaths within the hospital.

### Exclusion criteria

1. Children aged five years and above.
2. Deaths on arrival or in the emergency department.

**Data Collection:** A data form was developed from various Arabic studies, collecting details on patient demographics, admission and death dates, cause of death, feeding type, consanguinity, and neonatal-specific factors (gestational age, maternal age, gestational diseases, and mode of delivery). The patients were categorized into neonatal (1-28 days) and early childhood (1-59 months) groups. Data were sourced from hospital statistics, mortality records, death certificates, and patient files.

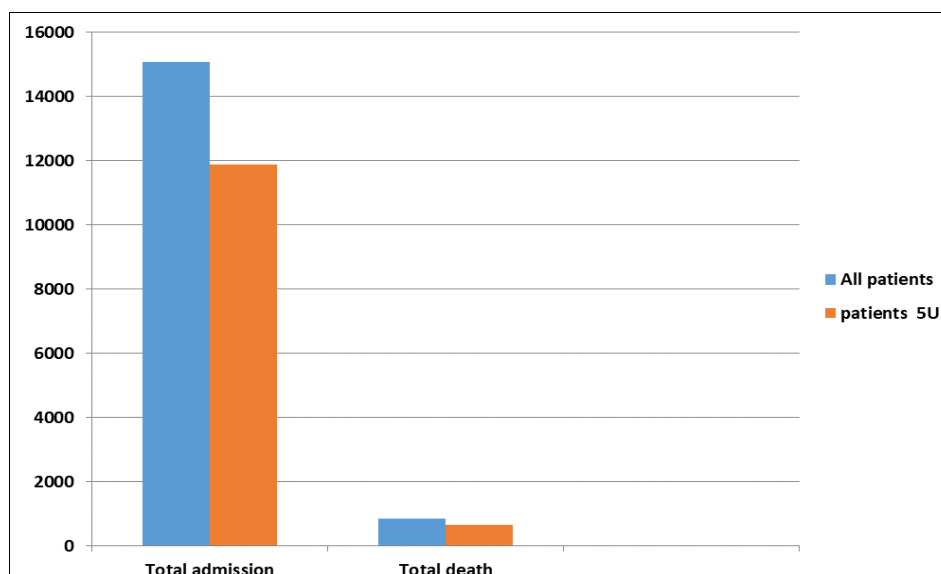
**Ethical Considerations:** Approval was obtained from the Arabic Board for Health Specializations, with an official request to the hospital administration to facilitate data collection.

**Study Limitations:** Some variables were missing from medical records, including number of children in the family, residence (urban/rural), socioeconomic status, maternal education, and history of previous child deaths, so these factors were excluded from the analysis.

**Statistical Analysis:** Data entry and analysis were performed using SPSS version 20. Categorical data were represented by frequency and percentage. The Chi-square test (or Fisher's exact test when required) was used for significance testing, with  $P \leq 0.05$  considered statistically significant.

## Results

The total number of admissions at the Central Child Teaching Hospital during the year 2015 was (15,069) patients. (11,884) patients (78.87%) were under the age of five years. The total number of deaths was (841) patients, of whom (654) patients (77.76%) were under the age of five years forming more than three quarters of the total death number (Figure 1).



**Fig 1:** Numbers of admissions & deaths of all and under 5 patients

For the total (654) deaths; 385 (58.8%) were male and 269 (41.2%) were female. The male: female ratio was about (1.4:1).

