



## Neonatal Mortality in Al- Basrah Maternity and Pediatric Hospital

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### Summary

Globally neonatal mortality (NM) accounts for almost 47 percent of under-five child mortalities. Identification factors related to neonatal mortality is important to guide the development of focused and evidence based health interventions to prevent neonatal deaths. this study aimed to identify the causes and risk factor of neonatal mortality Al- Basrah Maternity and Pediatric Hospital. We conducted a cross-sectional descriptive and analytic analysis, retrospective registry-based study. Total births and mortalities in the hospital for one year were selected randomly from the database of the last 10 years. Our findings showed a neonatal mortality (NM) rate of 14.4% out of total cases admitted to neonatal care units (NCU). The most common causes of deaths were respiratory distress syndrome (RDS) (48.1%) followed by congenital anomalies (21.3%), sepsis (13.2%), birth asphyxia (8.8 %), and other uncommon causes show a minority (8.4%).

Neonatal mortalities were significantly associated with male gender, age 2-7 days, lower birth weight, prematurity, in all comparison , (P. value < 0.05). Also higher neonatal mortality rates were significantly associated with maternal age of 20-35 years, multipara, rural residence, singleton pregnancies, normal vaginal deliveries (NVD). In conclusion, the NM rate was relatively high. Neonatal mortalities were affected by neonatal and maternal factors. The significant predictors of NM were prematurity, low birth weight and admission to first neonatal care unit.

**Keywords:** Neonatal Mortality, Maternal Factors, Neonatal Factors

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## 1. INTRODUCTION

The neonatal period, from birth to the first 28 days of life, is the most hazardous period of life because of the different diseases that affect neonate. The risk of dying is highest in this period of life (1). Neonatal mortality includes all infants dying during the period from after birth to the first 28 days of life (3). The reduction in neonatal mortality over the last two decades is due to the progresses occur in prenatal and perinatal care as well as the improvement of the quality of services in neonatal intensive care units (4). Neonatal Mortality (NM) is an important outcome indicator that used to evaluate and assess the development of neonatal and maternal health services in the community (6). Neonatal mortality and morbidity reveal a country's socioeconomic status, and the efficiency of health care facilities (7). On the other hand, the first step in decreasing the mortality and improving the level of this index is to identify the causes of mortality (8). Therefore, identifying the major causes of neonatal death will provide the basis for proper planning to improve care systems for pregnancy, delivery, and children (8).

In order to assess needs and develop programs that will reduce preventable child deaths more quickly. However, national indicators of the health of newborn and mothers are often not readily available, especially in countries that lack vital registration systems (9). Globally, in 2017 alone, an estimated 6.3 million children and young adolescents died, mostly from preventable causes. Of these approximately 85% of deaths occurred in the first five years of life and nearly half (47%) of the under five deaths occurred in the first month of life. In other words, the probability of dying in the first 28 days of life was estimated at 18 deaths per 1,000 live births globally (10). The neonatal mortality rate in Iran has fallen from 16 per 1,000 live births in 2004 to 9.5 per 1,000 live births in 2015 (11). And at 2019 NMR in Iran was 8.6/1000 live birth (12). At 2019 the neonatal mortality rate in Jordan was 9.2 death/1000 live birth.

over the last 50 years, neonatal mortality in Jordan was declining from 30.8/1000 live birth in 1970 to 9.2 death per 1000 live birth at 2019 (12). Neonatal mortality rate in Saudi Arabia was 3.8 death per 1000 live birth at 2018. Between 1999 and 2018 neonatal mortality rate in Saudi Arabia was declining from 12.9 death per 1000 live birth in 1999 to 3.8 death per 1000 live birth at 2018 (12). At 2010 NM in Iraq was 19.7/1000 live birth, at 2011 NMR was 19.2/1000 live birth, at 2012 NMR was 18.8/1000 live birth, at 2013 NMR was 18.3/1000 live birth, at 2014 NMR was 17.9/1000 live birth, at 2015 NMR was 17.4/1000 live birth, at 2016 NMR was

