

# Outcome of newborn admitted to the neonatal care unit of the Central Teaching Hospital for Paediatrics, Baghdad-Al-Karkh in 2015

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## ABSTRACT

**INTRODUCTION:** Neonatal period is a very critical and vulnerable period of life due to many problems. In spite of advances in perinatal and neonatal care, the mortality rate of neonate is still high especially in developing countries. The World Health Organization estimates that globally four million neonatal die per a year; developing countries account for around 99% of the neonatal mortality in the world. In Iraq, neonatal mortality rate is about 19 per 1000 live births which represent 56% of child death below age of 5 years in 2012.

**OBJECTIVE:** To determine the case fatality rate of neonates admitted to neonatal care unit at Central Teaching Hospital in Al-Karkh Health Directorate in Baghdad in 2015. And to figure out the causes of death and finding the presence of association with some demographic factors.

**METHODS:** A record-base descriptive cross-section study was conducted at the neonatal care unit of the Central Teaching Hospital in Al-Karkh Health Directorate in Baghdad during 2015. The sample enrolled included all neonates admitted to the neonatal care unit for any reasons. Data were extracted related to demography of the neonates, causes of admission and causes of death. Case fatality rate was calculated; causes of admission, death, and association with some demographic factors were compared between two groups.

**RESULTS:** Total neonatal admission during 2015 was 1977. Neonate mortality rate was (9 %). Four main causes of death were respiratory related conditions, bacterial sepsis, disorder related to short gestation and low birth weight not relayed to elsewhere classification, and congenital malformation; 63(37.5%), 56 (33.3%), 12 (7.1%) and 12 (7.1%) respectively. While the main primary cause of admission were neonatal jaundice, respiratory related condition, bacterial sepsis 742(37.5%), 695 (35.2%), 278 (14.1%) respectively.

**CONCLUSION:** Case fatality rate of neonates admitted to neonatal care unit was lower than that reported in the previous years but still higher in comparison to nearby and remote countries.

**Key words:** Mortality, Morbidity, Neonate.

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## INTRODUCTION

Neonatal period, the first 28 days of life, is the most critical period of life because of various problems/diseases, which a neonate faces.<sup>1</sup> Also in this period, many physiological modification processes necessary for extra uterine life are formed. Thus, the neonate is very vulnerable with high rates of mortality and morbidity. Neonatal mortality rate is often used as a standard for the development of health care systems as well as achieving optimal educational and social conditions.<sup>2, 3</sup> Neonatal mortality rate is directly associated with high risk pregnancy

and therefore the major reasons for neonatal death can be revealed in relation to complications of risky pregnancy including prematurity, intrauterine growth retardation, congenital abnormalities and other disabilities.<sup>3</sup> Also delivery-related complications like birth injury and birth asphyxia are directly affect neonatal mortality and morbidity.<sup>3</sup> Therefore, woman's health, maternal and child health play substantial role in determine the neonatal fatality and morbidity.

Despite a marked lowering in the under five-year mortality rate (U5MR) in the past few years following substantial interventions like immu-

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nization, diarrhoea control programs and integration management of child illness program, the neonatal death in resource poor countries is still alarmingly high. It accounts for over 40% of all deaths of children under age five years. It is estimated that 34 of every 1000 babies born in developing countries die in the first month of life.<sup>4-6</sup>

However, the decline in neonatal death in 1990–2015 has been slower than that of post-neonatal, under-five mortality (1-59 months): 47 percent, compared with 58 percent globally. This manner applies to most low- and middle-income countries.<sup>4-6</sup>

Around two-third of infant deaths occur in the neonatal period, of which almost two-thirds die during the first week and of these two thirds die during the first 24 hours. Nearly all cases of deaths occur in low-income or middle-income countries.<sup>6</sup> This happens primarily because of most child survival strategies being designed passing the new born.