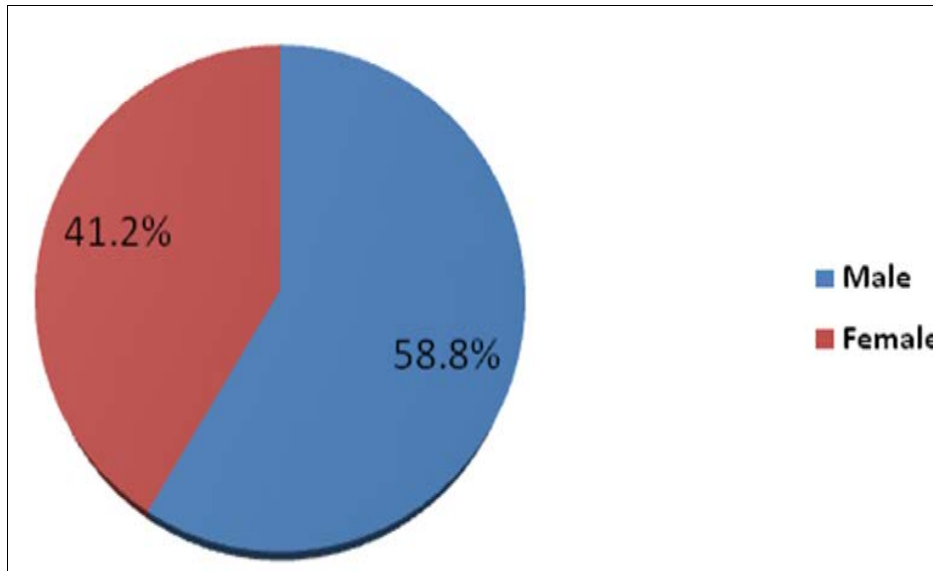


Fig 4: Gender distribution of under 5 mortalities.

The highest under five mortality occurred during February (7.6%) while the lowest rate occurred during June (4.3%),

the total number of under 5 year admissions and deaths according to the months of the year as in fig 3.

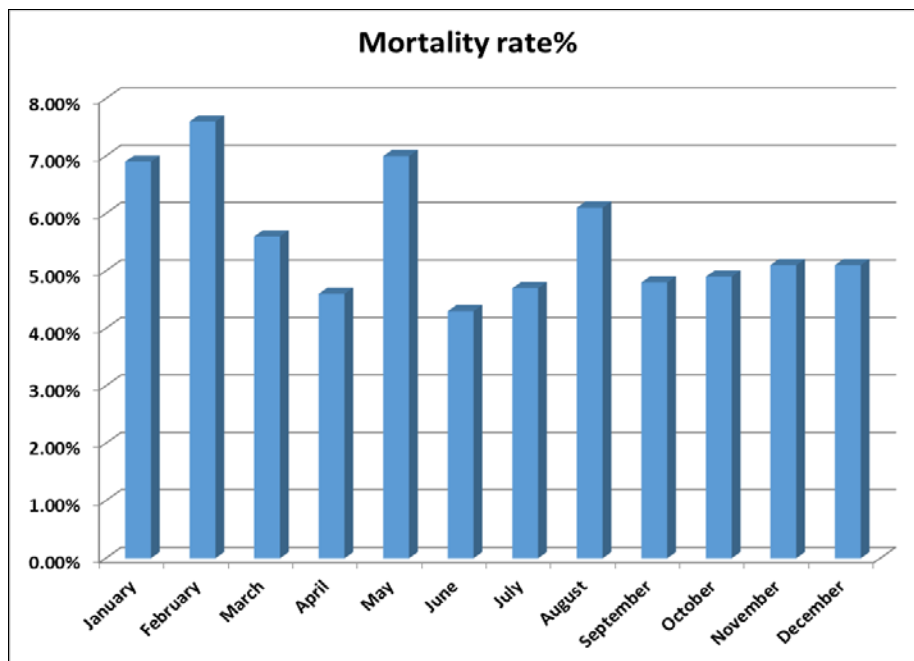


Fig 3: Under five mortality rate by month.

Prematurity and its complications (35.9%) were the leading cause of neonatal mortality, followed by congenital anomalies (22.8%) and sepsis (17.8%). Pneumonia (9.5%), birth asphyxia (8.0%), and kernicterus (4.6%) were also significant contributors. A small percentage of deaths (1.6%) were due to other unspecified causes. These findings highlight the importance of prenatal care and neonatal intensive care in reducing deaths related to prematurity and congenital anomalies. Pneumonia (21.7%) was the most common cause of death in children aged 1-59 months, followed by gastroenteritis (16.8%), tumors (14.3%), and meningitis/encephalitis (14.0%). Congenital anomalies (8.9%) and renal failure (7.4%) were also notable causes. Sepsis and liver failure (each 4.1%) played a role, along with metabolic disorders (2.1%). The data indicate that respiratory and gastrointestinal infections remain significant

threats to childhood survival, emphasizing the need for vaccination, early diagnosis, and improved pediatric healthcare services. In neonates, gastrointestinal tract anomalies (46.7%) were the most common, followed by cardiac anomalies (28.3%), renal anomalies (21.6%), and multiple anomalies (3.4%). In early childhood, cardiac anomalies (54.3%) were the most frequent, followed by renal anomalies (31.4%), multiple anomalies (8.6%), and gastrointestinal anomalies (5.7%). This suggests that gastrointestinal anomalies lead to early neonatal death, while cardiac and renal anomalies have a longer survival period but still contribute to childhood mortality. Out of 654 under-five deaths, 263 (40.2%) occurred in the neonatal period, with 165 deaths (25.2%) happening in the first week of life. 98 deaths (15%) occurred in the late neonatal period (8-28 days). 391 deaths (59.8%) occurred in early childhood

