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Determinant of Neonatal Mortality in Palestine - 2012 (Northern West Bank)

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Dedication

إلى الأيادي البيضاء التي امتدت لتنهضني من كل كبوة ، وتسندي بعد كل عثرة وتنتشلني بكل حنان من براثن اليأس لترفعني عاليا على معارج المجد !!

إلى من كلت أنامله لينسج لحظات سعادتي .... إلى تجرع من كؤوس المر ليسقيني قطرات الحب والحنان .... إلى من علمني أن ألهو بورد الروض وحارب شوكه ليغدو لي سهلا يانعا بخضاره إلى من علمني العطاء والصبر والجد دون انتظار .... إلى من احمل اسمه بكل افتخار إلى القلب الرحب ساطع الأنوار ..... **أبي العزيز**

إلى سيدة على سجادة صلاتها يعبق فوها بعبير كلمات تناجي الرحمن وتدعوه لياخد بيدي ويوفقني...إلى من نسجت كنزة حلمي بخيوط كدها وجهدها... إلى السيدة التي لم تنفك تحيل علقم أيامي حلاوة وظلمتها ضياءا وأرقمها بلسما ...إلى ملاكي الذي يرتعش قلبي بذكره .....**أمي الغالية**

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إلى كل سيدة حملت نبضا يناغي أحشائها منذ تكون الأزل ..

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الإقرار

أنا الموقعة أدناه مقدمة الرسالة التي تحمل العنوان:

Determinant of Neonatal Mortality in Palestine-2012 (Northern West Bank)

أقر بأن ما اشتملت عليه هذه الرسالة إنما هو نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، و أن هذه الرسالة ككل، أو أي جزء منها لم يقدم من قبل لنيل أي درجة علمية أو بحث علمي أو بحثي لدى أي مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's name: **اسم الطالبة:**

Signature: **التوقيع:**

Date: **التاريخ:**

List of Abbreviations

ANC	Antenatal Care
CDC	Center for Disease Control and Prevention
CMR	Child Mortality Rate
C/S	Caesarian- Section
DHS	Demographic Health Survey
EMR	Eastern Mediterranean Region
IMR	Infant Mortality Rate
LBW	Low Birth Weight
MDG	Millennium Development Goals
MCH	Maternal Child Health
MoH	Ministry of Health
NM	Neonatal Mortality
NMR	Neonatal Mortality Rate
PCBS	Palestinian Central Bureau of Statistics
PHIC	Palestinian Health Information Center
PNM	Prenatal Mortality
SPSS	Statistical Package for Social Science
UNRWA	United Nations Relief and Work Agency
WHO	World Health Organization

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Abstract

Background: Although the world has recently achieved significant declines in under-five and infant mortality rates, progress in neonatal mortality is less marked, where neonatal mortality accounts for about 40% of the world under-five child mortality. In Palestine, high ratio of infant mortality (67%) is due to neonatal mortality, determinants of which are still not well studied.

Objectives: The aim of this study is to determine the major risk factors contributing to neonatal mortality, and to describe the health reporting system regarding mortality of neonates and infants in the northern districts of the West Bank.

Methods: A case-control design was adopted. Cases were obtained from all available officially reported cases of neonatal death that died after birth within 28 days after delivery in the northern West Bank in 2012. Control data were obtained through interviewed questionnaires of mothers of live neonates born in 2012. Cross tabulation, odds ratio, and multilevel, bivariate logistic regression was done to explore the risk factors associated with neonatal mortality.

Results: First, this study explores defects in the health reporting system regarding NM in different aspects. Also, the lack of communication

between primary health care units and the health information system was found, as well as the lack of a health information data base for the analysis and interpretation of those reported cases.

Second, this study showed that a higher level of mother education (p-value= 0.042, odd=1.280, CI=1.098 - 1.642); numbers of antenatal visits more than 4 visits, (p-value=0.001, odd=2.980, CI=2.504 - 6.656); and the place of ANC in the private sector (p-value=0.007, odd=43.3, CI=2.82-665.13) were associated with fewer neonatal deaths. Breast feeding (p-value= <0.001, odd=1.18, CI=1.007-1.55) and early initiation of breast feeding immediately after birth (p-value= 0.027**,** odd=5.609, CI=5.25 - 125.911)were a protective factor for neonatal survival, whereas prematurity and low birth weight increased the risk of neonatal death.

The main causes related to the death of neonates in this study were prematurity (36%); congenital malformation (31.5%), from which 17.1% was due to Congenital heart disease and 3.6 % as Chromosomal/Genetic disorders

Conclusion: There is a need for the development of focused and evidence-based interventions to prevent neonatal deaths in Palestine. These interventions should be at all levels, and address risk factors of neonatal death. To strengthen reporting and the health information system is a major step in developing these strategies.

Chapter One

Introduction

Chapter One
Introduction

1.1 Background

Recently neonatal mortality has become one of the major public health problems, as it plays an increasingly important role in child mortality. Greater attention was directed towards child mortality as one of the United Nation's Millennium Development Goals: (*MDG Target 4.A: Reduce the under-five mortality rate by two-thirds, between 1990 and 2015)* [(1)] **,** hence becoming on top of the public health and international development agencies' agendas.

During the last 30 years, the reduction in neonatal mortality rates (NMR) has been slower compared to both under-five and infant mortality rates after the first month of life[(1)]. With this decreasing of under-five mortality, NM emerges as an increasingly prominent component of overall under-five child mortality, accounting for a higher share of global child death [(2)]**.** A recent review of child mortality has revealed that the proportion of under-five CMR that occurred during the neonatal period increased from 36% in 1990 to about 43% in 2011, and accounts for more than half of infant deaths [(3)].

Despite this fact, NM is not a target of the UN Millennium Development Goals; rather it is often included within infant mortality [(4)]. However, if the MDG4is to be achieved then a considerable decrease in neonatal death must be accomplished. This implies that the current global

NM level of 28 per 1,000 live births should be reduced to less than 20 per 1,000 live births, and if there is no serious action to address neonatal survival, achieving the MDG- 4 target of reducing child deaths will likely only be achieved by 2045 [5].

So, to meet the United Nations MDG, policymakers need to place a much greater emphasis on proven, evidenced-based, cost-effective strategies to save newborn lives, especially in developing countries where 99% of these neonatal deaths occur [6].

As one of these developing countries, the occupied Palestinian territories witnessed a considerable, but slow decline in the IMR and the CMR during the past two decades. Two thirds of these infant deaths occurred within the neonatal period, mostly during the first days of life [7].

1.2 Terms and Definitions

Infant mortality is defined as the death of a baby before his or her first birthday, and is calculated by dividing the number of infant deaths for a given period by the number of live births for the same period and then multiplying by 1,000[8] . The infant mortality rate is one of the most important health indicators in any country. It is a commonly used indicator of human development, and of health for whole populations, reflecting the intuition that structural factors affecting the health of entire populations have an impact on the IMR [9] .

The infant period is further divided into the neonatal period (from birth until 28 days or 4 weeks) and the post-neonatal period (more than 28 days until one year).

The death of a baby before 28 days of life is known as **Neonatal Mortality** (NM**)** which is also subdivided into the following categories:

- Early neonatal deaths occurring during the first seven days of life (0-6 days).

- Late neonatal deaths occurring after the seventh day up to the 28th day of life [(8)].

Age at death during the first day of life (day 0) should be recorded in units of completed minutes or hours of life. For the second day of life (day 1) through 27 completed days of life, age at death should be recorded in days. The legal requirements for registration of fetal deaths and live births vary between and even within countries. The World Health Organization recommends that, if possible, all fetuses and infants, whether alive or dead, should be included in the statistics using one of the three criteria in the following order: a birth weight of 500 grams or more; if birth weight is unknown, a gestational age of 22 weeks or more; and if both these criteria are unknown, a crown-heel length of 25 cm or more [(8)].

Neonatal health and survival are long term consequences influenced by many factors in different time periods. The first period starts before conception (*Pre-Pregnancy*) with factors such as: maternal educational and

social status, nutrition and health, age, time between pregnancies. The second period is during *Pregnancy*, with factors such as appropriate antenatal care, which is critical to reduce maternal mortality, stillbirths and neonatal deaths. Interventions during pregnancy can reduce premature birth, low birth weight, congenital malformations, congenital infections and neonatal tetanus. The final period is *Labour, Delivery and Post-Delivery*, including factors such as: skilled care at birth to ensure a safe and clean delivery, which benefits mothers and babies. This period is critical for preventing birth asphyxia, birth injuries and infections in the newborn, and the provision of supportive care for pre-term babies.

The PrePregnancy and Pregnancy periods are often linked with Neonatal Mortality as well as with another health indicator, which is **perinatal mortality**, which includes both deaths in the first week of life and fetal deaths (stillbirths). The *perinatal period* commences at 22 completed weeks (154 days) of gestation and ends seven completed days after birth[8]. Since the definition of the fetal period varies in individual countries, ranging from 16 to 28 weeks of gestation, the definition of the Perinatal Period also varies from country to country.

Stillbirth is a professional and lay term that refers to a dead-born fetus prior to the complete expulsion or extraction from its mother as a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of

the umbilical cord or definite movement of voluntary muscles [10] . The *Stillbirth Rate* for international comparison is the annual number of babies born dead after 28 weeks of gestation (late fetal deaths) per 1,000 total births. According to the International Classification of Diseases, Revision 10, a stillbirth, or late fetal death, is the death of a fetus weighing at least 500 g (or, if birth weight is unavailable, after 22 completed weeks gestation, or with a crown-heel length of 25 cm or more). For the purposes of international comparison, it is recommended that stillbirth be defined as a late fetal death weighing at least 1,000 g (or a gestational age of 28 completed weeks or a crown-heel length of 35 cm or more). Birth weight is prioritized over gestational age because it is believed to be more reliably reported[11] .

