Causes of Neonatal Mortality in Neonatal Care Units

AL-Diwaniya Province –Iraq 2013

By
Nazhat Jassab Hamza
M.B.Ch.B.
07805931328
dr.nazhat@yahoo.com

Abstract

Background: Neonatal mortality refers to death of a new born within the first 28 days of life. A child's risk of death in the first four weeks of life is nearly 15 times greater than any other time before his or her first birthday.

Methods: A cross sectional study was conducted to review records of neonatal deaths that took place in all neonatal care units in AL- Daiwynia province during the year 2013. Data collection form was designed to collect the demographic data, data concerning pregnancy and delivery and any complication during pregnancy, delivery and perperium, mode of delivery, place of delivery and causes of neonatal death. **Result**: respiratory distress syndrome was the highest among causes of neonatal deaths (55.2%), followed by birth asphyxia (16.5%), sepsis (15%), neonatal jaundice and its complications (7.1%), pneumonia (2.5%), cold injury (1.8%) and diarrhea (0.8). Preterm delivery was noticed in (55%) of the deceased neonates, 37.5% of them were with normal birth weight, 32% with low birth weight, 17.5% with very low birth weight and 13% were with extremely low birth weight. **Conclusion:** The most common causes of neonatal deaths were respiratory distress syndrome, birth asphyxia and sepsis. Prevention of prematurity and low birth weight as major cause for respiratory distress syndrome will lead to a decrease in neonatal mortality and morbidity.

Introduction

Neonatal mortality refers to death of a new born within the first 28 days of life, it is usually divided into: Early neonatal mortality (ENM) which includes deaths within the first seven days of life and late neonatal mortality (LNM) which includes deaths after the seventh day until 28th day of life. Neonatal mortality rate (NMR) is the number of deaths which occur in the first 28 days of life per 1000 live births and is usually calculated by the formula1 (WHO,2006)[1]:

$$NMR = \frac{\text{Number of neonatal deaths in a locality over a given time period}}{\text{Number of live births in the same locality over the same time period}} \times 1000$$

A child's risk of death in the first four weeks of life is nearly 15 times greater than any other time before his or her first birthday. Of the 8.2 million under-five children deaths per year 3.3 million occurred during the neonatal period, three millions of them died within the first week of their life and almost two millions died during their first day of life(WHO,2011)[2] . Neonatal period represent the most vulnerable time for a child's survival, in 2012 roughly 44% of under five deaths occur during this period. Reducing neonatal mortality is increasingly important not only because the proportion of under-five deaths that occur during the neonatal period is increasing as under-five mortality declines, but also because the health interventions needed to address the major causes of neonatal death generally differ from those needed to address other under-five death(WHO,2013)[3].During the neonatal period, 35.2% of deaths were due to prematurity, 23.9% were caused by intrapartum-related complications including birth asphyxia, and 15.2% were caused by sepsis and other infectious conditions of the newborn (WHO,2012)[4].

Most of neonatal deaths occurred at home (Lawn JE, et al 2005)[5], and the mortality rates for boys in the early neonatal period are higher than those for girls. However, it is less well known that differences in attitude towards boys and girls affect their future lives, gender preference and its consequences vary throughout the world(WHO,2006)[1]. Although neonatal deaths were often more difficult to

prevent, there are countries that have had great success in reducing neonatal mortality. In 1990 Estonia had a neonatal mortality rate above 11 per 1,000 live births. By 2012 this had been reduced to 1.6; a decline of 86 % (WHO, 2013)[3] .

According to World Health Organization (WHO); 99% newborn deaths occur in low- and middle-income countries. It is especially in Africa and South Asia that the least progress in reducing neonatal deaths has been made (WHO, 2011)[2] .

Aims of the Study:

The general aim is to study the pattern of neonatal mortality in AL- Diwaniya province – Iraq.

Specific Objective:

1. To determine the causes of neonate mortality among neonates admitted to neonatal care units in AL-Diwaniya Pediatric Hospital.
2. To estimate the neonatal mortality rate per 1000 live birth during the study period.
3. To determine some of the risk factors associated with neonatal mortality.

