



FACTORS ASSOCIATED WITH NEONATAL MORBIDITY AND MORTALITY IN JORDAN

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Article Received on 21/06/2024

Article Revised on 11/07/2024

Article Accepted on 01/08/2024

ABSTRACT

Neonatal morbidity and mortality are major global public health challenges. In developing countries where the majority of neonatal deaths occur in resource-limited settings, significantly higher neonatal mortality and morbidity rate have been reported in compared with developed countries.

KEYWORDS: Neonatal Mortality, Morbidity, NICU, Prematurity, RDS, Short Gestation Age.

INTRODUCTION

Despite the extraordinary improvement in healthcare technology and guidelines over the past 25 years including the advances of obstetric practice in terms of medical screening and surveillance and increased neonatal specialization. Neonatal mortality and morbidity remain a complex global challenge and considered as a public health problem worldwide for both developed and developing countries. However, in developing countries with low to middle income extensive efforts are still needed to improve neonatal and pediatrics health.

Globally, data and statistics still show unacceptable rates of mortality and morbidity across pediatrics. Neonatal mortality rate (NMR) is a significant health indicator that includes newborns dying during the first 28 days of life. NMR index represents the number of deaths per 1000 live births per year. NMR is usually associated with societies' health, culture, and economic level of population and represents an indicator for population health and wellbeing. Significantly, its estimated that around 27.8 million neonates will die in the first month of birth between 2018 to 2030 if the current rate of NMR is still without reduction.^[1] Dramatically, around 45% of deaths in children below five years of age occur during the neonatal period.^[2] In addition, among neonatal death, around 50% occurred with the first 24 hours of birth and one third occurred in the first 6 h after birth.^[3] In the Hashemite Kingdom of Jordan, according to the Jordan Perinatal and Neonatal Mortality study achieved by Khader et al. 2021, stillbirth, neonatal, and perinatal mortality rates were 11.6/1,000 total births, 14.9/1,000 live births, and 23.7/1,000 total births, respectively.^[4]

In 2004, the UN Inter-agency Group for Child Mortality Estimation (IGME) was established to report the progress toward child survival goals, to improve methods for estimating child mortality, and to enhance country capacity to produce timely and properly assessed estimates of child mortality. The UN IGME is led by the UN International Children's Emergency Fund (UNICEF), and it includes members from World health Organization (WHO), the World Bank Group, and the Population Division of the UN Department of Economic and Social Affairs.^[1] In addition, WHO declared the Sustainable Development Goals 2030 (SDG) Target 3.2 (End preventable deaths of newborns and children under 5 years of age). Substantial global progress has been made in reducing childhood mortality since 1990. The total number of under 5 years deaths worldwide has declined from 12.8 million in 1990 to 4.9 million in 2022. Since 1990, the global under-5 mortality rate has dropped by 59%, from 93 deaths per 1000 live births in 1990 to 37 in 2022. Globally, the number of neonatal deaths also declined, from 5.2 million in 1990 to 2.3 million in 2022. However, the decline in neonatal mortality from 1990 to 2022 has been slower than that of post-neonatal under-5 mortality. Significantly, the SDG target 3.2 for under-5 mortality rate (U5MR) is to reduce to 25 or less per 1000 live births and for neonatal mortality rate (NMR) to reduce to 12 or less per 1000 live births by 2030.^[5,6]

According to the WHO medical classification list issued in the 10th revision of the International Statistical Classification of Diseases and Related Health Problems 11th Revision. The most common causes of neonatal mortality and morbidity worldwide are related to respiratory distress syndrome, asphyxia, meconium aspiration syndrome, sepsis, seizures, hypoglycemia, air

leakage syndrome, intravascular coagulation, pulmonary hemorrhage, cold stress, necrotizing enterocolitis, intracranial hemorrhage, kidney failure, hydrops fetalis, and kernicterus.^[7,8] Unfortunately, around 40% to 60% of neonatal death could be preventable through low cost interventions.^[9,10] However,