Intrauterine death occurs either before onset of labour (antepartum death), because of pregnancy complications or maternal diseases, or complications arising during birth or labour (intrapartum death). This is the main cause of death among almost all infants who were alive when labour started, but were born dead. However, no special reason can be found for many antepartum intrauterine deaths.

Perinatal Mortality Rate: is defined as the annual number of stillbirths (fetal deaths) and early neonatal deaths (deaths in the first week of life) per 1,000 total births (includes stillbirths) during the same period in the same population. The Perinatal Mortality Rate is a major marker to assess the quality of health care delivery. The perinatal mortality indicator

plays an important role in providing the information needed to improve the health status of pregnant women, new mothers, and newborns. It also allows decision-makers to identify problems and assess changes in public health policy and practice. Worldwide, there are over 6.3 million perinatal deaths a year, almost all of which occur in developing countries, and 27% of them in the least developed countries alone [10] .

Studies often discuss neonatal mortality and stillbirth or perinatal mortality together due to the overlaps between risk factors and leading causes, which are especially sensitive to events during pregnancy, delivery and the neonatal period, and to the care given to mothers and their babies, while post-neonatal mortality rates are thought to be influenced to a greater extent by parental circumstances including socioeconomic status and the care they provide for their infant.

1.3 Justification

Palestine showed a decline in the IMR and CMR until the year 2000{IMR=24.1, CMR=29.1}, when they started to rise again mainly during the period from 2002-2006 {IMR=27.6, CMR=31.6} [7, 12] . After that, Palestine showed slow declines in under–five CMR and IMR reaching 20.6 and 25.1 per 1,000 live births respectively. This slow decline was due to the high rates of neonatal mortality [13, 14] , where the proportion of infant deaths occurring during the neonatal period increased from 45–55% in the period from 1995-1999 and from 65–70% in 2000 [15], and still account for two thirds of infant deaths (67%) in 2011 [7, 16].

Many successful health interventions and polices were applied in Palestine aimed at reducing the IMR and the CMR, although the general level of NMR, IMR, and CMR is quite low compared to other developing countries, but high when compared to Israel (IMR=4.12) and to some other Arab countries like Bahrain (IMR=10.20), Kuwait (IMR=7.67), and Qatar (IMR=6.5) [12, 17]. Therefore, more work needs to be done to achieve the MDG target and improve child health.

Studies regarding NM in Palestine are relatively limited [15, 18] , when compared with those dealing with infant and child mortality, or it is often mentioned or discussed as part of infant mortality studies.

In order to improve the neonatal survival in Palestine, attention must be directed toward the neonatal group separately from infant mortality because factors that affect NM differ in many aspects from those in the post neonatal period. Addressing these determinants will help in building public policies to modify these factors and provide effective interventions to decrease NM mortality through evaluating the health system and services, especially those directed at mothers and neonates [19].

Crucial to making this progress is the improvement of neonatal death data and registries and making better use of existing and future data [20]. Therefore, one source of this study data will be obtained from MoH registry files. This study can give assessment of the effectiveness the health information system in Palestine regarding the completion of neonate death files and completion of information and also the reporting system.

1.4 Research Statement

Few studies have been done in Palestine to explore the risk factors of neonatal death. According to literature, factors that may be associated with NMR are similar in most developing countries, and it can be categorized into socioeconomic and community factors, maternal factors, neonatal factors and finally health care services. Most of the studies are done depending on DHS in countries. In this study the researcher studied various variables that are related to neonatal mortality depending on data and information from the MoH, which presents a valuable opportunity to evaluate the health reporting system in the West Bank, and degree of application of MoH instruction regarding reporting of NM as well.

1.5 Objectives of the Study

Main Objective

To study the main determinants of neonatal mortality in the northern West Bank over the year 2012, and provide recommendation for possible interventions based on these determinants to improve neonatal survival in Palestine.

Specific Objectives

1- To describe the most common risk factors contributing to NM in Palestine throughout the year 2012.

2- To investigate the associations between Neonatal Deaths and selected socio demographic variables, maternal risk factors, neonatal factors, and health care services.

3-To describe the health reporting system regarding mortality of neonates and infants.

Chapter Two
Literature Review

Chapter Two

Literature Review

2.1. The Problem of Neonatal Mortality

The World Health Report indicates that each year 130 million babies are born annually, while more than 4 million die in the neonatal period [(4)]. Of these 4 million newborns who die, between 25% - 50% die in the first 24 hours and 75% die in the first week [(4, 6)]. Most of these deaths are preventable. The average daily mortality rate during the neonatal period is close to 30 fold higher than during the postnatal period, a child is about 500 times more likely to die in the first day of life than at one month of age. Every minute seven newborn babies die worldwide (415 newborn babies every hour) [(21)] .

2.1.1. The Global Magnitude of Neonatal Death

The second half of the twentieth century witnessed a remarkable reduction in child mortality; the majority of this reduction has been due to lives saved after the first four weeks of birth, with relatively little reduction in the risk of death in the neonatal period [(6)]. Worldwide mortality in children younger than 5 years has dropped from 11.9 million deaths in 1990 (Rate: 0.88 per 1,000 live birth) to 7.7 million deaths in 2010 (Rate: 0.57 per 1,000 live birth) [(22)]. The decline in the NMR was slower than the CMR and IMR, which declined by 32%, from 4.4 million in 1990 (Rate: 32 deaths per 1,000 live births) to 3 million (Rate: 23 deaths per 1,000 live

births) in 2010 and (Rate: 22 deaths per 1,000 live births) in 2011; an average of 1.8 % a year, much slower than for under five mortality (2.5 % per year) [23] .

Income is an important determinant of neonatal death; only 1% of neonatal deaths occur in the 39 high-income countries where the NMR is an average of 4 per 1,000 live births [6] . The remaining 99% of neonatal deaths occur in low and middle income countries where the average NMR is 33-41 per 1,000 live births [3] .

In 2006, across 106 national DHS surveys in developing countries , the NMR varied from 10 to 62 per 1,000 live births, with a median value of 33 per 1,000 live births. By region, the median value is highest in Central and Western Africa (41 per 1,000 live births), followed by Eastern and Southern Africa (36 per 1,000 live births), the Middle East- North Africa (33 per 1,000 live births), and the lowest in Latin America and the Caribbean (24 per 1,000 live births) [24] .

In 2011, while NMRs were halved in the European (NMR=10 per 1,000) and Western Pacific regions (NMR=11 per 1,000), Africa showed the largest increases in NM (NMR range 33-41 per 1,000). Of the 20 countries with the highest NMRs, 15 are African; Sub-Saharan Africa accounts for 38 % of global neonatal deaths and is among the regions that have shown the least progress in reducing that rate over the last two decades [3] . South Asia accounts for a third of the world's neonatal deaths,

with over a million per year in India alone, accounting for Almost 30 % world of NM [25] .

Regionally, the Eastern Mediterranean Region (EMR) ranks third after the South-East Asia and African regions with great variations and disparities in NM levels between and within countries of the region, ranging from 2 per 1,000 live births in Israel to 63 per 1,000 live births in Iraq. Pakistan and Afghanistan rank 3rd and 9th respectively among the 10 countries that account for 67% of global neonatal deaths, while together these two countries account for 9% of global NM [26] .

A large discrepancy in NMR is noted between Arab counties, where some Arab countries showed a marked decline in NMR similar to other developed countries like Qatar and Bahrain, both with NMR= 4 per 1,000; Kuwait, Oman and Saudi Arabia with NMR=5 per 1,000.Other counties still show high rates of NM such as Somalia and South Sudan where NMR equals 50 and 38 per 1,000 respectively [3]. Poverty, lack of resources, political conflict, and wars are some variables that lead to this high rate of mortality.

Similar to its neighboring countries, **Palestine** also showed a decline in the under five CMR by 13% within the years 2000-2010, but with a wide gap between regions (22.1 in the West Bank and 29.2 in the Gaza Strip) [7] . This decline in mortality rates among children younger than 5 years was the smallest compared with Arab countries with an apparent increase in NM [12]. In 2012, the NMR in Palestine equaled 13 per 1,000 live births [23],

representing more than 50.8 % of under five child death and 67% of infant mortality [12, 16] .

2.1.2. Achieving Millennium Development Goals MDG 4

In 2000, the United Nations lunched a global development agenda to be achieved by the year 2015. In this agenda, eight Millennium Development Goals (MDGs) were defined; one of these goals was reducing rates of mortality among children under 5 years old by two thirds from those of 1990 [4] .

Considerable progress has been made in reducing under-five mortality since 1990. Despite population growth, the number of under-five deaths worldwide has fallen by more than one third. Five of nine developing regions show reductions in under-five mortality of more than 50% from 1990 through 2010 [3]. Northern Africa and Eastern Asia already has achieved the MDG 4 target, bringing down the child mortality rate by 67% and 70% respectively, and Latin America and the Caribbean is close to doing so with a 64% reduction. Sub-Saharan Africa and Oceania have achieved reductions of only around 39% and 33% respectively, less than half of what is required to reach the target. Southern Asia is also falling behind with a decline in the child mortality rate of 44 % between 1990 and 2010 [3, 27] .

Although the rate of under-five deaths overall declines, the proportion that occurs during the neonatal period is increasing. Over the

last two decades, almost all regions have seen slower declines in neonatal mortality than in under-five mortality. The average annual decline of 1.7% a year is much slower than the 2.2 % per year reduction for under-five mortality, or than the 2.3% drop in maternal mortality. This trend is expected to continue as under-five mortality declines [27] . The fastest reduction in NMR was in Eastern Asia with 61% but with 57% contribution of NM to under five mortality. This was followed by Latin America and the Caribbean and Northern Africa, both with 55% reductions, and with neonatal deaths accounting for 53% of under-five deaths. The slowest reduction was in Sub-Saharan Africa (24 %), which suffers a higher neonatal mortality rate (35 deaths per 1,000 live births in 2010) than any other region and with NM accounting for more than 50% of under-five mortality [3, 27].