16.9/1000 live birth, at 2017 NMR was 16.3/1000 live birth, and at 2018 NMR was 15.8/1000 live birth (13). The neonatal causes of mortality are generally divided into two categories, including biological and non-biological factors. Although biological factors, such as prematurity, infection, birth asphyxia, are the prominent causes, non-biological causes are equally important, which include the socioeconomic status, gender, and mother's level of education, etc (14). Respiratory distress syndrome or hyaline membrane disease; its due to surfactant deficiency which reduce the surface tension and help maintain alveolar stability by inhibiting the collapse of small air space at the end of expiration (15). Neonatal asphyxia is defined as the failure of initiating and maintaining of breathing at birth (16,17). Worldwide, more than 1 million neonatal death occurred due to birth asphyxia each year (18,19). Birth asphyxia results in deficiency of tissue perfusion and then leading to hypoxemia and hypercarbia (22-23). Neonatal sepsis is a diagnosis made in infants less than 28 days of life and consists of a clinical syndrome that may include systemic signs of infection, circulatory shock, and multisystem organ failure, clinical diagnosis is difficult due to nonspecific sign and symptom (24). Congenital anomaly has been defined according to the WHO as any morphological, functional, and molecular or biochemical defects that may occur in the embryo and fetus from conception until birth, whether detected at birth or later (28). Other uncommon causes of neonatal mortality include neonatal jaundice and its complication, inborn error of metabolism, intracranial hemorrhage, bleeding disorder, neonatal trauma, hemorrhagic disease of newborn, severe anemia and unspecific causes (15). There is many factor affect NM, maternal factors: maternal knowledge (mother's knowledge of risk and danger signs in pregnancy, childbirth, and newborns); maternal health (mother's report of illness during pregnancy and complications noted in medical records); and maternal characteristics (age, previous pregnancies, and care) (31). Neonatal factors included sex, record of complications during birth delivery, Apgar score, early beginning of breastfeeding, and use of the kangaroo method of care (31). Delivery factors consisted of place of birth delivery (in a healthcare facility, or at home), and assistance during birth and delivery. Factor outside the control of health services were distance to health service, education level of parents, and poverty indicators (31). The aim of this study was to assess the causes and factors associated with neonatal mortality among neonates admitted to the Neonatal Intensive Care Unit (NICU) of Basrah maternity and pediatric hospital and calculate the neonatal mortality among these neonates during the mention period.

## 2. PATIENTS and METHODS

A descriptive, retrospective, registry-based study, was designed to measure NM, define the main causes of neonatal deaths and describe the sociodemographic characteristics of dead neonate, causes of neonatal death. This retrospective study had been carried out at Basrah Maternity and Children Hospital in both neonatal care units, the first neonatal unit (where cases of hospital delivery were admitted) and second neonatal unit (where cases from other hospitals, other than Basrah maternity and pediatric hospital, home deliveries, referred cases from private clinics or peripheries of Basrah were admitted). All reported cases of neonatal deaths, according to WHO definition, were included in this study, selected all neonates who died at the first and second neonatal care units (NCU) during the study period . Was conducted by the researcher on 20 cases from the hospitals (Basrah childhood and maternity hospital) to determine the difficulties that might arise during data collection and to test the information of the questionnaire form. The feedback was; some variables originally intended to be included in the study e.g. chronic disease of mother, pregnancy complication, educational level and occupation of mother, Apgar score but the lack of information in the files and medical registration lead to excluded from questionnaire. Data were obtained from medical registration and patient files and statistics unit of the hospital, Information was extracted by using data form administered by the researcher, Data were collected and reviewed from February 2020 to April 2020.

## 3. RESULTS

In this study, the mortality among 5045 neonates in both NICUs (1st, 2nd) in AL Basrah maternity and pediatric hospital was estimated to be (14.3%). The present study shows that, (307), 42.3% Of neonate die in the 2nd to the 7th day of life which is the highest percent and (247) ,37.7 % die in the 1st day of life and (144) 19.8 % die at age > 7 days, more than half 421 (58.1%) of the neonates are males, while 300 (41.3%) are females. Regarding birth weight of neonate, the highest mortality in low birth weight (1500-2500) which about 277 (38.2 %). Neonatal mortality more in preterm neonate (28-36) weeks of gestational age, which account 444 (61 %), (More than half of cases). Neonatal mortality more in 1st NCU (where neonate deliver in the same hospital) which account more than half of cases 395 (54.4 %) & 330 (45.5 %) in the 2nd NCU, (**Table 1**). The neonatal mortality in mother age (20-35 years) which account more than half of cases, about 501