2.1 Study Design:- Cross sectional study.

2.2 Study Settings: The current study was conducted during the period (from 1/3/2014 to 31/8/2014). All recorded of neonatal death that took place in all neonatal care units in AL-Diwaniya province during the year 2013 (from 1/1/2013 to 31/12/2013) were reviewed. There are five neonatal care units (two central and three districts) in Diwaniya province.

2.3 Data Collection: Data collection form was designed to collect the following:-

1. **Demographic data:** ID, age, gender, weight, place of family residence.
2. **Data concerning pregnancy and delivery:** Weight at birth, clinical condition of the mother, number of pregnancies (as prime gravida, gravida 2-4, and gravida five and more), gestational age (as full term deliveries after completing 37th week of gestation and pre term deliveries before completing the 37th week of gestation according to WHO (WHO,2011)[2], and any complication during pregnancy, delivery and perperium.
3. **Mode of delivery:** Normal vaginal delivery, elective cesarean section and emergency cesarean section.
4. **Place of delivery:** Home delivery or hospital (private and governmental hospital).
5. **Birth weight:** was recorded and classified as extremely low birth weight less than 1000 g (up to including 999 g), very low birth weight less than 1.500g (up to including 1499 g), low birth weight less than 2.5kg (up to including 2499g) and normal birth weight (2500–3500) according to WHO classification, (WHO,2011)[2].
6. **Congenital anomalies**: All registered congenital anomalies were recorded and classified according to the types of anomalies.
7. **Causes of neonatal death:** Asphyxia, preterm, jaundice, congenital anomalies, tetanus, diarrhea, pneumonia and sepsis (neonatal sepsis has been classified into early- onset sepsis (EOS) within first three days of life and late- onset- sepsis (LOS) occurring after first week of life (Shah BA and Padbury JF,2014)[6].
8. **Age at which the neonatal death occurred:** very early during the first hour, during the first day, first week, second week, third week and fourth week.

2.4 Statistical Analysis: Epi-info 3.5.3 computer software was used for data input and analysis. Discrete variables were presented as numbers and percentages and continuous variables presented as mean ± SD (standard deviation). Chi square test for independence was used to test the significance of association between discrete variables. Student's T test for two independent samples was used to test the significance in observed difference in mean of continuous variables. All tests were two sided. Findings with P value less than 0.05 considered significant.

2.5 Ethical Approval:- The official agreement from the Research Ethical Committee for performing the research was obtained.

Results: The Central Organization for Statistics and Information technology (COSIT) (Ministry of Health –Iraq; 2013)[7] estimated the population in AL-Diwaniya province during 2013 to be

1,191,106, and the under –five years population to be 171,389 (table 1).

During 2013 in AL-Diwaniya province; 81.1% of the live births deliveries took place at health institutions (table 2), number of neonatal death within health institutions was 395, reaching a rate of 10.04 per 1000 live births (table 3).

Table (1): Total Population, under five and live births in AL-Dewaniya Province during 2013*

Population in AL-Diwaniya Province	Male	Female	Total
Total Population	627,417	563,689	1,191,106
Under Five Year Population	90,260	81,129	171,389
Live Births	20,305	19,044	39,349

Source: Annual Statistical Report 2013, Ministry of Health-Iraq.

Table (2): Live Births by place of delivery during 2013 in AL-Diwaniya Province

Place of delivery	No	%
Within the Health Institutions	32212	81.9
Outside Health Institutions	7137	18.1
Total	39,349	100.0

Table (3): Neonatal Death and Neonatal mortality Rate in AL-Dewaniya Province during 2013

Variables	Numbers and rates
Number of neonatal death	395
Number of Live births	39349
Neonatal mortality rate	10.04 / 1000 live births

Neonatal deaths were more among males (60%) with a male to female ratio of 3:2 (figure 1), nearly two thirds of the deaths (63%) were among neonates whose families came from rural areas (figure 2).