Palestine in 2011 reached 22 per 1,000 live births under five mortality rate, with an annual reduction of 3.2% between 1990-2011, whereas the Millennium Development Goal target for 2015 is 14 per 1,000 live births [23]. This means that there is a lot of work to do.

Achieving the Millennium Development Goal 4, to reduce under-five child mortality to less than 30 per 1000 births by 2015, will clearly require major progress on reducing neonatal mortality [6], particularly in developing countries. A specific change called for was that the neonatal mortality rate be added as an indicator under MDG 4 for child survival. Despite ongoing discussions and recommendations by the Millennium Task

Force, this inclusion has yet to happen. However, the neonatal mortality rate was included as an indicator to be tracked as part of the Countdown to 2015 series of meetings planned for the next decade [28].

2.1.3. Interventions to Reduce Neonatal Mortality

Low-cost interventions could reduce the NMR by up to 70% if provided universally.

According to The Lancet Neonatal Survival Series published in 2005[29] , up to 3 million newborn lives of the 4 million deaths could be saved each year if all mothers and babies were reached with essential care [29]. Improved neonatal survival should be seen as part of wider package, with high coverage of proven, cost-effective interventions that start from the family-community level and are continued through outreach and clinical care services[29].

At the *family-community* level, services need to be developed that are family-oriented and community-oriented that support self care. Included should be the adoption of improved care practices and appropriate care seeking for illness, the empowerment of individuals and communities to demand quality services that respond to their needs, community mobilization and engagement to stimulate adoption of improved antenatal, intrapartum, and postnatal care practices [29] .

At the *outreach* level, the services should be population-oriented and can be standardized to meet common needs of a population. They can

also be delivered on a periodic basis, either through static health facilities or during visits within the community, like routine antenatal care, and immunization programs [29].

At the *facility-based clinical care* level, clinical care services should be provided by skilled personnel, typically at health facilities, and should be available around-the-clock to manage acute clinical problems. Provision of individual-oriented clinical care requires that providers be adequately trained, equipped, and supervised; respond promptly to complaints from individuals; and give careful diagnoses and choose appropriate treatment. Examples include skilled maternal and immediate neonatal care, emergency obstetric care, and emergency neonatal care [29].

In addition to implementing available, cost-effective interventions, it is also necessary to strengthen existing maternal and child health services, including high-impact interventions to target the main causes of neonatal deaths [30] . Despite this, care for the neonate often receives little attention in either maternal or child health care programs, where child survival programs have primarily focused on important causes of death after the first 4 weeks of life—pneumonia, diarrhea, malaria and vaccine-preventable conditions, whereas maternal health programs have focused primarily on the mother [29, 31] .

The health of mothers and newborns are intricately related to one another. At least 20% of the burden of disease in children below the age of five is related to poor maternal health and nutrition, as well as quality of

care at delivery and during the newborn period. Lowering a mother's risk of mortality and morbidity directly improves a child's prospects for survival. Therefore, improving maternal health was set as the fifth Millennium Development Goal (MDG5): "Reduce maternal mortality ratio by three quarters, between 1990 and 2015" [32] . Research has shown that in developing countries, babies whose mothers die during the first six weeks of their lives are 10 times more likely to die within the first two years of life than babies whose mothers survive [31, 33] .

Strategies to improve the mother's health, and thus her baby's health, should cover the whole continuum of care from maternal health before and during pregnancy to delivery, and early neonatal care to child health. In addition, it should also address wider issues of socioeconomic development like poverty, inadequate health care systems, and maternal illiteracy. Interventions that are applied to reduce neonatal mortality are categorized by time period [29, 30, 34];

The Pre-conception or Pre-pregnancy period include by folic acid supplementation, family planning, poverty reduction and education, as well as synergies between maternal and child health programs.

The Antenatal Care or Pregnancy period, during which appropriate antenatal care is critical to reduce maternal mortality, stillbirths and neonatal deaths. Interventions include Tetanus toxoid immunization, counseling on nutrition, birth preparedness and breastfeeding, Iron, Iodine, Calcium and Folate supplementation, identification of the major risk of

obstructed labor, Corticosteroids for preterm labor, screening treatment of Syphilis and Malaria, voluntary counseling and testing for HIV, and Pre-eclampsia and eclampsia prevention[29, 30, 34].

The Intrapartum - Labor, Delivery and the first 1-2 hours of life period, is critical for preventing birth asphyxia, birth injuries and infections in the newborn. Provision of supportive care for pre-term babies interventions include: skilled care at birth to ensure safe and clean delivery, which benefits mothers and babies, temperature maintenance, Kangaroo mother care, immediate and exclusive breastfeeding, cord and eye care, emergency obstetric care for complications, antibiotics for premature rupture of membranes, neonatal resuscitation, and management of newborn life-threatening complications[29, 30, 34] .

*The Postnatal -Newborn care period (*from 1-2 hours after delivery to 4 weeks*)* is divided into:

- *Early Neonatal period (week 1*), during which two thirds of neonatal deaths occur, and many maternal deaths. This period is critical for prevention and management of infections in all newborns and for providing extra care for low-birth-weight babies and those with complications following delivery, via keeping babies warm, and providing exclusive breastfeeding. During this period, support, recognition of danger signs and prompt care seeking is also provided as well as early management of complications, resuscitation of newborns, prevention of mother-to-child transmission of HIV and serious

infections, severe jaundice and very low-birth-weight babies, and Follow up of newborns in need of special care .

- *The Late Neonatal period (weeks 2-4*) includes the prevention and treatment of infections, which is the highest priority during this period. The one third of neonatal deaths that occur in this period can be reduced through interventions to ensure that families recognize the signs of infection and seek care promptly, and that antibiotics are available, accessible and used correctly[29, 30, 34] .

2.1.4. Implementation of Interventions to Reduce Neonatal Mortality

The neonatal mortality is not only a strong indicator of neonatal, perinatal and maternal health in any given country, region or population, it is also a very big challenge for the health strategists and perinatal health care planners. Although cost-effective interventions to prevent neonatal mortality are available, the level of implementation of the existing cost-effective interventions is low, whether delivered in the community or at health facilities [28]. Especially in the countries with the highest burden of neonatal deaths, coverage of cost-effective interventions is low, inequitable, and slow to progress [35] .

Variation exists between and even within countries. The numbers and causes of neonatal deaths, the capacity of the health system, and the obstacles faced all differ, as do the degree of support from policymakers and the availability of resources[36]. Even with a weak health system,

research has focused on the fact that measurable mortality reduction can be achieved by starting with outreach and at the family-community level like in women's groups, training of community and facility-based health workers, community-based intervention packages, antenatal and post-natal home visits and mass media. If only family-community and outreach interventions are scaled up, without attention to clinical care, the final effect is predicted to be lowering NM by (20–35%) [36, 37].

Several factors are required to implement these interventions. First, political commitment to newborn health at the global, regional, national, and local levels must sustain progress. The success of some low-income countries in reducing neonatal mortality shows that newborn deaths can be reduced, even with limited resources. These countries were able to reduce neonatal mortality by around half during the 1990s; a key feature of their success was sustained political commitment at the highest level of government, resulting in the provision of high quality, primary maternal and newborn care services and to redress the burden of perinatal and neonatal[36]. Other factors increase focus on the newborn within existing safe motherhood and child survival programs, efficient allocation of resources, effective implementation of cost effective interventions, and finally, clear documentation of impact [38, 39].

2.1.5. Limited Data Regarding Neonatal Mortality

Neonatal mortality is largely a hidden problem: deaths occur mostly at home without any contact with health professional and are not

documented in any official records [40]. Babies often are unnamed, and consequently not registered in the national vital records until 1 or even 6 weeks has passed [4]. Studies have also noted that there is a lack of information regarding the issue in the developing countries as only 3% of neonatal cases are available for cause of death analysis [6] and even if they die in a health care facility, causes of death are rarely documented [41] .

In most developing countries vital registration is incomplete or nonexistent. Therefore, crucial to making progress in reducing NM is the improvement of neonatal death data and making better use of existing and future data via strengthening the health system, in particular the health information system, in order to be able to track neonatal indicators, which are crucial for sound planning, successful implementation of interventions and monitoring of achievement[20].

2.2. Cause of Neonatal Death

Information regarding causes of neonatal death, particularly in the first week of life when two third of neonatal deaths occur, is fundamental. It is important for primary care providers, for investigators to design interventions for prevention and treatment, for local and national health administrators, and for decision makers for developing and tracking public health strategies [11, 42] .

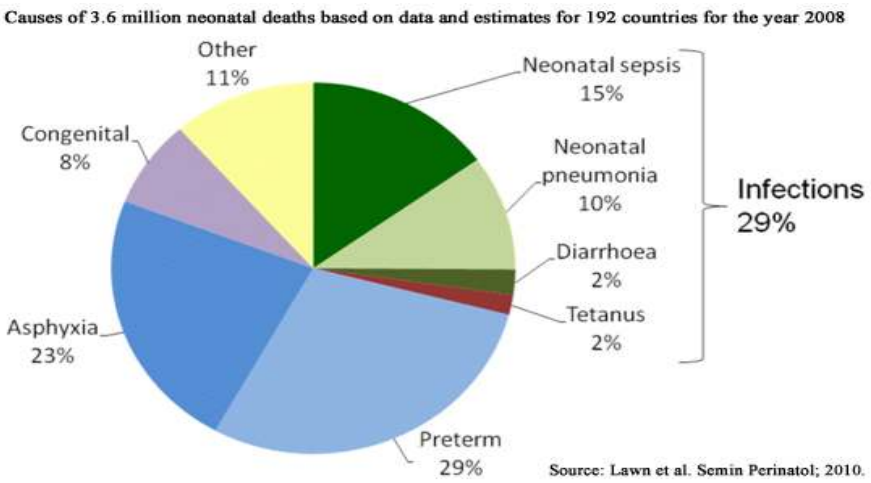

Figure (1): Causes of Neonatal Death Worldwide

Globally, the main direct causes of neonatal death can be categorized as:

(1) Preterm birth complications, (2) Birth asphyxia, (3) Severe neonatal infections (sepsis, pneumonia, meningitis and diarrhea, (4) Neonatal tetanus, (5) Congenital abnormalities, and (6) Residual "other neonatal" category comprising specific causes of neonatal death such as jaundice and hemorrhagic disease of the newborn [6, 11].