(1 month - 4 years), with 245 (37.5%) in infancy (28 days - 1 year) and 146 (22.3%) in children aged 1-4 years. The high neonatal mortality rate (especially in the first week of life) suggests a need for improved maternal and neonatal

healthcare services. The high early childhood mortality rate indicates gaps in preventive and primary healthcare interventions, particularly for infectious diseases. As in table 1.

**Table 1:** Distribution of collected reports according to the causes of neonatal mortality, causes of early childhood mortality, the type of congenital anomalies, the age group.

Causes of death	No. of cases	Percent %
Prematurity & its complications	94	35.9
Congenital Anomalies	60	22.8
Sepsis	47	17.8
Pneumonia	25	9.5
Birth Asphyxia	21	8.0
Kernicterus	12	4.6
Others	4	1.6
Causes of death	No. of cases	Percent %
Pneumonia	85	21.7
Gastroenteritis	66	16.8
Tumors	56	14.3
Meningitis / Encephalitis	54	14.0
Congenital Anomalies	35	8.9
Renal Failure	29	7.4
Sepsis	16	4.1
Liver Failure	16	4.1
Metabolic	8	2.1
Others	26	6.6
Type of congenital anomaly	Neonatal group (No. of cases, %)	Early childhood group (No. of cases, %)
Gastrointestinal tract	28 (46.7%)	2 (5.7%)
Cardiac anomalies	17 (28.3%)	19 (54.3%)
Renal anomalies	13 (21.6%)	11 (31.4%)
Multiple anomalies	2 (3.4%)	3 (8.6%)
Age of the patient	No. of deaths	Percent %
Neonatal group:	263	40.2
Early ( $\leq 7$ days)	165	25.2
Late (8-28 days)	98	15.0
Early childhood group:	391	59.8
Infancy ( $>28$ day-1 year)	245	37.5
Child (1-4 year)	146	22.3
Total	654	100.0

Table (2) show the association between the causes of neonatal and early childhood mortality with gender and both are statistically insignificant. In the neonatal period, the highest mortality rate (37.6%) was observed in infants weighing 2-3 kg, followed by 32.3% in the 1-2 kg group. In early childhood, the highest mortality (36.8%) occurred in

children weighing 5-10 kg, with 32.9% in those under 5 kg. Both neonatal and early childhood mortality showed a significant association with body weight ( $p < 0.05$ ). Lower weight categories consistently correlated with higher mortality rates in both periods.

**Table 2:** Association between causes of neonatal mortality and gender. Causes of Death by Gender in Early Childhood, Causes of Neonatal Death by Weight, Causes of Early Childhood Death by Weight.

Causes of Death	Male (No, %)	Female (No, %)	P-value
Prematurity & its complications	52 (55.4%)	42 (44.6%)	0.3
Congenital Anomalies	34 (56.7%)	26 (43.3%)	
Sepsis	33 (70.2%)	14 (29.8%)	
Pneumonia	15 (60.0%)	10 (40.0%)	
Birth Asphyxia	13 (61.9%)	8 (38.1%)	
Kernicterus	8 (66.7%)	4 (33.3%)	
Others	4 (100.0%)	0 (0.0%)	
Total	159 (60.4%)	104 (39.6%)	
Causes of Death	Male (No, %)	Female (No, %)	P-value
Pneumonia	52 (61.2%)	33 (38.8%)	0.2
Gastroenteritis	39 (59%)	27 (41%)	
Tumors	38 (67.9%)	18 (32.1%)	
Meningitis / Encephalitis	26 (48.2%)	28 (51.8%)	
Congenital Anomalies	14 (40%)	21 (60%)	
Renal Failure	14 (48.2%)	15 (51.8%)	
Sepsis	9 (56.3%)	7 (43.7%)	