Globally, the major reasons of neonatal deaths were preterm birth complications (35%), intrapartum related complications (24 %), and sepsis (15 %).<sup>6-9</sup>

In developing countries death in neonatal period accounted 50-70% of infant mortality.<sup>8</sup> The main direct cause of death is preterm birth (27 %), infection (26 %), asphyxia (23 %), congenital anomalies (23 %), others (7 %), tetanus (7 %), and diarrhoea (3%).<sup>9</sup>

Most deaths of children under age of five years are caused by diseases that are easily preventable or treatable with proven, cost-effective interventions.<sup>6</sup>

In 2000 United Nations Millennium Summit, the international community committed to reducing the child, neonate and maternal mortality as part of the Millennium Development Goals (MDGs). The fourth goal (MDG4) sets to reduce deaths of children under age of five years by 66% by 2015.<sup>10</sup> Fundamental decreases in deaths in children younger than 5 years old have been due to reductions in post neonatal mortality. No similar progress has been made in the lowering of neonatal mortality.<sup>11, 12</sup>

Neonatal outcome is substantial index of obstetrics and health care. It is estimated that effective implementation and high coverage of

interventions could prevent up to 70% of neonatal deaths globally.<sup>12</sup>

Neonatal mortality is broadly preventable and has been considerably reduced in developed countries using proper techniques and convenient preventive approaches.<sup>13, 14</sup>

However, improved neonatal care, particularly the wide spread use of surfactant replacement and antenatal steroids, has almost halved neonatal mortality in many parts of the world.<sup>15</sup>

In Iraq, UNICEF estimated that U5MR of 53 and 34 per 1000 live births in 1990 and 2012 respectively, infant mortality rate of 42 and 28/1000 live births in 1990 and 2012 respectively, and neonatal mortality rate of 27 and 19/1000 live births in 1990 and 2012 respectively.<sup>16</sup> The annual report of Ministry of Health in Iraq has stated that the total number of neonatal incubators in 2013 was 1682 that represents 2.7 incubators per 10 children's hospital beds.<sup>17</sup>

The studies in Iraqi hospitals recorded a difference in the rate of morbidity and mortality of neonates depending on the type of hospital neonatal care, the quality of antenatal care, and even the community educational level at the time of conducting the studies. To apply preventive strategies, we should have the data on morbidities and mortalities which are claiming the neonatal life.

The aims of this study are to determine the case fatality rate of neonates admitted to neonatal care unit at Central Teaching Hospital in Al-Karkh Health Directorate in Baghdad in 2015, figuring out the causes of death and finding the presence of association with some demographic factors.

## METHODS

**Settings and study design:** Across sectional, descriptive study was done at the neonatal care unite of the Central Teaching Hospital of Paediatrics in Al-Karkh Health Directorate in Baghdad from January to April 2016. The hospital in our study represents the largest paediatric hospital in Iraq. It contains 400 children's beds caters to the population of Baghdad- Al-Karkh and neighbouring districts. Neonatal Care Unit (NCU) in study has 24 neonatal incubators bed, facility for phototherapy, surfactant administration, exchange transfusion, and ventilator are avail-

able and so it is very busy all over the year and allow for a large population size (1977 patients during year 2015).

**Ethical consideration:** The study was officially approved by the research unit at Al-Karkh Health Directorate and the hospital data was retrieved in accordance with the rules of the Central Teaching Hospital of Paediatrics.

**Definition of the cases, inclusion and exclusion criteria:** data were extracted from the records of the neonatal care unit. A special extracting form was designed by the Statistical Department of Planning and Resource Development Directorate, MOH. Enrolment in this study has included all neonates who were admitted to the neonatal care unit from 1 January 2015 to 31 December 2015. Neonates who were referred to other hospitals or discharged on their parents' will were excluded from this study.

**Sampling:** All neonates who were recorded in the admission record of the neonatal care unit in the hospital from 1 January 2015 to 31 December 2015 were enrolled in this study.