Causes of death vary between the early and late neonatal periods, with deaths caused by preterm birth, asphyxia, and congenital defects occurring predominantly during the first week of life and infection being the major cause of neonatal deaths, Also variation in causes of neonatal death is seen between and within countries, closely associated with the NMR. More than half of neonatal deaths are due to infections in counties with a high NMR (more than 45 per 1,000 live births), whereas in countries with a low NMR (~15 per 1,000 live births) prematurity and congenital abnormalities are the major causes of death; sepsis/pneumonia accounts for

less than 20% of deaths, and tetanus and diarrhea are almost non-existent as causes of neonatal death [6].

The main leading cause of infant mortality in the West Bank in 2011was a respiratory tract infection (34.5%); this was followed by congenital anomalies (16.3%), whereas premature and low birth weight accounted for 13.4% and infectious diseases were the cause of 9.4% of infant mortality cases [14] .

In another survey that was conducted by the UN among refugees in Jordan, Lebanon, the Syrian Arab Republic, the Gaza Strip and the West Bank in 2008 and 2010 showed that about 43.2% of neonates who died were from causes related to low birth weight or prematurity; communicable diseases accounted for15% of all neonatal deaths [43].

2.2.1 Preterm Birth Complications

Pre term birth, defined as childbirth occurring at less than 37 completed weeks or 259 days of gestation, is a major determinant of neonatal mortality and morbidity and has long-term adverse consequences for health [44]. Preterm birth complications are estimated to be responsible for 35% of the world's 3.1million annual neonatal deaths, and are now the second most common cause of death after pneumonia in children under 5 years old [45]. It account for 75% of perinatal mortality and more than half of the long-term morbidity [46]. Worldwide, 15 million babies are born preterm , 1.1 million babies die from prematurity, and many survivors are

disabled [47]. The global average preterm birth rate in 2010, based on 184 countries, was 11.1% [48]. Within the last two decades there was an increasing of preterm birth rates in almost all countries. It is ranging from about 5-9% in several European countries and in the USA it has even risen to 12-13% and to 18% in some African countries [45]. The risk of a premature neonate to die in a high NMR country is three times higher than in low-mortality countries [6]. In a study conducted on six developing countries (Egypt, Argentina, India, Peru, South Africa and Vietnam) to research the causes of still birth and early neonatal mortality in which 7,993 pregnancies were studied, prematurity was the main cause of early neonatal mortality (62%) [49].

Etiology of preterm birth is thought to be multifactorial. Approximately 45–50% of preterm births are idiopathic while 30% are related to preterm rupture of membranes (PROM) and another 15–20% are attributed to medically indicated or elective preterm deliveries [48]. Although most preterm babies survive, they are at increased risk of neurodevelopment impairments and respiratory and gastrointestinal complications. These complications arise from immature organ systems that are not yet prepared to support life in the extra uterine environment.

In a study done about risk factors associated with preterm birth in the Gaza strip in 2002, it was found that the significant risk factors for preterm birth were maternal age >35 years, inadequate antenatal care, failure to gain adequate weight during pregnancy and previous history of preterm birth ;

other significant risk factors included short status, short interval between the last two pregnancies, presence of congenital gynecological abnormalities, previous history of caesarean delivery and previous history of still birth [50].

2.2.2 Birth Asphyxia

Defined by the World Health Organization as "the failure to initiate and sustain breathing at birth", birth asphyxia can result from inadequate supply of oxygen immediately prior to, during or just after delivery [51].

Birth asphyxia is estimated to be the second/third most important global cause of neonatal death accounting for about 29% of deaths [52]. Accurate estimates of the proportion of neonatal mortality attributable to birth asphyxia are limited by the lack of a consistent definition for use in community-based settings and the absence of vital registration in communities where the majority of neonatal deaths occur [53]. There is variation between countries, where the risk of dying due to birth asphyxia is about eight times higher for babies in countries with very high NMRs [6]. Between four and nine million newborns suffer birth asphyxia each year, leading to an estimated global asphyxia-related neonatal death count of 0.7 - 1.2 million [54], and about the same number of infants suffer from serious neurological squeals**.** An estimated 1 million children who survive birth asphyxia live with chronic neuro- developmental morbidities, including cerebral palsy, mental retardation, and learning disabilities[55]. It is estimated that approximately half of asphyxia-related deaths could be

prevented with available interventions and techniques. Such interventions to prevent asphyxia include enhanced prenatal care, the improved management of labor and delivery, and basic resuscitative measures for hypoxic newborns.

2.2.3 Severe Neonatal Infections (Sepsis, Pneumonia and Meningitis)

Neonatal sepsis is a clinical syndrome characterized by signs and symptoms of infection with or without accompanying bacteria in the first month of life. It encompasses various systemic infections of the newborn such as septicemia, meningitis, pneumonia, arthritis, osteomyelitis, and urinary tract infections. Superficial infections like conjunctivitis and oral thrush are not usually included under neonatal sepsis [(56)]. Neonatal sepsis contribute to more ore than one-third of the estimated four million neonatal deaths around the world, and a quarter - around one million deaths - are due to neonatal sepsis/pneumonia alone [**(57)**]. In developing countries it is responsible for about 30-50% of the total neonatal deaths and the risk of neonatal death due to severe infection in very high mortality countries is about 11-fold the risk in low mortality countries[**(6)**].

The combination of an immature and slow responding immune system increases the risk of infection in the neonate. Neonatal sepsis is divided into two categories: *early-onset sepsis,* which develops in the first 2-3 days after birth and is usually caused by organisms acquired during intrauterine or intrapartum stages and *late-onset sepsis,* which develops

within 3-7 days after birth and frequently results from Postpartum often nosocomial colonization [56].

2.2.4 Neonatal Tetanus

Tetanus is an acute toxin-mediated, often fatal, disease caused by an exotoxin produced by Clostridium tetani. Under favorable anaerobic conditions, such as in dirty, necrotic wounds, this bacillus may produce an extremely potent neurotoxin. Tetanus toxin blocks inhibitory neurotransmitters in the central nervous system, resulting in muscular stiffness and spasms that are typical of tetanus. There is no natural immunity against tetanus; protection can be provided by active immunization with tetanus toxoid-containing vaccine. Therefore, it occurs in infants born to mothers who do not have sufficient circulating antibodies to protect the infant passively, by transplacental transfer between the 3rd and 28th day after birth[58].

The 2011 global estimate was 4,213 reported cases of neonatal tetanus with 59,000 estimated deaths [59]. Most neonatal tetanus deaths occur in 20 countries in South Asia and Sub-Saharan Africa[34]. Neonatal tetanus is common in many developing countries and is responsible for about 14% of all neonatal deaths, but is very rare in developed countries. It is particularly common in rural areas where deliveries are at home without adequate sterile procedures[60].

Neonatal tetanus can be prevented by immunizing women of childbearing age with tetanus toxoid, either during pregnancy or outside of

pregnancy. This protects the mother and, through a transfer of tetanus antibodies to the fetus, also her baby. Immunization of pregnant women or women of childbearing age with at least two doses of tetanus toxoid is estimated to reduce mortality from neonatal tetanus by 94% [(61)].

Worldwide, all countries are committed to the "elimination" of maternal and neonatal tetanus i.e. a reduction of neonatal tetanus incidence to below one case per 1,000 live births per year in every district. Worldwide, the most rapid reductions have been made in reducing neonatal tetanus from 600,000 deaths in 1990 to fewer than 60,000 in 2008 due to immunization[(60)]. In **Palestine** there were no reported cases of neonatal tetanus in the last eight years since the MoH ensures high vaccination coverage among pregnant women[(62)].

2.2.5 Congenital Abnormalities

Congenital abnormality is the term that includes any morphological, functional and biochemical-molecular defects that may develop in the embryo and fetus from conception until birth, present at birth, whether detected at that time or not [(63, 64)], and this term is synonymous with the term birth defect used in the United States of America. Congenital anomalies, congenital abnormalities, birth defects and congenital malformations are all terms used to describe developmental disorders of the embryo and fetus.

Congenital malformations are the fifth leading cause of mortality, affecting approximately 1 in 33 infants and resulting in approximately 3.2

million birth defect-related disabilities every year [65]. The world health statistics in 2008 reported that every year more than 7.9 million children – 6% of total births worldwide – are born with a serious congenital disorder due to genetic or environmental causes[66] . It is a major cause of fetal, neonatal and infant morbidity and mortality in all industrialized countries and account for more than 20% of infant deaths in developed countries**.** An estimated 270,000 newborns die during the first 28 days of life every year from congenital anomalies[65].

A congenital disorder varies widely in causation and abnormalities. It can be caused by single gene defects, chromosomal disorders, multifactorial inheritance, environmental teratogens and micronutrient deficiencies [64, 66]. The type of birth defect is related to the time of exposure in relation to conception and to fetal development stages, which can be classified as a minor *anomaly,* which is defined as an unusual anatomic feature that is of no serious medical or cosmetic consequence to the patient, or a major *anomaly,* which is defined as a birth defect of serious medical and cosmetic consequence to the child, mainly affecting the heart, kidney, brain, or limbs.

In **Palestine,** in 2006 congenital anomalies account for 16.8% of infant mortality[67]. According to (Teebi), Palestinians have increased frequency of congenital malformations and autosomal recessive disorder , which could be explained due to the high rate of consanguinity [68].