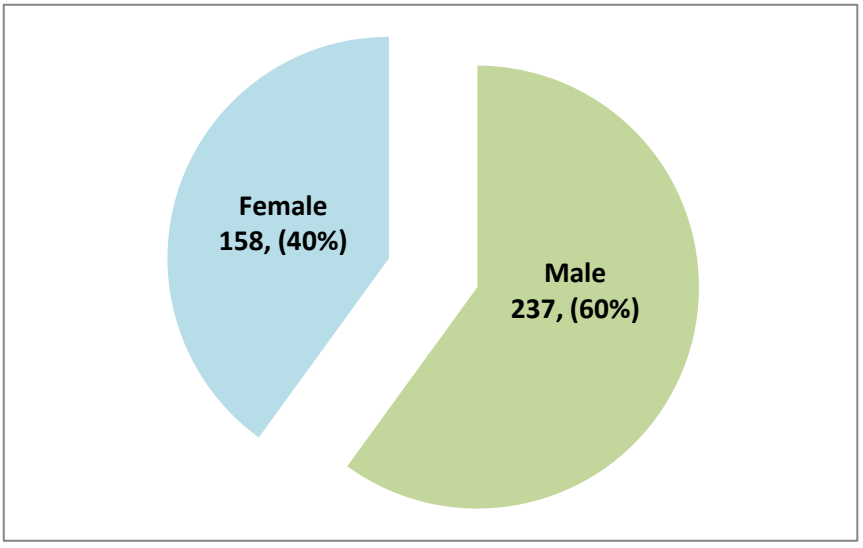

Figure 1: Neonatal Death by Gender

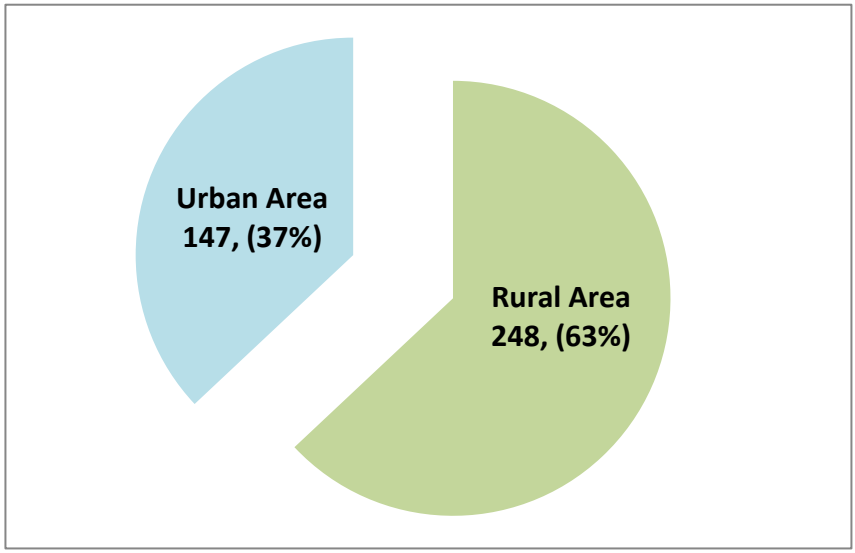

Figure 2: Neonatal Deaths by Residency

According to gestational age; neonatal death was more among those neonates born before completing the 37th week of gestation (preterm delivery) (55%) than full term neonates (45%) (figure 3).

Considering mode of delivery; among the deceased neonates 54.9% were born by normal vaginal delivery(NVD), 45.1% by cesarean section (CS) among which 27.1% were delivered by emergency CS and only 18.0% were delivered by elective CS (table 4).