Liver Failure	11 (68.8%)		5 (31.2%)			
Metabolic	5 (62.5%)		3 (37.5%)			
Others	18 (69.3%)		8 (30.7%)			
Total	226 (57.8%)		165 (42.2%)			
<b>Causes of Death</b>	<b>&lt;1 kg (No, %)</b>	<b>1-2 kg (No, %)</b>	<b>2-3 kg (No, %)</b>	<b>3-4 kg (No, %)</b>	<b>&gt;4 kg (No, %)</b>	<b>P-value</b>
Prematurity & its complications	14 (14.9%)	33 (35.1%)	31 (33.0%)	16 (17.0%)	0 (0.0%)	0.02
Congenital Anomalies	6 (10.0%)	26 (43.3%)	19 (31.7%)	9 (15.0%)	0 (0.0%)	
Sepsis	0 (0.0%)	15 (32.6%)	23 (50.0%)	9 (17.4%)	0 (0.0%)	
Pneumonia	0 (0.0%)	6 (24.0%)	12 (48.0%)	6 (24.0%)	1 (4.0%)	
Birth Asphyxia	0 (0.0%)	1 (4.8%)	6 (28.6%)	13 (61.9%)	1 (4.8%)	
Kernicterus	0 (0.0%)	3 (25.0%)	6 (50.0%)	3 (25.0%)	0 (0.0%)	
Others	0 (0.0%)	1 (25.0%)	2 (50.0%)	1 (25.0%)	0 (0.0%)	
Total	20 (7.7%)	85 (32.3%)	99 (37.6%)	57 (21.6%)	2 (0.8%)	
<b>Causes of Death</b>	<b>&lt;5 kg (No, %)</b>	<b>5-10 kg (No, %)</b>	<b>10-15 kg (No, %)</b>	<b>&gt;15 kg (No, %)</b>		<b>P-value</b>
Pneumonia	27 (31.8%)	45 (52.9%)	10 (11.8%)	3 (3.5%)		0.01
Gastroenteritis	31 (47.0%)	26 (39.4%)	8 (12.1%)	1 (1.5%)		
Tumors	11 (19.6%)	17 (30.4%)	16 (28.5%)	12 (21.5%)		
Meningitis / Encephalitis	7 (12.9%)	23 (42.6%)	15 (27.8%)	9 (16.7%)		
Congenital Anomalies	18 (51.4%)	6 (17.1%)	8 (22.9%)	3 (8.6%)		
Renal Failure	13 (44.8%)	9 (31.0%)	7 (24.1%)	0 (0.0%)		
Sepsis	9 (56.3%)	7 (43.7%)	0 (0.0%)	0 (0.0%)		
Liver Failure	2 (12.5%)	6 (37.5%)	5 (31.3%)	3 (18.7%)		
Metabolic	2 (25.0%)	1 (12.5%)	3 (37.5%)	2 (25.0%)		
Others	9 (32.0%)	4 (16.0%)	9 (36.0%)	4 (16.0%)		
Total	129 (32.9%)	144 (36.8%)	81 (20.7%)	37 (9.6%)		

In the neonatal period, 51.4% of patients were not fed at all, while 34.6% received artificial feeding. In early childhood, artificial feeding was most common (62.1%), followed by mixed feeding (29.7%). Both neonatal and early childhood

mortality showed significant associations with feeding types ( $p < 0.05$ ). Lack of feeding in neonates and artificial feeding in early childhood were linked to higher mortality rates. As in table 3.