In another study conducted to detected congenital anomalies at birth among the Palestinian population living in East Jerusalem and the southern part of the West Bank, 828 newborns died during the first 28 days of life (2.47% of total deliveries), 306 (37%) of these deaths were due to sever malformations. About 47% of malformed live newborns died in the neonatal period, where major congenital anomalies constituted 38% of all cases [(69)].

2.2.6. Other Neonatal Category Comprising Specific Causes of Neonatal Death

- **Low birth weight**

Is defined as a newborn weighing less than 2,500 grams at birth, with the main causes of low birth weight being prematurity and fetal growth restriction. It is estimated that low birth weight occurs in approximately 15% of all newborns, almost 20 million infants annually throughout the world. This 15% of births, however, accounts for some 60–80% of all neonatal deaths**,** with about 95% occurring in low-income countries[(6, 42)]**.**

Low birth weight is not a direct clinical cause of neonatal mortality as it can reflect a variety of specific path physiologic problems. That can elevate the risk of death-like metabolic, nutritional, and infectious processes. It was found that an increase in 100 grams in mean birth weight is associated with a 30–50% reduction in neonatal mortality [(70)].

- **Birth injury**

Refers to both avoidable and unavoidable, either mechanical or hypoxic-ischemic injuries suffered by the neonate during labor and delivery [(71)].

The rate of birth trauma has dropped precipitously and now accounts for less than 2% of neonatal deaths [(72)]. Risk factors were researched in a cross sectional study that was done in special care baby unit of Baghdad Teaching Hospital; factors founded were macrosomia, prematurity and multiple pregnancies, primigravida, chronic maternal illness like diabetes mellitus, history of pelvic anomalies or contracted pelvis, prolonged labor (especially the second stage), abnormal fetal presentation and shoulder dystocia [(73)]. Although injury may occur despite skilled care at delivery, some injuries result from inadequate medical knowledge or lower care during labor and delivery, which was another risk factor in a study done in Iran, which found association between academic degree of attendant physician at delivery and fetal injuries [(74)]. In addition, delivery during risk hours (night shifts and weekends) was found to be a risk factor by a recent study done in Israel; this study also showed that instrumental delivery was responsible for most cases of neonatal birth while Cesarean delivery was the only protective factor of birth injury [(75)].

There is a wide spectrum of birth trauma ranging from minor and self-limited problems (e.g. scalp injuries), to severe injuries that may result in significant neonatal morbidity or mortality (e.g., intracerebral

hemorrhage; blunt trauma to the liver, spleen, or other internal organs; injury to the spinal cord or peripheral nerves, the most common being brachial plexus injury; and fractures to the clavicles or extremities. The most common types of birth trauma are injuries to the scalp and fractures of the clavicle [(76)].

- **Neonatal Jaundice/Hyperbilirubinemia**

The most common problem in newborns, which is dealt with on a daily basis is neonatal jaundice, which is usually a normal physiologic condition occurring during the transitional period after birth. In this period neonates have relatively impaired hepatic conjugation of bilirubin, and jaundice is determined by the balance between the production and elimination of bilirubin from the plasma by the liver, with a multitude of factors and conditions affecting each of these processes. Jaundice is reflected by the accumulation of the yellow-orange pigment bilirubin in the skin, sclera and other tissues. Although it is a relatively rare cause of death in neonates, untreated high levels (severe hyperbilirubinemia) can lead to neurologic injury, long-term disability or death. The major risk of untreated hyperbilirubinemia is bilirubin encephalopathy or kernicterus [(77, 78)].

2.3. Determinants of Neonatal Mortality

Determinants of neonatal mortality differ from those of post neonatal, while examining theses determinates leads to greater understanding of this problem and more progress in reducing neonatal

death. Since developing countries account for the share of global neonatal death, recent care was directed toward theses countries in order to minimize this problem**.** Many studies were directed to study determinants of neonatal mortality in developing countries.

2.3.1 Community-level factors

Whether a neonate's family lives in a rural or urban place is a determinant factor of neonatal mortality in many countries. Understanding the difference in neonatal deaths between rural and urban populations is important for assessing health needs of the populations and addressing health disparities. This difference in neonatal mortality is mostly due to a lack of health services and availability and accessibility to public health services [(79)],where the urban areas are mostly equipped with a better infrastructure for health services than rural areas, and urban women have better access to health care services, emergency obstetric care and essential newborn care [(80)].

In a study done in China to assess rural-urban risk factors for neonatal mortality, it was found that causes of death were similar in both areas, but each cause-specific death rate was higher in rural infants than in urban infants, and more rural than urban neonates died out of hospital or did not receive medical care before death[(81)].

In India there was a difference in neonatal mortality rates between rural (42.5 per 1000) and urban rates (28.5 per 1000 live births), where villages with no health facility and villages with a population >6000 were

associated with 27.3% of all neonatal deaths [25]. Even in more developed countries like Australia, premature births from rural areas have a higher risk of stillbirth and mortality in neonatal intensive care than urban infants [82].

Other studies resulted in that demographic characteristics of the rural mother play a role in determining neonatal mortality in rural areas [82, 83]. Later on, during the post-neonatal period, the effect of the determinant of place of living increased due to the overlap with other socio- economic, and environmental factors, as well as norms and beliefs and nutritional status of the living children in developing countries.

2.3.2 Socioeconomic Variables

- **Parental education, parental occupation, maternal education:**

The inverse relationship between socio-economic factors of the parents with infants and the child mortality rate was found in several studies [1, 84, 85].

Low educational status of parents [OR 2.1] and father's occupation [OR 1.8] were main socio-economic determinants of NM in (UPAdhyay) study(2010) [25]. Theses determinants were also found in two studies conducted by (Abuqamar), the first to assess the relationship between socio-economic differences and infant mortality in the Arab world during the last two decades, and the second to study the impact of parental education on infant mortality in the Gaza strip. He found an inverse

association between parental education and survival of infants, where families with lower educational levels had a much higher risk of infant mortality [85, 86]. This relation seems to be correlated with numbers of years of education of parents. The birth cohorts from lower educated parents (less than elementary school) showed higher mortality rates compared with those from higher educated parents (over university level) [87] .

However, the mother's education level showed a stronger relationship with infant mortality than that of the fathers' [87] , where it was found that the effect of the father's education on infant and child mortality appears to be about one half that of the mother's education [88].

The educational level of fathers is usually correlated with the type of the fathers' occupation. As in (Abuqamar) study[86] who found that the fathers with high education had skilled and semi-skilled occupations. Other studies have proven that infant mortality was less among fathers with skilled occupations and fathers involved in manual occupation were more likely to have neonatal deaths than in managerial/professional jobs (OR :2.00, 95%CI :1.03-3.85). Additionally, father's unemployment status was associated with LBW babies (OR: 1.52, 95%CI :1.06-2.16) [89]. In India, a study showed a protective effect of paternal education and an occupation with a steady source of income on neonatal survival [80].

Socioeconomic status also has a strong relationship to maternal education[90] . Studies were conducted to observe the influence of education levels of the mothers on reducing infant and child mortality rates. Infant

mortality rates ranged from 38.2 per1,000 live births for children of illiterate mothers to 7.8 per1,000 for children of mothers with higher education, where it was found that an infant of an illiterate mother had a risk of death in the first year 4.9 times higher than the infant of a mother with higher education [91].

Many studies over the last two decades have shown that maternal education is an important factor in neonatal survival. This association has been observed in both developing[92 -94] and developed countries [95]. Increased levels of mother's education were associated with improved chances of child survival in a wide range of developing countries. Where educated women are more likely to have initiated immunization and even more likely to fully vaccinate their children, it was found that maternal education remains statistically significant for children's immunization status in about one-half of the countries [96].

Also, educated women are also more likely to have received prenatal care, to have been immunized with tetanus toxoid during pregnancy, and to have their deliveries attended by trained personnel. This will lead to reduction in risks of preterm birth, small-for-gestational-age (SGA) birth, stillbirth and neonatal and post neonatal death [97], and maternal mortality where lower levels of maternal education were associated with higher maternal mortality even amongst women able to access facilities providing intrapartum care. A WHO survey's results showed that women with no education had 2.7 times the risk of maternal mortality, and those with

between 1-6 years of education had twice the risk of maternal mortality of women with more than 12 years of education [98].

A causal relationship between mother's education and child health and mortality was concluded by (Caldwell) who emphasized that mother education plays an important role in determining child survival even after control for a number of other factors, including such socioeconomic characteristics of the husband such as his educational level and occupation[84].

A mother's education may influence child health and mortality through different pathways, among which are: (1) the acquisition and use of health knowledge, (2) the use of health services, (3) increasing family resources, either through their own work or that of their husband, which in turn affect the health of family members, and (4) affecting preferences for child health and family size[99].

Socioeconomic development, improvement in maternal education and perinatal health care was done through low-cost, community-based interventions such as the success of Qatar, where, over a period of 35 years, these developments led to a stronger impact on maternal, neonatal, and perinatal survival [100].

- **Consanguinity**

Consanguinity refers to a relationship between two people who share a common ancestor or blood. In other words, consanguineous marriage refers to unions contracted between biologically-related individuals [101] .

Consanguineous marriages have been practiced since the early existence of modern humans. To this day, consanguinity is widely practiced in several global communities with variable rates depending on religion, culture, and geography. It is estimated that some 10.4% of the world population are either married to a biological relative or are the progeny of a consanguineous union, with over 1,000 million people living in countries where 20-50+% of unions are contracted between couples related as second cousins or closer [102].

Arab populations have a long tradition of consanguinity due to socio-cultural factors. Many Arab countries display some of the highest rates of consanguineous marriages in the world, and specifically first cousin marriages which may reach 25-30% of all marriages [101]. Consanguinity was found to be widely practiced in the Palestinian Territories with rates of total consanguinity reaching 45% of all marriages in 2004 [103].