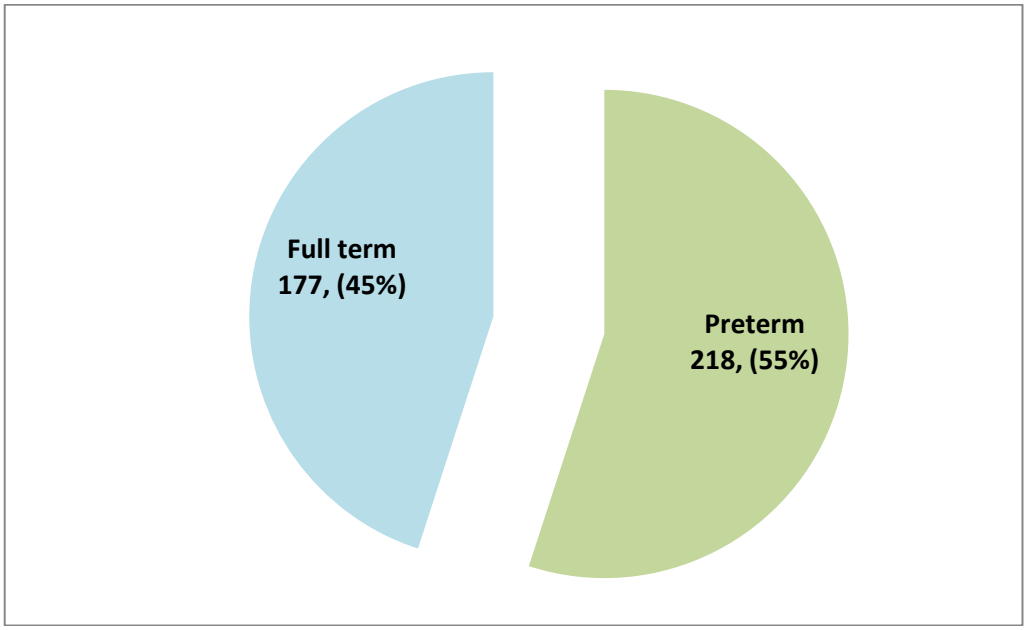

Figure 3: Neonatal Death by Gestational age

Table 4: Neonatal death by type of delivery

Type of Delivery	Neonatal Death	
	No	%
Normal Vaginal Delivery	217	54.9
Emergency Cesarean Section	107	27.1
Elective Cesarean Section	71	18.0

Total	395	100.0

Regarding place of delivery; 84.6% of the deceased neonates were delivered at governmental hospital, 10.1% in private hospital and only 5.3% were delivered at home (table 5).

Table 6 showed the distribution of the deceased neonates by their birth weight. It was found that the birth weight was within normal in 37.5% of the deceased neonates, low in 32%, very low in 17.5% and extremely low birth weight in 13%.

Table 5: Neonatal Death by Place of Delivery

Place of Delivery	Neonatal Death	
	No	%
Governmental Hospital	334	84.6
Private Hospital	40	10.1
Home Delivery(Midwives)	21	5.3
Total	395	100.0

Table (6): Neonatal Death by their Birth Weight

Birth Weight	Neonatal Death	
	No	%
Normal Birth Weight	148	37.5
Low Birth Weight	127	32.0
Very Low Birth Weight	69	17.5
Extremely Low Birth Weight	51	13.0
Total	395	100.0

Based on the causes of death; more than half the deceased neonates (55.2%) died from respiratory distress syndrome which was registered as the first cause of death, followed by birth asphyxia (16.5%), sepsis (15%), neonatal jaundice and its complications (7.1%), pneumonia (2.5%), cold injury (1.8%), tetanus neonatorum (suspected case)(0.2%) and diarrhea (0.8%)(table 7).

Among those neonates with sepsis; in 44.4% sepsis appeared during the first week of their life, 17.5 % from their first day of life, 15.9 % during the second week, 14.3 % during the third week and 7.9 % during the fourth week of their life (table 8).