**Extraction of data and definitions of outcomes:** the extraction of data were done by the author into a unified extraction form. The data included gender categorized into male and female; age of the neonate on admission that categorized into at birth (day one), first week of life, 2<sup>nd</sup> – 4<sup>th</sup> week of life, and > 4 weeks (28 days); state of pregnancy into single or twins; types of delivery that categorized into Normal vaginal delivery, Caesarean section, and assisted vaginal delivery (instrumental); age of mother in years categorized into: <20, 20-29, and 30-39 years; weight of the neonate at birth in grams which categorized into: extremely low <1500 grams, low weight 1500-2499 grams, acceptable 2500-4000 grams, and macrosomia >4000 grams;<sup>13,14</sup> cause of admission was taken from the recorded diagnosis of the hospital match which then categorized at the MOH according to ICD10; the outcome of the admission was defined as discharging well or death. Cause of death was taken from the records for neonates who died. Gestational time of the neonate was not considered because some documents were missing.

According to the outcome, the neonates were grouped into those who were discharged well or died. For each group we define the causes of admission and causes of death, per-

centages were calculated with measurement of P value to test significance. The same thing was done to measure the association of some demographic factors on the outcomes.

**Data analysis:** Computerize data which were collected by IBM version 21 SPSS programs then analysed the data compared statistically using a Z-test were used for continuous variables and chi square test data for categorized variables, P-value of less than 0.05 Considered statistically significant.

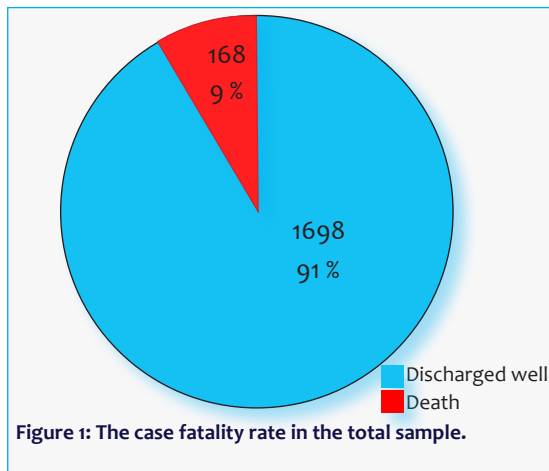
## RESULTS

**Table 1** shows the frequency distribution of the demographic features of the 1977 neonates who were admitted to the neonatal care unit during the studied period.

| Table 1: Socio-demographic variables of the sample. |        |      |
|-----------------------------------------------------|--------|------|
| Character                                           | Number | %    |
| <b>Gender</b>                                       |        |      |
| Male                                                | 1179   | 59.6 |
| Female                                              | 798    | 40.4 |
| <b>State of pregnancy</b>                           |        |      |
| Single                                              | 1942   | 98.2 |
| Multiple                                            | 35     | 1.8  |
| <b>Way of delivery</b>                              |        |      |
| Normal vaginal delivery                             | 902    | 45.6 |
| Caesarean section                                   | 1071   | 54.2 |
| Assisted vaginal delivery                           | 4      | 0.2  |
| <b>Age of mother (years)</b>                        |        |      |
| < 20                                                | 23     | 1.2  |
| 20-29                                               | 1548   | 78.3 |
| 30-39                                               | 406    | 20.5 |
| <b>Weight of neonate in grams</b>                   |        |      |
| Extremely low weight (<1500)                        | 15     | 0.8  |
| Low weight (1500-2499)                              | 1476   | 74.7 |
| Acceptable (2500-4000)                              | 481    | 24.3 |
| Macrosomia (>4000)                                  | 5      | 0.3  |
| <b>Duration of hospital stay in days</b>            |        |      |
| Discharged on the same day                          | 219    | 11.1 |
| 1-5 days                                            | 1214   | 61.4 |
| 6-10 days                                           | 359    | 18.2 |
| 11+ days                                            | 185    | 9.4  |
| <b>Newborn's age at admission</b>                   |        |      |
| At birth                                            | 341    | 17.2 |
| First week of life                                  | 855    | 43.2 |
| 2nd to 4th week of life                             | 757    | 38.3 |
| >28 days                                            | 24     | 1.2  |