Many studies have suggested a strong association between first cousin marriages and the incidence of autosomal recessive diseases and congenital anomalies. The risk of birth defects in first-cousin marriages was estimated to be 2-2.5 times the general population rate, mainly due to the expression of autosomal recessive disorders[101]. Palestinians showed an increase in the frequency of congenital malformations and autosomal recessive disorder due to the high rate of consanguinity[68]. Consanguinity was a major risk factor that influence neonatal deaths in many studies [89, 104, 105], and was also associated with an increased incidence of death in previous siblings [106].

- **Family history of previous sibling death**

Children of certain families have biological traits which predispose them to high mortality due to either genetic, environmental, or nutritional factors. It is evidenced that the effects of sibling deaths on the health of the subsequent child are considerably significant even after controlling for socioeconomic, biological and behavioral factors [1, 94]. It was found that neonates whose preceding sibling had died as a neonate in the mothers' lifetime pregnancy history were more likely (up to 1.9 times) to die than those with a living sibling [107].

- **Household size and number of members living in same house**

It was observed that the babies born in joint and large-sized families and in families with crowded homes had greater risks of mortality during the neonatal period [108].

2.3.3 Maternal factors at current birth

Literature focuses on the importance of maternal factors (biological, social, or demographic) on neonatal and child health and survival, in different time periods starting from preconception to pregnancy and antenatal care, extending to factors of delivery, post delivery and to the post natal care and utilization of health services.

- **Mother age at baby birth**

Age of the mother is a main determinant of NM. It was found to be higher in mothers with a younger maternal age (less than 19 years) [109-111].

CMACE released a report that the youngest (less than 20 years old) mothers were 1.4 times more likely to have a stillbirth and 1.2 times more likely to have a neonatal death than mothers of 25-29, and the older (40+ years old) mothers were 1.7 and 1.3 times more likely to have a stillbirth or neonatal death respectively compared to mothers of 25-29 [112].

- **Maternal employment**

Employment of mothers can be an added bonus to the household, where economic activity of the mother can generate earnings, increase her autonomy, and her power in decision-making, all outcomes that are expected to improve child survival [113]. Many researches in developing countries suggested that there is a negative relationship between maternal work and infant and child survival [114,115] and considered maternal employment as an important predictor of childhood mortality [113]. The negative association between maternal employment and child survival is usually attributed to the reduction in the amount of time working mothers spend in childcare. As children of working mothers receive less attention and less care[113,116].

- **Parity (#of live births, dead babies, abortions) and preceding birth intervals measured**

Birth order and preceding birth interval of the child is significantly associated with neonatal mortality.

High parity of the mother increases risk of labors and pregnancy complications which are risk factors for maternal mortality, and neonatal

morbidity and mortality. In a study done on 12,532 women to examine the influence of multiparty on perinatal morbidity and mortality it was found that multiparty (delivery of six or more children) had an increased risk both for newborns and mothers [117].

Birth spacing or birth interval is increasingly recognized as a major determinant of various infant health indicators, including neonatal mortality. Short inter pregnancy interval has been associated with adverse perinatal and maternal outcomes, ranging from preterm birth and low birth weight to neonatal and maternal morbidity and mortality. Long inter pregnancy interval has in turn been associated with increased risk for preeclampsia and labor dystocia [118] . The risk of neonatal mortality and infant mortality decreases with increasing birth interval lengths. Neonatal mortality is reduced by roughly 40% for preceding birth intervals of 3 years or more, compared with intervals of less than 2 years [119, 120]. Death is 2.2 times more likely to occur for a newborn that is less than 24 months younger than siblings compared to those who arrive after 36 months [121].

In an analysis of the DHS from 18 countries, (Shea Rutstein) reported that the risk of perinatal mortality was highest in women with short and very long intervals between pregnancies. Women with less than 15 months between pregnancies, or more than 39 months, had a 43% greater chance of experiencing a perinatal death than women who spaced their pregnancies between 16 and 38 months. Women who waited 15-26 months between pregnancies had only an 11% risk of losing their child [121].

2.3.4 Neonatal factors

- **Age (date of death- date of birth)**

The neonatal period is only 28 days and yet accounts for 38% of all deaths in children younger than age 5 years. The remaining 62% of deaths in this age group arise over a period of almost 1,800 days. Thus, the average daily mortality rate during the neonatal period is close to 30-fold higher than during the post-neonatal period. This is especially true in the least developed countries where a baby is 14 times more likely to die during the first 28 days of life than one born in an industrialized country [(33)]. Even within the neonatal period there is considerable variation in the daily risk of death. Mortality is very high in the first 24 hours after birth (25–45% of all neonatal deaths) [(6)]. Palestine [(15)] and developing countries (in Asia, North Africa, and Latin America and the Caribbean) reported higher early neonatal mortality than late neonatal mortality [(25, 122)].

- **Sex of the neonate**

Girls have a better survival advantage than male newborn babies due to biological factors, which include immunodeficiency, higher risks of infectious diseases, late maturity, high prevalence of respiratory diseases, and congenital malformations of the urogenital system in males [(125)].

Some studies reported that boys had a 26% higher risk of dying than girls [(121)]. In India, consistent with the results of other developing countries, a study showed a higher risk of early neonatal mortality among boys compared to girls [(123)].

Other studies showed that the gender of the neonate was not significantly associated with neonatal mortality. In the 1970's, in the United States of America it was found that male babies have an excessive risk of neonatal death in comparison to females, and it wasn't clear whether this male disadvantage is due to specific disease processes or is a general biologic feature of being male disadvantage [(124)]. Later in the 20th century an analysis of 15 developed countries showed that the male disadvantage in infant mortality underwent a surprising rise and fall, which also revealed that sex differences in mortality are due to a combination of biological, social, and environmental factors [(125).]

Significance between gender and infant mortality was clearer in the late neonatal period and infant periods due to sex preference. (Imtiaz J) explained that in South Asia there was reduced care seeking for girls compared to boys and there were more female deaths [(122)].

- **Birth weight**

Although the birth weight of the baby is a major determinant of neonatal mortality, it can be influenced by a variety of factors that affect the neonate's chance of survival.

Enormous studies evaluate the risk of low birth weight and increased risk for mortality; low birth weight can elevate the risk of death from a variety of metabolic, nutritional, and infectious processes. It is estimated that low birth weight occurs in approximately 15% of all newborns, almost 20 million infants annually throughout the world, with about 95%

occurring in low-income countries [42]. 60% -80% of neonatal deaths arise in low birth weight infants [11, 35].

Big baby or macrosomia is encountered in up to 10% of deliveries[126]. These babies developed this size due to genetic factors such as parental height and weight or maternal obesity, and excessive maternal weight gain, multiparty, advanced maternal age or most commonly diabetic mothers [126]. These babies are at risk of neonatal mortality more than normal weight neonates. (Mahmood MA) reported that babies of very large size have more than 8.5 times the risk of neonatal mortality than normal-sized babies[79].

- **Time of birth**

Term and preterm delivery are influenced by many obstetrics, neonatal and maternal factors.

Preterm birth rates vary widely between countries; the global average preterm birth rate in 2010, based on 184 countries was 11.1%, giving a worldwide total of 14.9 million preterm births [45]. Preterm birth complications are estimated to be responsible for 35% of the world's annual neonatal deaths, and are now the second most common cause of death after pneumonia in children under 5 years old [45].

- **Birth order**

Birth order is often discussed with parity and birth spacing. Birth order not only tells us the rank of the child in the family but also tells us

something about the number of children in the family. In households with limited resources, its distribution depends on the number of children in the household. The larger number of children indicates a smaller share of resources. Higher birth rank was found to be an important risk factor for neonatal mortality in many studies [79,94, 120,122,109], whereas prim parity in a full-term pregnancy was a risk factor for perinatal death in (Kalter et al.) study which was done in the Gaza Strip and the West Bank [15].

- **Breast feeding and time of initiation of breast feeding**

Numerous researches have been done discussing the influence of breast feeding on reducing neonatal and infant mortality.

In a review of literature done by (Huffman) on the relationship between breast-feeding practices in the first month of life and neonatal mortality. It concluded that breast feeding helps prevent hypothermia and hypoglycemia in newborn babies, both of which are contributory causes of early neonatal deaths, especially among low birth weight and premature babies. During the late neonatal period , feeding colostrums and breast feeding (especially exclusive breast feeding) protects against infections, which is one of the major causes of death mainly in developing countries[127].

At the national level, a study was done to evaluate the impact of exclusive breastfeeding on infant morbidity in the first six months of infants' lives in Nablus refugee camps. The study confirmed that exclusive breast feeding during the first six months of life protects against lower

respiratory tract infection, otitis media, gastroenteritis, diarrhea, wheezing, and allergies [41].

Breast feeding has many health benefits for both the mother and the infant. To reduce infant mortality and ill health, WHO recommends that mothers first provide breast milk to their infants within one hour of birth – referred to as "early initiation of breastfeeding" [128]. In her study, (Huffman) reported that in most developing countries, nearly all women breast feed in the first month of life, but often breast feeding is delayed beyond the first hour after birth, and exclusive breast feeding is not usually practiced [127]. Globally, over one million newborn infants could be saved each year by initiating breastfeeding within the first hour of life. In developing countries alone, early initiation of breastfeeding could save as many as 1.45 million lives each year[129].

In a recent study done in a rural Ghanaian population, early initiation of breast feeding within 1hour after birth has been associated with reduced neonatal mortality. In this study mortality was higher among late (≥24 h) compared with early (<24 h) initiators (RR = 1.41; 95% CI = 1.08–1.86) of breast feeding. It was also found that approximately 16% of neonatal deaths could be saved if all infants were breastfed from day 1, and 22% if breastfeeding started within the first hour [130].