**Table 3:** Causes of Neonatal Death by Feeding Type, Causes of Early Childhood Death by Feeding Type.

<b>Causes of Death</b>	<b>Breast Feeding (No, %)</b>	<b>Artificial Feeding (No, %)</b>	<b>Mixed Feeding (No, %)</b>	<b>Not Fed Yet (No, %)</b>	<b>P-value</b>
Prematurity	3 (3.2%)	27 (28.8%)	2 (2.1%)	62 (65.9%)	0.02
Congenital Anomalies	6 (10.0%)	18 (30.0%)	4 (6.7%)	32 (53.3%)	
Sepsis	4 (8.6%)	24 (51%)	6 (12.8%)	13 (27.6%)	
Pneumonia	5 (20.0%)	12 (48.0%)	2 (8.0%)	6 (24.0%)	
Birth Asphyxia	0 (0.0%)	2 (9.5%)	1 (4.8%)	18 (85.7%)	
Kernicterus	2 (16.7%)	5 (41.7%)	2 (16.7%)	3 (25.0%)	
Others	0 (0.0%)	3 (75%)	0 (0.0%)	1 (25%)	
Total	20 (7.6%)	91 (34.6%)	17 (6.4%)	135 (51.4%)	
<b>Causes of Death</b>	<b>Breast Feeding (No, %)</b>	<b>Artificial Feeding (No, %)</b>	<b>Mixed Feeding (No, %)</b>		<b>P-value</b>
Pneumonia	10 (11.8%)	53 (62.4%)	22 (25.8%)		0.04
Gastroenteritis	2 (3%)	53 (80.3%)	11 (16.7%)		
Tumors	4 (7.2%)	32 (57.1%)	20 (35.7%)		
Meningitis / Encephalitis	4 (7.5%)	28 (51.8%)	22 (40.7%)		
Congenital Anomalies	4 (11.4%)	20 (57.1%)	11 (31.5%)		
Renal Failure	0 (0.0%)	19 (65.5%)	10 (34.5%)		
Sepsis	1 (6.2%)	10 (62.5%)	5 (31.3%)		
Liver Failure	5 (31.2%)	4 (25.0%)	7 (43.8%)		
Metabolic	1 (12.5%)	6 (75 %)	1 (12.5%)		
Others	1 (3.8%)	18 (69.3%)	7 (26.9%)		
Total	32 (8.2%)	243 (62.1%)	116 (29.7%)		

In the neonatal period, 45.6% of patients had parents with positive consanguinity, while 29.3% were negative. In early childhood, 49.1% had positive consanguinity, and 35.1% were negative. Both neonatal and early childhood mortality

showed significant associations with parental consanguinity ( $p < 0.05$ ). Higher consanguinity rates were linked to increased mortality in both periods. As in table 4.

**Table 4:** Causes of Neonatal Death by Consanguinity Status, Causes of Early Childhood Death by Consanguinity Status.

<b>Causes of Death</b>	<b>Positive (No, %)</b>	<b>Negative (No, %)</b>	<b>Not Recorded (No, %)</b>	<b>P-value</b>
Prematurity	39 (41.5%)	34 (36.2%)	21 (22.3%)	0.01
Congenital Anomalies	32 (53.3%)	14 (23.4%)	14 (23.3%)	
Sepsis	23 (48.9%)	9 (19.2%)	15 (31.9%)	
Pneumonia	12 (48.0%)	6 (24.0%)	7 (28.0%)	
Birth Asphyxia	7 (33.3%)	8 (38.1%)	6 (28.6%)	

Kernicterus	5 (41.7%)	4 (33.3%)	3 (25.0%)	
Others	2 (50.0%)	2 (50.0%)	0 (0.0%)	
Total	120 (45.6%)	77 (29.3%)	66 (25.1%)	
<b>Causes of Death</b>	<b>Positive (No, %)</b>		<b>Negative (No, %)</b>	<b>Not Recorded (No, %)</b>
Pneumonia	40 (47.2%)		36 (42.3%)	9 (10.5%)
Gastroenteritis	34 (51.5%)		20 (30.3%)	12 (18.2%)
Tumors	33 (58.9%)		18 (32.2%)	5 (8.9%)
Meningitis / Encephalitis	22 (40.7%)		21 (38.9%)	11 (20.4%)
Congenital Anomalies	18 (51.4%)		11 (31.4%)	6 (17.1%)
Renal Failure	12 (41.4%)		11 (37.9%)	6 (20.7%)
Sepsis	9 (56.3%)		4 (25.0%)	3 (18.8%)
Liver Failure	8 (50.0%)		4 (25.0%)	4 (25.0%)
Metabolic	4 (50.0%)		3 (37.5%)	1 (12.5%)
Others	12 (46.2%)		9 (34.6%)	5 (19.2%)
Total	192 (49.1%)		137 (35.1%)	62 (15.8%)

Among neonatal deaths, 60.1% were preterm, while 39.9% were term, with a significant association between gestational age and neonatal mortality ( $p < 0.05$ ). Maternal age was most commonly 20-30 years (49.4%), followed by

30-40 years (28.6%), and also showed a significant association with neonatal mortality ( $p < 0.05$ ). Both preterm birth and maternal age were key factors linked to neonatal deaths. As in table 5.