**Table 2 : Relative frequency for selected categories of causes of admission according to ICD 10.**

| Cause of admission                                                                     | N   | %    |
|----------------------------------------------------------------------------------------|-----|------|
| Neonatal jaundice (P59)                                                                | 742 | 37.5 |
| Respiratory conditions (P21/ P22/P23)                                                  | 695 | 35.2 |
| Infection/sepsis (P36)                                                                 | 278 | 14.1 |
| Disorders related to short stature and low birth weight not elsewhere classified (P07) | 45  | 2.3  |
| Blood and bleeding problems (D64/ P61.9/ P53)                                          | 41  | 2.1  |
| Congenital malformations/chromosomal abnormalities (P91/ Q00-Q99)                      | 40  | 2    |
| Renal conditions (UTI/ renal failure) (P96/ P39)                                       | 37  | 1.9  |
| GIT problems/symptoms (A09/ P76/ P92.0)                                                | 38  | 1.9  |
| Others (miscellaneous) (P71/ R69/ M00)                                                 | 19  | 1    |
| CNS conditions/symptoms (convulsion-meningitis) (G40/ P90/ A87.8/ P91.6)               | 11  | 0.6  |
| Endocrine diseases/symptoms (P72)                                                      | 8   | 0.4  |
| Symptomatic labels (E64/ P28.2/ L20.9/ P74.1)                                          | 8   | 0.4  |
| PUO (P81.9)                                                                            | 6   | 0.3  |
| Cardiovascular conditions (P29)                                                        | 5   | 0.3  |
| Trauma (P15)                                                                           | 4   | 0.2  |



**Table 2** shows that neonatal jaundice is the commonest cause of admission reported in 742

(37.5) neonates followed by respiratory causes 695 (35.2 %). Death as an outcome of admission to the neonatal care unit was reported in 168 neonates (9%), while 1693 (91 %) neonates were discharged home well. (See **figure 1**) Respiratory conditions and infection/sepsis were the commonest two causes of death both constitute about 70 % of the causes (**table 3**). Congenital malformations/chromosomal abnormalities and Disorders related to short gestation and low birth weight not elsewhere classified were the causes of death in 12 neonates for each (7.1 %).

**Table 4** shows the relative frequency of the cause of death. It has been shown that cardiovascular conditions were the highest relative cause of death four out of five neonates who were admitted because of cardiovascular condition were died (80 %) (p value < 0.001) followed

**Table 3: Cause of death ratio**

| Cause of death                                                                           | N   | %    |
|------------------------------------------------------------------------------------------|-----|------|
| Respiratory conditions (P21/P22 /P23)                                                    | 63  | 37.5 |
| Infection/sepsis (P36)                                                                   | 56  | 33.3 |
| Congenital malformations/chromosomal abnormalities (Q00-99)                              | 12  | 7.1  |
| Disorders related to short gestation and low birth weight not elsewhere classified (P07) | 12  | 7.1  |
| Renal conditions (UTI/ renal failure) (P96/ P39)                                         | 8   | 4.8  |
| Neonatal jaundice (P59)                                                                  | 8   | 4.8  |
| Cardiovascular conditions (P29)                                                          | 4   | 2.4  |
| GIT problems/symptoms (A09/ P76/ P92.0 )                                                 | 2   | 1.2  |
| Blood and bleeding problems (D64/ P61.9/ P53)                                            | 2   | 1.2  |
| Others (miscellaneous) (P71/ R69/ M00)                                                   | 1   | 0.6  |
| Total                                                                                    | 168 | 100  |