Early breastfeeding provides an important intervention for neonatal health and survival and has the potential to make a major contribution to the achievement of the child survival millennium development goal.

Therefore one of WHO targets is to increase, by 2025, the rate of exclusive breastfeeding for the first six months up to at least 50%. WHO reported that if every child was breastfed within an hour of birth, given only breast milk for their first six months of life, and continued breastfeeding up to the age of two years, about 220,000 children's lives would be saved every year[(128)].

Policies to encourage early initiation of breast feeding and exclusive breast feeding include training of health workers, staff of maternity centers and hospitals to provide skilled support to breastfeeding mothers; educating mothers about the benefits of breastfeeding and early contact suckling during the first hours after the delivery, and continuing breastfeeding after the postpartum period.

- **If neonate was part of multiple gestations pregnancy**

Multiple gestations can increase the risk of pregnancy for the mother and for all the babies. Multiple pregnancies are associated with increased maternal morbidity, and can induce maternal complications like pre-eclampsia, anemia, postpartum hemorrhage, and Cesarean delivery. These have been reported to occur 3-7 times more often in association with multiple than with singleton pregnancies.

Perinatal morbidity and mortality also increased 4 to 10 fold in twins. Multiple gestations may be complicated by prematurity, low birth weight, intrauterine growth restriction, and birth defects. Multiple gestation children may suffer long-term consequences of perinatal

complications, including cerebral palsy and learning disabilities. Even when the babies are healthy they must share their parents' attention and may experience slow language development and behavioral problems. Due to improved perinatal care, there has been a decrease of maternal and perinatal risks during the last 20 years[131] .

2.3.5 Health care service

- **Antenatal care and visits**

Women visiting a health care facility for antenatal care at least 3 times usually get investigated for common obstetrical and medical problems and high risk factors get identified and managed, thus reducing the risk of mortality.

In many studies either in developing or developed countries, have shown positive effects of antenatal care on perinatal outcomes, including reduced rates of pre-term labor, low birth weight and also perinatal death. Lack of prenatal care is associated with increased risk of neonatal death of about 40% [132] . The WHO recommends 4 antenatal care visits for low risk pregnancies and prescribes the evidence-based content for each visit, comprising interventions such as tetanus toxoid vaccination, screening and treatment for infections, and identification of warning signs during pregnancy [133].

In addition to the direct benefits of antenatal care it has an indirect benefit, where women attending antenatal care clinics are more likely to

have their delivery assisted by a professional health care provider or in a health facility. The proportion of births attended by a skilled health provider is one of the two indicators for measuring progress toward the fifth MDG, improving maternal health. In developing countries nearly half of all mothers and newborns do not receive skilled care during and immediately after birth. Up to two thirds of newborn deaths can be prevented if known, effective health measures are provided at birth and during the first week of life [(39)].

- **Place of birth**

Place of birth can obviously affect the health of a newborn. Deliveries can take place either at home or in the hospital; in developing countries most of the maternal, perinatal and neonatal deaths and morbidities occur at home, and home delivery was associated with increased risk of neonatal death [(134)].

In a study done in Indonesia to examine the association between the type of delivery attendant and place of delivery and early neonatal mortality, depending on 4 Indonesia DHS there was no significant reduction in the risk of early neonatal death for home deliveries assisted by the trained attendants compared with those assisted by untrained attendants. An increased risk was associated with deliveries in public hospitals in rural areas [(132)].

In the Gaza Strip and the West Bank (Kalter et al,) found that term delivery in a government hospital was associated with prenatal mortality[(15)].

- **Type of delivery**

There are two modes of deliveries: vaginal delivery and C-section. The decision of mode of delivery (whether normal vaginal or c-section) is influenced by maternal and fetus medical conditions, which themselves have a great impact on the outcome of pregnancy.

Worldwide the proportion of elective C-section has been increasing over the past 30 years. The CDC found that regardless of risk factors, babies born by Cesarean section face a risk of death nearly three times that of vaginally born babies. It was documented in other studies that a C-section was a risk factor for neonatal mortality in Iran **(120),** Pakistan(79), and Jordan **(135)**.

In USA a study aimed to examine whether rates of selected neonatal complications vary by mode of delivery, and whether these rates are changing as a result of the increasing cesarean delivery rate. The results were that with the total cesarean section rate increase of 46% from 1997-2005, the rates of respiratory distress syndrome, transient tachypnea of the newborn and intra-ventricular hemorrhage were highest for cesarean delivery without trial of labor, while the rate of injuries was highest for instrumental vaginal delivery (136).

Chapter Three

Methodology

Chapter Three
Methodology

3.1 Study Design

This is a population-based case-control study, with one case to one control (1:1) matching. Case-control study is used because it is a relatively inexpensive and frequently used type of epidemiological study that can be carried out by small teams or individual researchers. Case-control studies are used for studying infrequent events, which is efficient in both time and cost as it provides a cheaper and quicker study of many risk factors and requires few subjects.

This study is a comparison study which compares between two groups: cases that have the condition (Neonatal Mortality: dead neonates) and controls, which do not have the condition (Live neonates). Cases are dead neonates who died in year 2012. The researcher relied on secondary data that were obtained from mortality files of these infant, from six districts in the northern West Bank, and matched by gender and place of residence with the controls from these districts.

3.2 Study Populationn

The study population was all available official reported cases of neonatal death that died after birth and within 28 days after delivery in the northern Districts in the West Bank over the year 2012, and another group of controls who were born in 2012 and still alive in the same period. For every dead neonate (a case), one living infant was taken as a control.

3.3 Study Setting

The study was conducted in the northern Districts in the West Bank, namely Nablus, Jenin, Tulkarem, Qalqilia, Tubas, and Salfet. All cases were obtained from the vital registries at the different heath care departments that belong to the Palestinian Ministry of Health and matched with controls that were collected from these districts according to birth date (born in 2012), gender, and place of residence.

3.4 Sample Size & Sampling

The researcher collected all available dead neonate files that were found in each central health care department in the northern districts and all those found in the Palestinian Health Information Centre (PHIC) for the year 2012 for these districts. 98 files (cases) were found where the distribution of cases were 28 from Nablus, 24 from Jenin, 19 from Tulkarem, 11 from Qalqilia, 8 from Tubas, and 8 from Salfet. This was matched with 98 control (living infants) in the same districts; matching was based on gender\, year of birth (2012), and place of residence.

3.5 Tool of the Study

For every dead infant below 1 year of age in the West Bank, a formal file (form) named *"dead infant questionnaire"* *(Annex 1)*, should be filled out by the responsible doctor in the central primary health care department in every district in the West Bank. Information is usually obtained from parents of the dead neonates or filled out in the hospital at which death

occurred, also by a chief doctor, and then sent to the central primary health care department in that district. The recent form which is used now was modified in 2006 by a local committee, and then was put to use in 2007 as a formal file for any dead infant and stillbirth**.**

The *"dead infant questionnaire"* form is designed with several variables to study neonates death (cases). The same variables were used by the researcher to compare it with the controls. The variables were reorganized in a study questionnaire and then organized into groups to facilitate comparison and analysis. This study questionnaire was designed about determinants of neonatal mortality and divided into parts; The first part contains community-level factors. The second part contains socio economic factors. The third part contains maternal factors at current birth. The forth part contains neonatal factors, and the fifth part contains health care system information.

3.6 Data Collection

Two types of data were obtained in this study; primary data collected from mothers of living infants as controls, and secondary data from the MoH files as cases.

To collect cases the researcher visited central health departments in the northern West Bank and PHIC for available infant mortality files. After files were separated and filtered, only files of dead neonates who met inclusion criteria were obtained, and information was entered in the study questionnaire.

To collect controls, the researcher redesigned variables in the *"dead infant questionnaire"* and used it as a study questionnaire to collect information via face to face interviews with mothers of living infants, who came to routine post natal checkups and routine care or immunization of infants at different primary health care clinics in the northern West Bank, and who were born in 2012. All study questionnaires were prepared, organized and numbered with serial numbers.

3.7 Eligibility Criteria

3.7.1 Inclusion Criteria

A singleton newborn infant who died in the neonatal period (from after birth to 28 completed days after birth), in year 2012.

One control was matched for each case, based upon sex and place of residence and date of birth in 2012.

3.7.2 Exclusion Criteria

Stillbirth, and files of neonates who died in a year other than 2012 but were reported in 2012.

3.8 Variables

After reviewing previous literature, and with the assumption that the factors that play a role in determining the NMR are similar to the factors in different developing countries, the researcher grouped selected variables that may influence the NMR in the Palestinian population as: community

level factors, socio demographic and maternal factors, neonatal factors and health care factors.

3.8.1 Dependant variable

Neonatal Mortality vs. live neonates

3.8.2 Independent variables

3.8.2.a Conceptual Definitions

* Birth Weight: Is the first weight of the fetus or newborn obtained after birth. For live births, birth weight should preferably be measured within the first hour of life, before significant postnatal weight loss has occurred. It is *classified* into: Low birth weight (weight of baby at birth of less than 2,500 grams, irrespective of the gestational age of the infant), Normal birth weight (weight of baby 2,500g-4,000 g), Macrosomia or large baby (including birth weight of 4,000-4,500 g or more, or greater than 90% for gestational age) [(137)] .

* Term baby: From 37 completed weeks to less than 42 completed weeks (259-293 days) [(137)]. Pre term baby: baby delivered less than 37completed weeks (less than 259 days of gestation) [(137)]. Post term: 42 completed weeks (more than 294 days of gestation) [(137)].

* Prenatal care and antenatal care: Defined by WHO as any health-care service provided by trained health personnel during pregnancy that might include health care, counseling, and any related services provided during

pregnancy to assure the best possible health outcome for both mother and child. This could include recording medical history, physical examinations, assessment of individual needs, advice and guidance on pregnancy and delivery, screening tests, education on self-care during pregnancy, identification of conditions detrimental to health during pregnancy, first-line management and referral if necessary, iron and folic acid supplementation and tetanus toxoid vaccination. Care should start in the first trimester and continue throughout pregnancy [138].