(69.2 %). NM more in multipara. Regarding mother parity, multi para mother (2-4) have more risk to lose here neonate which about 401 (55.2%) of cases. Urban residence more than rural which about more than half of neonatal death 379 (52.3) %. Single pregnancy more risk for neonatal mortality than twin which about 673 (92.7 %). The neonatal mortality more in NVD than C.S which account 439 (60.5 %) of cases (**Table 2**). Respiratory distress syndrome was the more frequent cause of NM, they contributed for 349 (48.1%), followed by congenital anomalies 155 (21.1%), sepsis 96 (13.2), birth asphyxia 64 (8.8), other causes including (neonatal jaundice and its complication, inborn error of metabolism, intracranial hemorrhage, bleeding disorder, neonatal trauma, hemorrhagic disease of newborn, severe anemia and un specific causes), were about 61 (8.8 %), (**Table 3**). In our study we found there is high significant association between neonatal mortality and age of neonate; neonatal death more at 2-7 days of life (P. value <0.001). In addition, there is high significant association between NM and gestational age of neonate p-value 0.000. NM more in low birth neonate (P. value <0.001) The neonatal death more in 1st NCU than 2nd NCU (P. value <0.001). We found there is no association between NM and the sex of neonate, (**Table 4**) show these finding. We found there is association between NM and maternal age p- value 0009, There is no association between NM and Mother Parity, Address, Type of pregnancy and Mode of delivery, (**Table 5**). To identify significant independent predictor of NM we made a logistic regression analysis, we found that only three variables were significant independent predictors of NM; lower gestational age, lower birth weight and type of NCU, (P. value < 0.001).

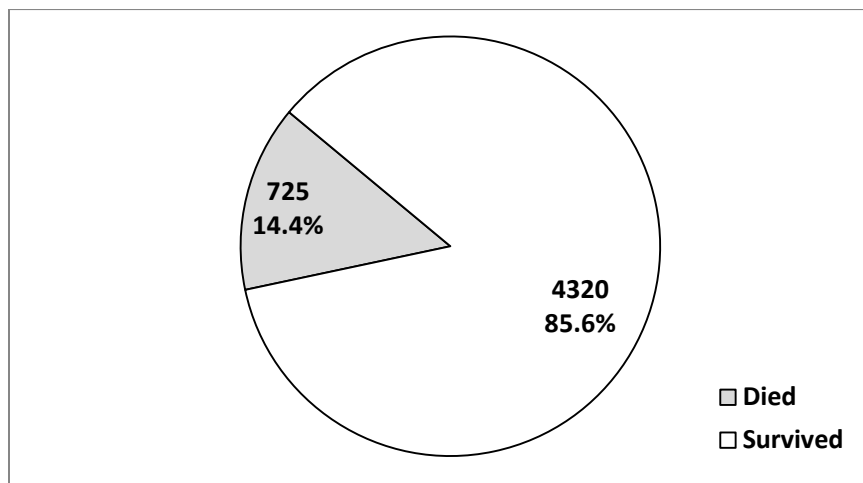


Figure 1. Mortality rates among the studied group during the studied year

Table 1. Neonatal risk factor of neonatal mortality

Neonatal risk factor	Total mortalities	%	
Age of neonate	1 day	274	37.8
	2-7 day	307	42.3
	>7 day	144	19.9
Sex	Male	421	58.1
	Female	300	41.4
	Ambiguous genitalia	4	0.6
Birth weight (gram)	<1500	179	24.7
	1500-2500	277	38.2
	2500-4000	256	35.3
	>4000	13	1.8
Gestational age (weeks)	>42	2	0.3
	37-42	269	37.1
	28-36	444	61.2
	<28	10	1.4
NCU	First	395	54.5
	Second	330	45.5

Table 2. Maternal risk factor of neonatal mortality

Maternal risk factor	Total mortalities	%	
Mother's age	<20 years	57	7.9
	20-35 years	502	69.2
	>35 years	166	22.9
Mother's parity	Para 1	61	8.4
	2 - 4	401	55.3
	≥ 5	263	36.3
Residence	Urban	379	52.3
	Rural	346	47.7
Type of gestation	Single	673	92.8
	Twin	52	7.2
Mode of delivery	VD	439	60.6
	C.S	286	39.4

Table 3. Causes of neonatal mortality

Causes	No. of mortalities	%
RDS	349	48.1
Congenital anomalies	155	21.3
Sepsis	96	13.2
Birth asphyxia	64	8.8
Others	61	8.4