**Table5: The relative frequency of death as an outcome by category of causes of admission**

| Cause of admission                                                                       | Death as an outcome |      |       |      |       |     | P (z test)** |
|------------------------------------------------------------------------------------------|---------------------|------|-------|------|-------|-----|--------------|
|                                                                                          | Well                |      | Death |      | total |     |              |
|                                                                                          | N                   | %    | N     | %    | N     | %   |              |
| Cardiovascular conditions (P29)                                                          | 1                   | 20   | 4     | 80   | 5     | 100 | <0.001       |
| Congenital malformations/chromosomal abnormalities (Q00-99)                              | 20                  | 62.5 | 12    | 37.5 | 32    | 100 | <0.001       |
| Disorders related to short gestation and low birth weight not elsewhere classified (P07) | 31                  | 72.1 | 12    | 27.9 | 43    | 100 | <0.001       |
| Renal conditions (UTI/ renal failure) (P96/ P39)                                         | 28                  | 77.8 | 8     | 22.2 | 36    | 100 | 0.005        |
| Infection/sepsis (P36)                                                                   | 204                 | 78.5 | 56    | 21.5 | 260   | 100 | <0.001       |
| Respiratory conditions (P21 /P22 .P23)                                                   | 603                 | 90.5 | 63    | 9.5  | 666   | 100 | 0.65[NS]     |
| GI/T problems/symptoms (A09/ P76/ P92.0 )                                                | 31                  | 93.9 | 2     | 6.1  | 33    | 100 | 0.56[NS]     |
| Others (miscellaneous) (P71/ R69/ M00)                                                   | 16                  | 94.1 | 1     | 5.9  | 17    | 100 | 0.66[NS]     |
| Blood and bleeding problems (D64/ P61.9/ P53)                                            | 6                   | 94.7 | 2     | 5.3  | 38    | 100 | 0.43[NS]     |
| Neonatal jaundice (P59)                                                                  | 691                 | 98.9 | 8     | 1.1  | 699   | 100 | <0.001       |
| CNS conditions/symptoms (convulsion-meningitis) (G40/P90/ A87.8/P91.6)                   | 8                   | 100  | 0     | 0    | 8     | 100 | 0.37[NS]     |
| Trauma P15                                                                               | 3                   | 100  | 0     | 0    | 3     | 100 | 0.59[NS]     |
| PUO (P81.9)                                                                              | 6                   | 100  | 0     | 0    | 6     | 100 | 0.44[NS]     |
| Endocrine diseases/symptoms (P72)                                                        | 7                   | 100  | 0     | 0    | 7     | 100 | 0.41[NS]     |
| Symptomatic labels (E64/ P28.2/ L20.9/ P74.1)                                            | 8                   | 100  | 0     | 0    | 8     | 100 | 0.37[NS]     |

by congenital malformations and chromosomal abnormalities, 12 out of 32 ( 37.5 %). ( p value <0.001). Also, disorders related to short gestation and low birth weight not elsewhere classified, Renal conditions, and Infection/sepsis have shown a statistical significance as a causes of death. ( See [table 4](#))

**Table 5** shows that duration of hospital stay and newborn's age at admission were the only studied demographic features that showed a statistical significance associated with the outcome of admission.

## DISCUSSION

Availability of accurate data about the morbidity and mortality is very essential and important for the providers of primary and secondary health care, investigators, local and national health administrators, and for decision makers to know the scope of any health problem, design interventions for prevention and treatment, and to implement and evaluate health care programs.

Studying neonatal morbidity and mortality is a parameter important at the level of strategic health planning for example prematurity was the second leading cause of hospital admission

for neonates in 2004,<sup>18</sup> Ten years later this problem moved down to become 4th cause of death Targeting specific important causes of neonatal morbidity allowed other less important causes to climb up the list.