**Table 5:** Causes of Neonatal Death by Gestational Age, Causes of Neonatal Death by Maternal Age.

Causes of Death	Term (No, %)	Preterm (No, %)	P-value		
Prematurity & its complications	23 (24.4%)	71 (75.6%)	0.03		
Congenital Anomalies	35 (58.3%)	25 (41.7%)			
Sepsis	13 (27.7%)	34 (72.3%)			
Pneumonia	9 (36.0%)	16 (64.0%)			
Birth Asphyxia	18 (85.7%)	3 (14.3%)			
Kernicterus	4 (33.3%)	8 (66.7%)			
Others	3 (75%)	1 (25%)			
Total	105 (39.9%)	158 (60.1%)			
Causes of Death	< 20 Years (No, %)	20-30 Years (No, %)	30-40 Years (No, %)	> 40 Years (No, %)	P-value
Prematurity & its complications	22 (23.4%)	46 (48.9%)	22 (23.4%)	4 (4.3%)	0.04
Congenital Anomalies	11 (18.3%)	22 (36.7%)	26 (43.3%)	1 (1.7%)	
Sepsis	6 (12.7%)	28 (59.6%)	9 (19.2%)	4 (8.5%)	
Pneumonia	3 (12.0%)	15 (60.0%)	6 (24.0%)	1 (4.0%)	
Birth Asphyxia	2 (9.5%)	13 (61.9%)	6 (28.6%)	0 (0.0%)	
Kernicterus	2 (16.7%)	4 (33.3%)	6 (50.0%)	0 (0.0%)	
Others	1 (25%)	2 (50.0%)	0 (0.0%)	1 (25%)	
Total	47 (17.8%)	130 (49.4%)	75 (28.6%)	11 (4.2%)	

Among neonatal cases, 45.2% were delivered by cesarean section, while 30.5% had NVD at the hospital and 24.3% had NVD at home, with a significant association between delivery mode and neonatal mortality ( $p < 0.05$ ). Maternal

gestational diseases were present in 41.4% of cases but showed no significant association with neonatal mortality. Cesarean section was the most common delivery mode linked to neonatal deaths. As in table 6.

**Table 6:** Association between Causes of Neonatal Mortality and Modes of Delivery, Association between Causes of Neonatal Mortality and Gestational Disease.

Causes of Death	NVD at Home (No, %)	NVD at Hospital (No, %)	Cesarean Section (No, %)	P-value
Prematurity & its complications	25 (26.6%)	28 (29.7%)	41 (43.7%)	0.01
Congenital Anomalies	7 (11.7%)	24 (40.0%)	29 (48.3%)	
Sepsis	11 (23.4%)	11 (23.4%)	25 (53.2%)	
Pneumonia	4 (16.0%)	10 (40.0%)	11 (44.0%)	
Birth Asphyxia	13 (61.9%)	2 (9.5%)	6 (28.6%)	
Kernicterus	4 (33.3%)	3 (25.0%)	5 (41.7%)	
Others	0 (0.0%)	2 (50%)	2 (50%)	
Total	64 (24.3%)	80 (30.5%)	119 (45.2%)	
Causes of Death	Positive (No, %)	Negative (No, %)	Not Recorded (No, %)	P-value
Prematurity & its complications	40 (42.5%)	35 (37.3%)	19 (20.2%)	0.6
Congenital Anomalies	24 (40%)	26 (43.3%)	10 (16.7%)	
Sepsis	20 (42.5%)	11 (23.4%)	16 (34.1%)	
Pneumonia	8 (32%)	14 (56%)	3 (12%)	
Birth Asphyxia	13 (62%)	7 (33.4%)	1 (4.6%)	
Kernicterus	3 (25%)	7 (58.4%)	2 (16.6%)	
Others	1 (25%)	2 (50%)	1 (25%)	
Total	109 (41.4%)	102 (38.8%)	52 (19.8%)	