Table 4. Neonatal death in relation to neonatal risk factor

Neonatal risk factor		RDS	Sepsis	Birth asphyxia	Congenital anomalies	Others	P. value
Neonatal age (day)	1	158	12	29	63	12	<0.001
	2 – 7	151	35	28	62	31	
	>7	40	49	7	30	18	
Sex	Male	199	56	40	91	35	0.242
	Female	149	40	24	63	24	
	Ambiguous	1	0	0	1	2	
Gestational age	<28	5	0	1	3	1	<0.001
	28-36	274	54	25	69	22	
	37-42	69	42	38	82	38	
	> 42	1	0	0	1	0	
Weight (gram)	<1500	145	16	1	12	5	<0.001
	1500-2500	143	34	24	57	19	
	2500-4000	57	43	38	81	37	
	>4000	4	3	1	5	0	
NCU	First	250	15	35	83	12	<0.001
	Second	99	81	29	72	49	

Table 5. Neonatal death in relation to selected maternal factor

Maternal Risk factor		RDS	Sepsis	Birth asphyxia	Congenital anomalies	others	Total	P. value
Maternal age	<20	18	16	7	13	3	57	0.009
	20-35	252	61	43	97	48	501	
	>35	79	19	14	44	10	166	
Mother parity	Para 1	24	15	7	13	2	61	0.060
	2 - 4	187	53	37	83	41	401	
	≥ 5	138	28	20	59	18	263	
Address	Urban	191	41	37	78	32	379	0.250
	Rural	158	55	27	77	29	346	
Type of pregnancy	Single	316	92	62	144	59	673	0.136
	Twin	3	4	2	11	2	52	
Mode of delivery	NVD	212	56	44	85	42	439	0.343
	C.S.	137	40	20	69	19	285	

Table 6. Results of logistic regression analysis for the predictors of neonatal mortalities

Variables	Beta	95% Confidence Interval for Beta		P. value
		Lower	Upper	
<b>Predictors</b>				
Gestational age	-0.138	-0.604	-0.175	<0.001
Birth Weight	-0.304	-0.683	-0.407	<0.001
NCU	0.159	0.249	0.675	<0.001
<b>Non-predictors</b>				
Type of pregnancy	-0.002	-0.386	0.358	0.942
Mode of delivery	0.016	-0.083	0.135	0.637
address	0.012	-0.157	0.224	0.730
Age of neonate	0.016	-0.108	0.173	0.652
Mother age	0.037	-0.135	0.335	0.403
Mother parity	-0.033	-0.286	0.127	0.449
Sex of neonate	0.009	-0.163	0.213	0.795



#### 4. DISCUSSION

A retrospective - quantitative study was chosen in order to find out the main causes of neonatal death among all the neonate admitted to NCUs at al Basrah Maternity and pediatric Hospital. This study found that in 2018 out of total 5045 neonate admitted to NCUs, 726 of them were dead in the neonatal period. In this study, the mortality among 5045 neonates in both NICUs (1st, 2nd) in AL Basrah maternity and pediatric hospital was estimated to be (14.3%). This result not much higher than the result of study made in Hamadan - Iran (32), which account (13.1 %), and 13.3 % in (NICU) of Jimma- Ethiopia (33). In our study, we found the higher mortality in the 1st week of life (2-7 days) which account 42.3%, while neonatal death in 1st day of age account 37.7 %, and 19.8 % for > 7 days' neonatal age, this is the same result in study at Imam Reza Hospital in Kermanshah- Iran (34). Most deaths occurred in the early neonatal period (1st week); this may be due to some causes like RDS, early sepsis, and birth asphyxia are usually of early onset and had short courses of illnesses so less duration of hospitalization was observed among those neonates. NM more in male gender than female (58.1 % male, 41.3 % female, 0.6 % ambiguous genitella, this same result in study at Indonesia (35). Regarding to birth weight we found highest mortality in low birth weight neonate (1500-2500 gm.), which account 277 (382%), and 256 (35.3 %) in normal birth wt. (2500\_4000), NM in extreme low birth weight < 1500 was 179 (24.7 %) and the lowest mortality in birth weight >4000 gm. which account 13 (1.8 %), this agree with result of study made in Jimma-Ethiopia (33), and the intensive care unit in Abha, Saudi Arabia (36). NM more in preterm neonate (28-36 weak) gestational age which account 444 (61 %) of cases, and 269 (37%) in term neonate (37- 42 weak), and 10 (1.4) in extreme preterm neonate, and the lowest mortality in post term neonate 2 (0.3%). This agree with result in studies in intensive care unit in Abha, Saudi Arabia. (36). Neonatal mortality is more in 1st NCU (where neonate deliver in the same hospital) which is account more than half of the cases 395 (54.4 %) & 330 (45.5 %) in the 2nd NCU (patient referral), .this agree with result in study made in Basrah (37) at 2008 where NM more in 1st NCU which account ( 84.82%), this can explained by the cases in 1st NCU deliver in same hospital and admitted to the NCU in the same day and the RDS and sepsis were more in 1st NCU (P.value < 0.001) .