Table (7): Neonatal Death by Causes of Death

Causes of Death	Neonatal Death	
	No	%
Respiratory Distress Syndrome(RDS)	218	55.2
Asphyxia	65	16.5
Sepsis	63	15.9

Neonatal Jaundice	28	7.1
Pneumonia	10	2.5
Cold Injury	7	1.8
Diarrhea	3	0.8
Tetanus Neonatorum (Suspected Case)	1	0.2
Total	395	100.0

Table (8): Deceased neonates with sepsis by time of occurrence

Time of occurrence of sepsis	Neonatal Death	
	No	%
1st Day	11	17.5
1st Week	28	44.4
2nd Week	10	15.9
3rd Week	9	14.3
4th Week	5	7.9
Total	63	100.0

Among the deceased neonates, 10.3% of them died during their first hour of life, 43.0% died during their first day of life, 34.7% during the first week of life, 7.1% during the second week and 5.1% during their third week of life (table 9).

Congenital anomalies were found in 70 of the deceased neonates, 54.3% of them were with multiple anomalies, 21.4 % with congenital heart disease, 8.6% with hydrocephaly, 7.1% with anencephaly, 4.3% with renal deformities and 4.3% with Dawn syndrome (figure 4).

Table 9: The deceased neonates by their age at death

Age of Occurrence of Death	Neonatal Death	
	No	%
First Day	170	43.0
First Week	125	31.7
First Hour	41	10.3
Second Week	28	7.1
Third Week	20	5.1
Fourth Week	11	2.8
Total	395	100.0

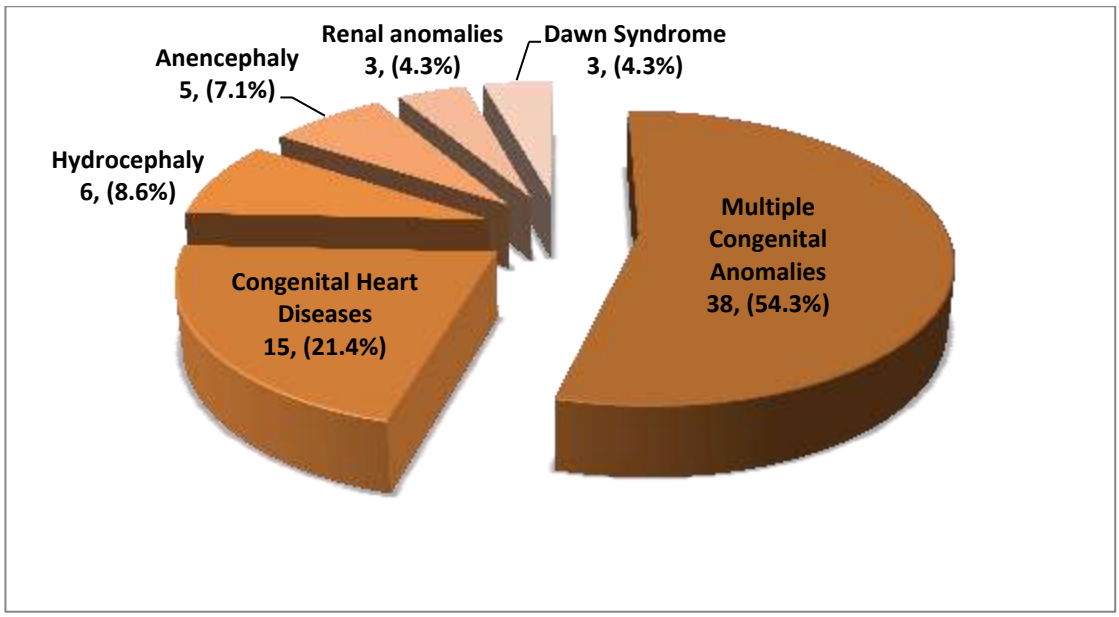

Figure (4): Deceased neonates with congenital anomalies by type of anomalies (Total number = 70)

Regarding maternal conditions affecting neonatal survival table nine showed that 40% of the deceased neonates were delivered to mothers with 2-4 pregnancy, 34.7% were the first babies for their mothers and 25.3% of them were delivered by grand mutiparaus, whereas 19.4% of the deceased were twins pregnancy, 16.1% were delivered after obstructed labor, the mothers of 16.1% of them had previous CS, 10.8% had hypertension, 10.8% had placenta previa and 8.1% had diabetes mellitus (table 10).