## Discussion

Children are the future of nations, and under-five mortality (U5M) serves as a key health indicator locally and globally [10]. In this study, the U5M rate was 55/1000, lower than Al-Hadad SA *et al.*'s [11] study in Baghdad (88.6/1000) but higher than the global rate (43/1000) [5]. Neonatal mortality accounted for 40.2% of U5 deaths, similar to UNICEF's findings [4] but lower than Rashid JA [12] in Sulyamania (61.8%) and Awqati NA *et al.* [13] in Iraq (55.8%). Causes of Mortality: Prematurity was the leading neonatal cause (35.9%), followed by congenital anomalies and sepsis, consistent with Hameed N. [14] but differing from WHO findings, where congenital anomalies ranked fourth after prematurity, birth asphyxia, and sepsis [15]. Increased congenital anomalies in Iraq due to wars may explain this trend [16, 17]. In early childhood, pneumonia (21.7%) and gastroenteritis (16.8%) were the most common causes, similar to Rashid JA *et al.* [12] and WHO/UNICEF [18, 19], but different from Awqati NA *et al.* [13], where diarrhea was most common. Tumors (14.3%) ranked third, unlike WHO's global estimate, which identified malaria [3], possibly due to rising tumor incidence in Iraq [20, 21]. Demographic and Seasonal Trends: There was a male predominance (M:F ratio = 1.4:1), similar to Younis NM [21] in Mosul, Rashid JA *et al.* [12], and Hameed N. [14], though no significant association was found ( $p = 0.3$  neonatal,  $p = 0.2$  early childhood). The highest mortality was in February (7.6%) and May (7.0%), lowest in June (4.3%). Seasonal variations are noted worldwide, with Egypt (Elabbasy M.A [22] reporting peaks in January and August and Ghana (Engelaer FM *et al.* [23] in September and April, likely due to regional disease patterns.

## Risk Factors

- **Body Weight:** Two-thirds of neonatal deaths occurred in 1-3 kg infants, consistent with prematurity as a leading cause, matching findings from Hameed N. [14] and Kassar SB *et al.* [24] in Brazil. In early childhood, most deaths occurred in 5-10 kg children. Statistical analysis showed a significant association (neonatal  $p = 0.02$ , early childhood  $p = 0.01$ ).
- **Feeding Type:** Only 7.6% of neonates and 8.2% of early childhood deaths were in breastfed children. Mortality was higher in artificially fed infants, with a significant association (neonatal  $p = 0.02$ , early childhood  $p = 0.04$ ), aligning with Victora CG *et al.* [25] and Gebretsadik S [26] in Africa.
- **Consanguinity:** Found in 45.6% of neonatal and 49.1% of early childhood deaths, with higher mortality in consanguineous families (neonatal  $p = 0.01$ , early childhood  $p = 0.04$ ), similar to Khayat R. [27] in Egypt and Obeidat BR. [28] in Jordan.

## Maternal and Perinatal Factors

- **Gestational Age:** 60.1% of neonatal deaths were in preterm infants, except for congenital anomalies and birth asphyxia, which were higher in term infants. This aligns with Hameed N. [14] (80%), Al-Sadi EK [29] (52.2%) in Al-Amara, and Rashid M. [30] (59.5%) in Bangladesh ( $p = 0.03$ ).
- **Maternal Age:** 49.4% of neonatal deaths occurred in mothers aged 20-30 years, with only 17.8% in mothers <20 years. This contrasts with Rashid M. [30], Sharma V *et al.* [31], and Kang G *et al.* [32] in Asia, where younger

maternal age was linked to higher neonatal deaths ( $p = 0.04$ ).

- **Mode of Delivery:** Cesarean section (C/S) was the most common mode (45.2%), except in birth asphyxia, which was more common in home vaginal deliveries. This aligns with Al-Sadi EK [29], Ghotbi N. [33] in Iran, and Xie R. [34] globally ( $p = 0.01$ ).
- **Maternal Gestational Diseases:** 41.4% of mothers had gestational diseases, associated with higher neonatal mortality, consistent with Ghotbi N. [33] and Vogel JP. [35]. However, statistical analysis showed no significant association ( $p = 0.6$ ).

## Conclusion

Prematurity is the leading cause of neonatal mortality, while pneumonia is the most common in early childhood. U5M is highest in the neonatal period, with congenital anomalies and tumors significantly contributing. Key risk factors include low birth weight, preterm birth, artificial feeding, cesarean delivery, young maternal age, and consanguinity.

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