Study sample by socio-demographic variables. The admissions of male babies 1179 (59.6%) were more than those of females; this may be related to the predilection for the male child in the society and the biological vulnerability of the males to infection. The male overbalance for admissions has been documented in previous studies.<sup>19, 20</sup> Our study showed that 1942 (98.2%) of the sample was singleton delivery. It was recorded in USA that one twin was born for every 30 single infants born 2009.<sup>19, 21</sup> The current study found that neonate delivered by caesarean section admission to hospital is 1071 (54.2%). This is similar to a study in USA at 2007, which showed that about two thirds of admitted neonates were delivered by caesarean section.<sup>22</sup>

As large as 1548 (78.3%) of admitted baby had mothers aged 20 -29 years, women at this age are more fertile. This agrees with a study by Aljawadi in 2003 in Mosul Iraq which showed that more than half (55.6%) of pregnant women had presented at age of twenties.<sup>23</sup> Most admit-



**Table 6: The case fatality rate by selected explanatory variables**

| Demographic features                    | Death as an outcome |      |       |      |       |       | P value    |
|-----------------------------------------|---------------------|------|-------|------|-------|-------|------------|
|                                         | Well                |      | Death |      | Total |       |            |
|                                         | N                   | %    | N     | %    | N     | %     |            |
| Age of mother years-categories          |                     |      |       |      |       |       | 0.299 [NS] |
| <20                                     | 19                  | 90.5 | 2     | 9.5  | 21    | 100   |            |
| 20-29                                   | 1336                | 91.5 | 124   | 8.5  | 1460  | 100   |            |
| 30-39                                   | 338                 | 88.9 | 42    | 11.1 | 380   | 100   |            |
| Neonatal weight (gm)- categories        |                     |      |       |      |       |       | 0.028      |
| Extremely low neonatal weight (<1500)   | 12                  | 92.3 | 1     | 7.7  | 13    | 100   |            |
| Low neonatal weight (1500-2499)         | 1264                | 90   | 141   | 10   | 1405  | 100   |            |
| Acceptable/macrosomia (2500+)           | 417                 | 94.1 | 26    | 5.9  | 443   | 100   |            |
| Duration of hospital stay               |                     |      |       |      |       |       | <0.001     |
| Discharged on the same day              | 147                 | 77.8 | 42    | 22.2 | 189   | 100   |            |
| 1-5 days                                | 1062                | 92.2 | 90    | 7.8  | 1152  | 100   |            |
| 6-10 days                               | 318                 | 93   | 24    | 7    | 342   | 100   |            |
| 11+ days                                | 166                 | 93.3 | 12    | 6.7  | 178   | 100   |            |
| Newborn's age at admission (categories) |                     |      |       |      |       |       | 0.009      |
| At birth                                | 279                 | 87.7 | 39    | 12.3 | 318   | 100   |            |
| First week of life                      | 741                 | 92.9 | 57    | 7.1  | 798   | 100   |            |
| 2nd to 4th week of life                 | 654                 | 90.7 | 67    | 9.3  | 721   | 100   |            |
| >28 days                                | 19                  | 79.2 | 5     | 20.8 | 24    | 100   |            |
| Multiple pregnancy( state of pregnancy) |                     |      |       |      |       |       | 0.542[NS]  |
| Single                                  | 1663                | 91.0 | 164   | 9.0  | 1827  | 100.0 |            |
| Twins                                   | 30                  | 88.2 | 4     | 11.8 | 34    | 100.0 |            |
| Type of delivery                        |                     |      |       |      |       |       | 0.165[NS]  |
| Normal vaginal delivery                 | 762                 | 85   | 10.0  | 847  | 100.0 | 90.0  |            |
| Caesarean section/assisted delivery     | 931                 | 91.8 | 83    | 8.2  | 1014  | 100.0 |            |
| Gender                                  |                     |      |       |      |       |       | 0.295 [NS] |
| Male                                    | 1014                | 91.3 | 97    | 8.7  | 1111  | 100   |            |
| Female                                  | 679                 | 90.5 | 71    | 9.5  | 750   | 100   |            |