Table (10): Deceased neonates and number of pregnancies (gravidity) among their mothers

Number of Pregnancies	Neonatal Death	
	No	%
Prime Gravid (G_1)	137	34.7
Gravid (G_2-G_4)	158	40.0
Multi Gravid (G_5 and above)	100	25.3
Total	395	100.0

Table (11): Deceased neonates by maternal problems during pregnancy

Maternal problems during pregnancy	Neonatal Death	
	No	%
Twin Pregnancies	36	19.4
Obstructed Labor	30	16.1
Previous Cesarean Section	30	16.1
Hypertension	20	10.8
Placenta Previa	20	10.8
Diabetes Mellitus	15	8.1
Abnormal Position	10	5.4
Meconum Aspiration	10	5.4
Premature Ruptured Membrane	10	5.4
Rh Incompatibility	5	2.7
Total	186	100.0

Table 11 showed the association between timing of neonatal death and gravidity, causes of death, gender, mode of delivery, gestational age and congenital anomalies. It was found that

Respiratory Distress Syndrome (RDS) and asphyxia were higher among neonates who died early whereas sepsis and neonatal jaundice were more among neonates who died lately and the association was statistically significant (P< 0.0001). Regarding gestational age; most of those who died early were preterm whereas nearly all those who died late were full term neonates and the association was statistically significant (P<0.0001). Although a noticeable differences were found between neonates who died early and those who died late regarding gravidity, gender and mode of delivery yet the differences were statistically not significant.

Table 12 showed the association between gender and gravidity, causes of death, mode of delivery, gestational age and congenital anomalies. It was found that neonatal deaths were more among full term boys whereas among girls the highest rate was among preterm girls and the association was statistically significant (P=0.004). Gender has no significant association with gravidity, causes of death, mode of delivery and congenital anomalies.

Table 12: Association between timing of neonatal death and gravidity, causes of death, gender, mode of delivery, gestational age and congenital anomalies

Variables	Timing of Neonatal Death				
	Early		Late		
	N	%	N	%	P
Gravidity					**0.13[NS]**
Primigravida	112	33.3	25	42.4	
G2-4	133	39.6	25	42.4	
G5+	91	27.1	9	15.2	
Total	**336**	**100.0**	**59**	**100.0**	
Causes of neonatal death					**<0.0001**
Respiratory Distress Syndrome(RDS)	210	62.5	8	13.6	
Asphyxia	58	17.3	7	11.8	
Sepsis	39	11.6	24	40.7	
Neonatal Jaundice	16	4.8	12	20.3	
Others	13	3.9	8	13.6	
Total	**336**	**100.0**	**59**	**100.0**	
Gender					**0.49[NS]**
Males	204	60.7	33	55.9	
Females	132	39.3	26	44.1	
Total	**336**	**100.0**	**59**	**100.0**	
Gestational age					**<0.0001**
Full term	119	35.4	58	98.3	
Preterm	217	64.6	1	1.7	
Total	**336**	**100.0**	**59**	**100.0**	
Mode of delivery					**0.19[NS]**
NVD	180	53.6	37	62.7	
CS	156	46.4	22	37.3	
Total	**336**	**100.0**	**59**	**100.0**	
Congenital anomalies					**0.866[NS]**
Positive	60	17.9	10	16.9	
Negative	276	82.1	49	83.1	

Total	**336**	**100.0**	**59**	**100.0**

Table 13: Association between gender and gravidity, causes of death, mode of delivery, gestational age and congenital anomalies