Regarding maternal risk factor of NM, mortality more in mother age group (20-35 years) which is the reproductive age and account 501 (69.2%), and 166 (22.9%) in mother age >35 years, and 57 (6.9%) in <20 years' mother age, this same result in study of Indonesia (51) and Pakistan (38); where NM more in mother age group (20-35 years) which account (71%) of cases, this can explain by this age is the reproductive age group of female and the most birth in this age. NM more in multi para (2-4) which account 401 (55.2 %), 263 (36.2) in grand-multipara (5 child & more) and lowest mortality in our study in para 1 mother about 61 (4.8 %) this same result in study in Sulamania –Iraq (39) and in Hamadan Iran (23) study where NM more in multi para than primi mother. This can be explained by mother take more care in 1st pregnancy and more ANC and medical consultation than subsequent pregnancy. NM between Urban residence more than rural which about more than half of neonatal death 379 (52.3%) and rural account 346 (47.7%), this differ from result of study in Ethiopia (33) where found that those neonates who came from centers outside the city had increased risk of mortality, this may have explained by the position of the hospital in the center of the city and most patient from the center of the city. NM more in single neonate than twin pregnancy 673 (92.7%) for single and 52 (7.2 %) for twin, this same result in study made in Basrah 2008 (37), NM more in single than twin pregnancy which account (81.6) p-value <0.001, this can explain by the twin pregnancy is represent a small number of total delivery, and most twin pregnancy deliver by elective C.S where the patient well prepared and at appropriate gestational age and under close observation from gynecologist and pediatric doctor. The neonatal mortality more in NVD than C.S which account 439 (60.5 %) of cases, and 258 (39.3%) for C.S, this same result in Sulaimani Intensive Care Unit (39) Vaginal 67.3% of cases, and that's differ than study in Iran (34) where NM more in C.S delivery which account (77.2%) of cases p< 0.001 this can explain by the most delivery are normal vaginal delivery (NVD more than C.S) and resuscitation done by pediatric doctor in operation room while done by medical staff in labor room. In the present study, the most common cause of mortality in the mention hospital was RDS, accounting for about half of the deaths (48.1%), and the other causes of NM in our study are congenital anomalies (21.1%), sepsis (13.2%), birth asphyxia (8.8), other uncommon causes including (jaundice, inborn error of metabolism, hemorrhagic disease of newborn, severe anemia and un specific causes) about (8.8) respectively. This result is consistent with the results of study in

sulamania (39) in Iraq and in the Neonatal Intensive Care Unit of Imam Reza Hospital in Iran (34) and study in the intensive care unit in Abha, Saudi Arabia (36). And disagree with result of study of Ethiopia (33) where most common causes reported that low birth weight 60.4%, prematurity 55% and RDS 41%, this may be due to disinfection measure in the hospital. This study shows that there is significant association between neonatal death and neonatal age (1st week of life), gestational age (28-36), birth weight and with 1st NCU admission and maternal age.

## 5. CONCLUSIONS

The Neonatal mortality rate reported in our study is relatively high. Neonatal mortalities were affected by neonatal and maternal factors. The most common causes of death in the present study were RDS, congenital anomalies, septicemia, birth asphyxia and other causes including (jaundice, metabolic disorder, etc....). The higher NM rate was related to lower gestational age, lower weight male sex, neonatal age 2-7 days, rural residence, types of neonatal unite, mode of delivery, mothers age, type of gestation and parity. However, regression analysis revealed only three predictors of NM which are lower gestational age, lower birth weight and type of NCU, We recommended further studies including multiple centers on national level to address the possible underlying causes of higher NM rates.

### **Ethical Clearance:**

Ethical issues were approved by the Authors. Data collection was in accordance with the World Medical Association (WMA) declaration of Helsinki for the Ethical Principles for Medical Research Involving Human Subjects, 2013 and all information and privacy of participants were kept confidentially.

**Conflict of interest:** Authors declared none

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