ted neonates 1476 (74.7%) were of low weight; this is similar to many studies which considered the weight of neonate as a risk factor for many diseases. Low neonatal weight may be related to low socio-economic status and poor, maternal health condition. It is often used as indicator of quality for the maternal care facilities.<sup>24, 25</sup> The relation between age of neonate and the morbidity showed that neonate admission at birth (first day) and at first week of life is more than other ages 341 (17.2%) and 855 (43.2%) respectively. This is because neonate at this age is biologically vulnerable. Many studies in different times and places agree with the previous argument.<sup>24-26</sup>

Study cause of admission in the hospital;the

first three primary causes of admission were neonatal jaundice, respiratory conditions, infection/Sepsis 742 (37.5%), 695 (35.2%) and 278 (14.1%) respectively. These represent more than 86% of admissions. Study in India in 2014 reported that respiratory condition, sepsis, encephalitis, neonatal jaundice are the commonest causes of admission.<sup>18</sup> In Pakistan,<sup>26</sup> prematurity, sepsis, respiratory condition, and neonatal jaundice are the leading causes of neonatal admission. These two studies share in respiratory conditions and sepsis as leading causes of neonatal admission similar to our study. Difference in rates of causes leading to admission observed in studies reflected the neonatal care, maternal education and antenatal care in community.<sup>26, 27</sup>

### The case fatality rate in the total sample

Neonatal mortality rate in Iraq as estimated by the WHO was declining from 27.1 per 1000 birth in 1990 to 18.4 per 1000 birth in 2015.<sup>28</sup> Despite that, Neonatal mortality rate in 2015 was higher in Iraq compared to Saudi Arabia, Jordan, Egypt and Syria.<sup>28</sup> The difference is much higher if we compare it to the developed countries like the UK and the USA.<sup>28</sup>

At the level of neonatal care units, a great variation in neonatal fatality statistics was found among different parts of the world.<sup>28</sup> This variation probably reflects the differences in cultures, provision of antenatal care, admission criteria, and specific exclusion and inclusion criteria and level of neonatal care.

The case fatality rate for hospitalized neonates in the current study was 168 (9%) from total neonatal admission, this figure was higher than hospital fatality rate reported in Canada (4%), Pakistan (7%) and Brazil (6%) in 2015 (29,30). On other hand, this figure was lower than that reported by two studies from Children welfare teaching hospital at the Medical city; 15% in 2007 and 19.2% in 2009.<sup>31</sup>

### Cause of death ratio in the total sample

In our study, about 70 % of death was due to respiratory conditions and infection/ sepsis. As a percent of admission respiratory conditions, infection/ sepsis, congenital malformations, disorders related to short gestation and low birth weight were the leading causes of death 63 (37.5%), 56 (33.3%), 12 (7.1%) and 12 (7.1%) respectively which represent 85% of all death. These figures were nearly similar to the national figures reported by Iraq MOH annually report<sup>17</sup> and that of Children Welfare Teaching Hospital at the Medical city,<sup>31</sup> though sepsis is reported in the above resources as the third cause. Infection/sepsis in neonates is considered very important worldwide, WHO estimated that more than a third of the 4 million neonatal deaths each year around world are caused by severe infection.<sup>9</sup> In our study 56 (33.3 %) of death were due to infection/ sepsis.