In addition, the burden of neonatal mortality and morbidity in low- and middle-income countries is still unclear where the majority of neonatal deaths occur without a clear cause of death (i.e., pre-maturity). WHO declared that around 98% of neonatal deaths occurred in developing countries.^[11,12] The highest NMR was recorded in South Asia with 51 per 1000 live births. In Africa the rate was 42 per 1000 live births. While the lowest NMR was found in Europe and North America less than 10 per 1000 live births.^[13,14] However, it is difficult to confirm the cause of neonatal mortality because there are many factors associated with exact underlying cause neonatal death. In general, neonatal mortality and morbidity have occurred as an emergency cases directly after birth or later due to infections which are the leading causes of mortality and morbidity worldwide.^[15] Around more than 20% of children born in developing countries acquire an infection during the neonatal period.^[13]

Global statistics suggest a slow trend in reducing neonatal mortality and showed that preventing prenatal deaths seems more difficult than during infancy.^[16] Between 1990 to 2012, the developed countries have succeeded to reduce NMR by 45%, while in developing countries the reduction rate was around 37% and with some regions as low as 17%.^[17] However, available data including timing about causes of neonatal mortality and morbidity and NICU treatments and admission data are less reliable than other medical data in low- and middle-income countries leading to inaccurate estimation and essential challenges to provide evidence-based interventions to prevent neonatal mortality.^[18] Therefore, improving data and timely identification of neonatal mortality and morbidity are a significant key factor to establish a specific context community and strategies that dramatically improve appropriate intervention to reduce mortality and morbidity rates. In Hashemite Kingdom of Jordan an electronic stillbirths and neonatal deaths surveillance system (JSANDS) was developed and established in 2019 including the five large hospitals in Jordan to determine the rate, risk factors, and causes of neonatal mortality.^[19]

METHODS AND OBJECTIVES

Web based review study was conducted to explore associated factors with neonatal mortality and morbidity that have been reported through published studies since 2020 in developing countries especially in Hashemite Kingdom of Jordan. By using combinations of keywords Neonatal, Mortality, Morbidity, Associated Factors, Jordan. Our study aims to reduce preventable neonatal morbidity and mortality in our country through

collecting data for evidence-based planning, this five-year study investigated the causes of neonatal mortality and morbidity, the period that neonatal death happened, and the related factors in our referral and central neonatal hospital.

DISCUSSION

Our study investigated the causes and factors associated with neonatal mortality and morbidity in developing countries and especially in Jordan. According to Batieha et al. 2016 and Al-Sheyab et al. 2020 the reported NMR was almost similar to (14.9 per 1000 live births) with cut off point of gestational weeks (≥ 20 weeks) which indicated that the rate is almost stable, and no significant reduction has been occurred. Therefore, more effort and improvement are required to reduce the NMR to (12 per 1000 live births) according to Sustainable Developmental Goal by 2030 in Jordan.^[12,20] Also, Al-Sheyab stated that the significant leading cause of death among study population were respiratory distress of newborn (45%), low birthweight and pre-term (33%), pulmonary hemorrhage (14.5%).^[20] In addition, reported timing about causes of neonatal mortality and morbidity was significantly associated with the first week and the first day after birth. Where 79 % of all neonatal deaths occurred in the first week after birth with over 42 % occurring in the first day after birth.^[12] Which is compatible with WHO reports about the time of neonates' death show that most neonatal mortality occurs within the first day and first week of life. Furthermore, associated factors with neonatal deaths were classified according to the Neonatal and Intrauterine Death Classification according to Etiology (NICE) into 13 categories. While preventable causes of deaths were classified according to Herman's classification into preventable.^[21]