Variables	Gender				
	Males		Females		
	N	%	N	%	P
Gravidity					**0.24[NS]**
Primigravida	85	35.9	52	32.9	
G2-4	87	36.7	71	45	
G5+	65	27.4	35	22.1	
Total	**237**	**100.0**	**158**	**100.0**	
Causes of neonatal death					**0.96[NS]**
Respiratory Distress Syndrome(RDS)	128	54.0	90	56.0	
Asphyxia	40	16.9	25	15.8	
Sepsis	40	16.9	23	14.6	
Neonatal Jaundice	16	6.8	12	7.5	
Others	13	5.4	8	5.1	
Total	**237**	**100.0**	**158**	**100.0**	
Gestational age					**0.004**
Full term	120	50.6	57	36.1	
Preterm	117	49.4	101	63.9	
Total	**237**	**100.0**	**158**	**100.0**	
Mode of delivery					**0.5[NS]**
NVD	127	53.5	90	57	
CS	110	46.5	68	43	
Total	**237**	**100.0**	**158**	**100.0**	
Congenital anomalies					**0.59[NS]**
Positive	40	16.9	30	19.0	
Negative	197	83.1	128	81.0	
Total	237	**100.0**	**158**	**100.0**	

Discussion

Neonatal mortality rate in AL- Diwaniya during the study period (relative to admission) was 10.04 per 1000 live births which was lower than what was found by Hameed and Abed, 2012, (Hameed NN and Abed BN; 2012)[8] on studying neonatal deaths during 2008 and 2009 in Baghdad Teaching Hospital /Medical City where the NMR was 20% during 2008 and 19.2% during 2009.

Regarding gender, neonatal mortality was found to be higher among males, same conclusion was noticed by Mirfazeli et al., 2014(Mirfazeli A, et al 2014)[9] in Gorgan-North of Iran. This may be due to that male neonates have higher incidence of sepsis and respiratory distress syndrome than females (Hameed NN and Abed BN; 2012)[8]

The most frequent cause of neonatal mortality was prematurity, neonatal deaths were significantly associated with preterm 218(55%) deliveries (P value <0.0001) which was similar to the study of Dadipoor et al., 2014 (Dadipoor S; et al 2014)[10] in Bandar Abbas/Iran. Several factors contribute to the birth of a premature baby, such as maternal age less than 20 years and more than 40 years, smoking, poor maternal nutrition, maternal infection and socio-economic factors , this is on the one hand, on the other hand prematurity could affect other neonatal factor including weight at birth (Dadipoor S; et al 2014)[10] . In the current study 49.5% of the deceased neonate were with low

and very low birth weight, and this was inconsistent with (Mirfazeli A, et al 2014)[9] in Gorgan-North of Iran. More than half the deceased neonates in the current study were delivered by normal vaginal delivery (54.9%), the same was noticed by Hameed and Abed, 2012, Hameed NN and Abed BN; 2012)[8] in Baghdad Teaching Hospital /Medical City where 44.7% of their deceased neonates were delivered by C/S and 55.3% by normal vaginal delivery. This may be attributed to that those born by C/S usually receive intensive care and examined by health professionals (usually a doctor) and any problem will be dealt with immediately and urgently not as those delivered by NVD especially outside the health facility.The current study revealed that early neonatal death was found in 88.0% of the deceased neonates, 10.3% of them died during their first hour of life, 43.0% died during their first day of life and 34.7% during the first week of life which was similar to a study that was conducted in AL- Fallujah General Hospital/Fallujah City/Anbar Province/ West of Iraq by of (Abdulghani ST, et al 2012), during 2012 in which 23.4% of neonatal death occurred in first day of life, 31.7% of neonatal death occurred between 24-72 hours and 44.8% occurred after 72 hours of life.

Conclusions: Neonatal mortality rate in AL-Dewaniya Province during 2013 was 10.04 / 1000 live births:

1- Neonatal deaths were more among males.
2- The most important causes of neonatal deaths were respiratory distress syndrome, birth asphyxia and sepsis.
3- Prematurity and low birth weight were associated with RDS.
4- Twin pregnancy, obstructed labor, previous cesarean section and maternal hypertension were associated with neonatal death.
5- **Recommendations**

1- Proper antenatal care help in identifying those at high risk to act urgently.
2- Intensive care is required for preterm and low birth weight babies especially those with respiratory problems and guideline should be ready to prevent and deal with neonatal infections and congenital anomalies.

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