We also found that disorders related to short gestation and low birth weight not elsewhere classified as primary cause of death constituted 12 (7.1%) of all death in hospital. This figure is lower than that globally estimated (28%)<sup>9</sup>

and that reported from India (41%).<sup>32</sup> Neonatal death due to congenital malformations and deformations and chromosomal abnormalities, in our series, constituted 12 (7.1%) all death in neonatal care unit, which is lower than that reported by Numan in 2010<sup>31</sup> which were 18.4%, 14.2%, and 19.5% in 2007, 2008, 2009 respectively. It was also lower than that reported by a study in India (12%),<sup>32</sup> but it was nearly similar to a global estimated figure that recorded 7% in 2004.<sup>2</sup> The decline in death ratio for related to short gestation and low birth weight not elsewhere and Neonatal death due to congenital malformations and deformations and chromosomal abnormalities Clearly indicates an improvement in the quality of service provided in the neonatal care unit.

### Specific case fatality rate by cause of admission

In the current study, 4 out of 5 (80%) of neonates who were admitted to the neonatal care unit due to cardiovascular causes died. The relative case fatality rate is remarkably high rate. This reflects the capability of our hospital to deal with such difficult conditions that need a highly skilled and sometimes sophisticated cardiac surgical intervention to save lives. Wren<sup>33</sup> has showed that 10 - 20% of all neonates with cardiac malformations, corresponding to 1-2 per 1000 newborns, have a cardiac defect that if undetected may cause circulatory collapse and death during the neonatal period and 30% of such cases were not diagnosed before death.

The case fatality rate attributed to congenital malformation is equal to 12 (37.5%) which was significantly higher than the average case fatality rate for an admitted neonate of 9%; however, it is still lower than that reported in Northern Tanzania (44.1%) in 2010.<sup>34</sup> Congenital abnormalities are related to genetic and environmental factors which differ from one geographical region to another and this, in addition to the local availability of diagnostic tools, can explain this variation in the figures reported from different countries.

The case fatality of sepsis was 56 (21.5%) which was significantly higher than the average case fatality rate for an admitted neonate of 9%. This agree with WHO which suggested that the chances of survival are weak for newborns with a serious infection, and controlling of neonatal infection/ sepsis can serve as a powerful tool to

reduce neonatal mortality since sepsis is both preventable and treatable.

Our study revealed that disorders related to short gestation and low birth weight not elsewhere classified was associated with a case fatality rate of 12 (27.9%) which was significantly higher than the average case fatality rate of all admitted neonate (9%), This finding was slightly higher than that of Tanzania which was 22.4%.<sup>34</sup>

Relation between death and some variables: neonatal weight, age on admission, and duration of hospital stay were found to affect care fatality rate and this effect was statistically significant. We have shown that neonatal fatality rate was 1 (7.7) and 141 (10 %) among extremely low and low neonatal weight respectively.

Also we found that the case fatality rate in neonates aged one day was highest 39 (12.3%) compared to those at age of fourth weeks of life 67 (9.3%). This result agrees with that of many studies which showed that death is commoner at early age neonate than neonates of older age.<sup>35</sup> This result is supported by Nayeri who has stated that each 250 g increase up in weight of a neonate has a protective effect, and reduce mortality rate. Nayeri has reported that the survival rate is 80.4% for neonates weighing more than 1000 gram.<sup>35</sup>

## CONCLUSION

Case fatality rate on neonates admitted to neonatal care unit is still higher in comparison to nearby and remote countries. Neonatal jaundice, respiratory condition, and Infection / Sepsis are the leading cause of admission to the neonatal care unit. At the same time, respiratory conditions and infection / sepsis are the leading causes of death in about three quarters of all deaths. Neonatal weight, age on admission, and duration of hospital stay are factors associated with increase neonatal death in neonatal care units with a statistical significance. Still cardiac and congenital malformation have a relatively high fatality rates among those neonates admitted to the neonatal care unit.

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**Abbreviation list:** The 10th revision of the International Classification of Diseases and Related Health Problems (ICD10), Low Birth Weight (LBW), Millennium Development Goals (MDGs), Ministry of Health (MoH), Neonatal mortality rate (NMR), Respiratory distress syndrome (RDS), United Nations International Children's Emergency Fund (UNICEF), Under five years mortality rate (U5MR), World Health Organization (WHO).

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