On the other hand, morbidity clinical profile has been evaluated from 2016 to 2018 at KAUH among all NICU admission by a single-center cross-sectional descriptive study performed by Khasawneh et al. 2020 who reported the primary reasons for NICU hospitalization include prematurity (33.4%), respiratory failure caused by respiratory distress syndrome (RDS) 28.9% and transient tachypnea of newborn (TTN) 12.3% respectively.^[22] In addition, retrospective analysis based on medical records for all admitted to the NICU at Princess Rahma Pediatric Hospital in Jordan between 2018 and 2019 was performed by Al-Momani et al. 2020 who declared that the common causes of neonate's admission were sepsis (27.3%), followed by respiratory distress syndrome (RDS) (24.9%) and asphyxia (13.1%). While the common factors leading to neonatal death were RDS (35.6%), followed by sepsis (27.7%).^[23] Significantly, Khader et al. 2020 discussed and analyzed the rate, causes, and preventability of stillbirths in Jordan through national study of perinatal mortality in 18 selected hospitals including 21,980 women who delivered at a gestational age ≥ 20 weeks during the study period. The main causes of stillbirth were classified according to

NICE guidelines. The study showed that the primary causes of stillbirth among study population were maternal diseases (19.5%), unexplained immaturity (18.8%), congenital anomalies (17.6%), unexplained antepartum stillbirths (17.6%), obstetric complications (8.4%), placental abruption (5.7%), and multiple births (5%). Remarkably, 34.5% of all neonates deaths were preventable and 30.3% were possibly preventable with advanced and optimal care.^[24] However, the prevalence rate of low birth weight in Jordan was estimated around 16.6% by Mohammad *et al.* 2020 through retrospective study investigated all singleton live birth records over a 5-year period from 2011 to 2015 in four government funded hospitals.^[25]

Furthermore, studies from regional countries have been explored and discussed factors associated with increased mortality and morbidity rate among neonates. For example, a study conducted at Neonatal Care Unit of Central Teaching Hospital of Pediatric in Baghdad Al-krakh Health Directorate by Ibrahim *et al.* 2020 showed that the main identified causes of death respiratory failed conditions (37.5%), sepsis (33.3%), premature neonates and disorder related to short gestational age (7.1%). While the main factors leading to admission were jaundice (37.5%), respiratory related condition and bacterial sepsis (35.2%) and (14.1%) respectively.^[26] Also, a case-controlled study conducted at Pak-Emirates Military Hospital to determine the frequency and association of different risk factors for morbidity and mortality in neonates by Aslam *et al.* 2021 revealed that risk factors associated with increased mortality and morbidity were low birthweight, multiple gestations, early delivery. However, increment of neonatal mortality rate was linked to early onset sepsis, hypoxic ischemic encephalopathy, meconium aspiration syndrome, congenital anomalies.^[27] In Egypt, Hassan *et al.* 2022 reported higher prevalence mortality rate was reported among preterm neonates admitted to NICU at Assiut University Children's Hospital with respiratory complications.^[28]

Moreover, Khan *et al.* 2020 determined neonatal mortality rate among low birth weight and gestational age. Significantly, mortality rate among neonates with short gestational age was reported (p -value <0.005). As well as, once weight at birth was used as the independent variable, the mortality rate was 90% for neonates with 1000 grams, 55.88% for neonates with 1000-1499 grams and 10.73% for neonates with 2000-2499 grams (p value <0.005).^[29] Similarly, Mekasha reported significant risk factors for preterm death were low gestational age, and low birth weight.^[30]

In addition, studies from Africa aim to assess neonatal mortality and associated factors showed that prematurity and low birth weight were associated with around 50 % of NICU admission. As well as early onset neonatal sepsis was the leading cause for 43% of neonates' admission. In consequence, another study from Ethiopia

revealed that the leading causes for neonatal deaths among study population were prematurity (43%), low birth weight (33%), RDS (22%), and neonatal sepsis (14%).^[30,31]

Furthermore, a descriptive retrospective cross-sectional study to determine the number, disease pattern, and outcome of the patients admitted at the Neonatal Care Unit (NCU) at Al-Bayda medical center (AMC) in Libya conducted by Younis *et al.* 2021. The study reported the admitted rate of neonates was 6% of total delivery. Mainly the common causes of admission were neonatal jaundice (29.3%), followed by neonatal infections (17.6%), prematurity (16.3%), and respiratory distress (11.1%). Accordingly, the neonatal mortality rate overall for hospitalized neonates were 7.6%. the causes-specific death rate analysis presented that prematurity was the most common cause of death (29.8%), followed by sepsis (17%) and birth asphyxia (12.8%).^[32]

Globally, it has been widely believed that the comprehensive understanding of factors linked or associated with neonatal mortality and morbidity is the essential key to guide the development of focused and evidence-based health interventions to reduce and prevent both neonatal deaths and admissions. A huge difference in the rate of neonatal morbidity and mortality between developed and developing countries is presently one of the most burning problems. Despite the efforts of developing countries to reduce neonatal deaths and morbidity, the decline has been slow and doesn't seem to reach the goals of SDG target 3.2 and Millennium Development Goal 4. However, it is significant to learn from the successful developed countries and focus on the major causes associated with neonatal mortality and morbidity. Several developed countries shared their experience to reduce neonatal mortality and morbidity quickly and dramatically without much cost.

In general, improvement of neonatal interventions needs to extend from pregnancy, through childbirth and the neonatal period, and beyond. The great reduction of NMR was a result of sustained inputs into and use of primary care services and facilities government sector such as easy and free access to pre- and postnatal care, free essential drugs for all pregnant women and children, antibiotics for neonatal infections, promote breastfeeding, evidence-based treatment and guidelines, developing national neonatal networks and data recording. For example, in United Kingdom of England, the achieved decrease in NMR was attributed to the introduction of free prenatal care, better labor and delivery care, and the accessibility of antibiotics.

In addition, for low birth weight and short gestation age neonates, it was found that exclusive breastfeeding, kangaroo mother care by skin-to-skin contacts especially a mother's bare chest promoting medically stable LBW infant weighing less than 2500 g. Also, utilization of high-level medical technology such neonatal intensive

care units (incubators and monitoring) and specialized medical staff and healthcare providers dramatically improve clinical output of low birthweight and short gestation age infants which will reduce neonatal mortality.^[33] Also, perinatal outcomes improvement by interventions at neonatal intensive care units that significantly reduce mortality and morbidity of preterm neonates such as prevention and management of hypothermia, hypoglycemia, and infection and providing adequate respiratory and feeding support. Moreover, regular antenatal visits leading to diagnose and follow all possible diseases or complications of pregnant women or fetal anomalies with sustainable documentation and monitoring with appropriate and timely medical intervention dramatically promote neonatal outcomes and minimize mortality and morbidity rate. All published studies about neonatal mortality have been extracted from national neonatal and stillbirth surveillance system. Unfortunately, the majority of causes of neonatal deaths are not reported and documented, development of national information system and evidence-based interventions to mothers and newborn to improve data registration and documentation will encourage appropriate utilization of current interventions to reduce neonatal mortality and morbidity.

CONCLUSION

Our review has demonstrated that there are limited published contemporary data regarding neonatal mortality and morbidity in Jordan. However, understanding the leading causes of neonatal mortality and morbidity plays a significant role in reducing NMR and neonatal admissions. Our review revealed that prematurity, respiratory distress syndrome, transient tachypnea of newborn, neonatal sepsis, asphyxia, congenital complications were the most common factors associated with neonatal mortality and morbidity. Neonatal mortality rate in Jordan is estimated around 14 per 1000 which is higher than SDG target, however, most of causes of neonatal mortality and morbidity could be preventable but additional and contemporary data are required to set priorities and potential interventions to improve neonatal care targeted to reduce neonatal mortality and morbidity in Jordan. Government investment in national information system and evidence-based interventions is essential to improve mothers and newborn health and improve current interventions to reduce neonatal mortality and morbidity.

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