3.8.2.b Operational Definitions'

- *Community level factors:* place of living either in village, city or refugee camp.

- *Socioeconomic variables:* Parental education: number of years of education, parental occupation: working or not working, maternal education: number of years of education. Consanguinity: 1st, 2nd degree or not relatives. Family history of previous sibling death: yes, no; if yes at age: < 1 year or > 1 year .Household size: number of family members.

Maternal factors at current birth: Mother age at baby birth: categorized into maternal employment, parity, and preceding birth intervals.

Neonatal factors: Age, Sex, Birth weight, Time of birth (duration of pregnancy in weeks), Birth order, Breast feeding and time of breastfeeding, and if neonate was part of a multiple gestation pregnancy.

Health care service: Antenatal care and visits: number of antenatal visits during pregnancy measured; Place of antenatal care; Place of delivery; Type of delivery.

3.9 Data Analysis

The collected data was entered and analyzed by using Statistical Package for Social Science (SPSS version 17), carrying out data analysis as follows:

Over viewing the data of cases and controls, coding, designing data entry model, defining variables, coding variables, frequency, cross tabulation, statistical significance, and other tests. Than data analysis was done in multistage:

- A descriptive analysis of the data as means, standard deviations for continuous variables and frequencies, percentages for categorical variables.

- A bi-variate analyses, chi square test ,one sample t-test, for identifying association between neonatal mortality and each individual risk factor. An association was considered to be significant if p-value was <0.05.

- The variables which had significance association were then reintroduced into multiple logistic regression models.

3.10 Ethical Consideration

After the IRB committee approval, official permission from the MoH was obtained, in addition to verbal consent from mother of live infants for obtaining information before doing the interview.

3.11 Limitation of Study

The main and unexpected problem that the researcher faced in this study was finding official files of the cases.

- Researcher could find only 98 written "dead infant questionnaires" out of 263 officially reported neonatal deaths, in the six northern districts.

- These 98 were collected from two places, first from each central department in each district, where number of files were found, and then from (PHIC) where a second copy of each file must be sent. However, unfortunately, there was a problem with inter communications and reporting between these districts and the PHIC, where fewer files were available there.

- In some departments the responsible unit for writing and saving these files wasn't clearly identified.

- The researcher could investigate the distribution of neonatal mortality at the districts level, but wasn’t able to do so at city, village, and camp level, due to lack of information either in the PHIC or Ministry of Interior Affairs.

- The researcher was not able to investigate some risk factors that are related to NM, because they were not included on the *"dead infant questionnaire"* form.

Chapter Four
Results

Chapter Four
Results

The first aim of the researcher in this study was to identify the main determinants that affect neonatal survival in Palestine, by comparing theses determinants between two groups: cases, or dead neonates, and controls, or live neonates. What strengthens this study is that previous studies that were done in Palestine did not focus on neonatal mortality specifically, but often included it with other conditions like infant or maternal mortality. Also, the researcher obtained data from stored reported health information, which was only collected in the form of special files but was not analyzed, which provided a good opportunity to evaluate the health reporting system and quality of these data and the tool *"dead infant questionnaire"* file, which is used to document neonatal death cases.

4.1 Study findings

The statistical analyses were performed using SPSS version 17, Chi-square test, and one sample t-test, which were used to evaluate overall associations as appropriate. Multiple logistic regressions were performed to assess the association (sig) and 95% CI between exposure and the outcome. Prediction with p-value of 0.05 and less were included as risk factors. The main risk factors of neonatal mortality were:

1-Mother education, p-value= 0.042, odd=1.280, CI=(1.098 - 1.642)

2- Breast feeding, p-value= <0.001, odd=1.18, CI=(1.007-1.55)

3- Time of breast feeding, p-value= 0.027**,** odd=5.609, CI=(5.25 - 125.911)

4- Receiving ANC, p-value=0.001, odd=2.980, CI=(2.504 - 6.656)

5- Place of ANC (private sector), p-value=0.007, odd=43.3
, CI=(2.82-665.13)

Part of the results of this study depends on the data obtained from files of MoH (Cases), and the other part controls (live infants) from mothers who were interviewed at the MCH clinics. In this chapter, the researcher will describe the data that were obtained, the health information reporting system in brief and in the second part the analysis of data collected.

4.2 Health Information Reporting Process

Table -1-shows distribution of reported infant and neonatal death in six northern governorates and contribution of neonatal mortality to the overall infant mortality in each district.

Table (1): Distribution of Reported Infant Deaths & Neonatal Death by Northern Governorate of Palestine, 2012 [(139)]

District	Live births	Infant deaths	Neonatal deaths	% NN death/ Infant death
Nablus	9,679	142	96	67,6%
Jenin	7,610	121	82	67.8%
Tubas	1,426	23	16	69.5%
Tulkarem	4,111	51	34	66.6%
Qalqilia	3,064	31	18	58%
Salfet	1,553	31	15	48.3%
Total		399	261	(65.4)

Although NMR is decreasing in Palestine as all over the world, it still contributes to big share of infant mortality. In this study and depending on the availability of official files, it is clear that neonatal

mortality contributes to 65.4% of total infant mortality for 2012 in these districts (Table-1), which is still a problem in Palestine, as the proportion of infant deaths occurring during the neonatal period accounted for two thirds of infant deaths (67%) in 2011 [7, 16].

Important to understanding this health problem is studying different cases of neonatal death and exploring various risk factors that affect them. For this reason, a formal file called the *"dead infant questionnaire"* was set by a local committee. The questionnaire contains different risk factors that can affect neonatal survival, which were then generalized to all health departments to be used as documentation for each dead infant and stillbirth in Palestine from the year 2007 onwards.

The first step was collecting cases from official files that are kept in the primary health care department or PHIC. The researcher was able to find and collect only 98 files (cases) out of 261 reported cases of neonatal death in the six northern districts for the year 2012. This represents about 37.5% of supposed written files; the distribution of reported neonatal death in the northern governorates and number of file found are presented in Table-2.

Table (2): Distribution of Reported Neonatal Death in the Northern Governorates of Palestine and the Number of File Found

District	Neonatal Deaths		# of Files Found	% of Files / # Of Reported Cases
	Early NN	Late NN		
Nablus	60	36	28	29 %
Jenin	46	36	24	29 %
Tubas	7	9	9	50 %
Tulkarem	16	18	18	52 %
Qalqilia	7	11	11	61 %
Salfet	6	9	8	53 %
Total			98	

Reviewing the above Table-2, the highest percentage of reported neonatal death through the *'dead infant questionnaire"*, was in Qalqilia with 11 files out of 18. This raises the concern about the efficacy of the health information reporting system, and gives interest to the researcher to follow up on the details of the process of reporting and documenting neonate mortality in Palestine, or more generally speaking, infant death. That process is as follows:

- When the death of an infant occurs, a death certificate is written by a doctor for that infant. The majority of times in hospital, this certificate is then delivered to each central health department in each district, where it is reported by a health statistician, and then data regarding name, age, residency, and ID number, is sent to Ministry of Internal Affairs.

- For every death certificate, a formal file: "*dead infant questionnaire"* must be written, taking information from the family member of the infant who came to handle and complete the procedures for the death certificate. Filling the questionnaire must be done by the doctor

responsible in each department, either by a MCH doctor or by a doctor in the preventive medicine unit.

- Two copies of these files should be written, one kept in each department and the second sent for analysis and evaluation. These files used to be sent to the central preventive unit at the MoH, then on 2/11/2011, based on new instructions, it began to be sent to the MCH department in the MoH. However, this was changed on 19/1/2012, when new instructions came to send these files to the PHIC, which is in effect to this day.

The problem that the researcher faced when looking up these files was that some of the departments still send these files to the MCH department instead of to the PHI, and some did not sending it anywhere. Also, there was a problem of finding defined responsible authority in the two health departments, in addition to not completing data in some files.

4.3 Results of data analysis

In this section the researcher presents descriptive statistics of the dependent variable, neonatal mortality, within each of the selected studied variables, with the bi-variate and then multivariate analysis with associated significance.

4.3.1 General Characteristics of Study Population

This study was conducted in the northern West Bank; data of 98 cases of neonatal death were collected from six districts. The distribution of

cases was as follows: Nablus (28.6%), Jenin (24.5%), Tulkarem (19.4%), Qalqilia (11.2%), Tubas (8.2%), and Salfet (8.2%).

Of the cases, there was a slightly higher number of males than of females, where 52 (53.1%) were male and 46(46.9%) were female, and same percentage for controls, since 1:1 gender matching was done.

4.3.2 Community and Social Variables

Community and socio-demographic data shows no relation to NM (Table -3). The study showed that the majority of the study cases lived in villages (71.4%) , 21.4% lived in the city, while only 7.1% lived in the camps. There was no difference between cases and controls due to 1:1 matching.

There was a slight difference between cases and controls in ***household s size***, but it did not reach statistical significance (P= 0.662). The majority of the study participants live in families with 2-6 members; for cases (79.6%) whereas for controls (78.7%), while only 20% of cases and controls have >6 member household sizes.

Table (3): Descriptive statistics for neonatal deaths with community and social variables by cross tabulation

Variables	Cases N (%)	Controls N (%)	P-Value
Place of residence			
-Village	**70 (71.4%)**	70 (71.4%)	1.000
-City	21 (21.4%)	**21 (21.4%)**	
-Camp	7 (7.1%)	**7 (7.1%)**	
House hold size=number of family members			
2-3	39(39.8%)	33(33.7%)	0.662
4-6	39(39.8%)	44(44.9%)	
>6	20(20.4%)	21(21.4%)	
Parent occupation			
-Working	95 (96.9%)	92 (94.8%)	0.461
-Not working	3 (3.1%)	5 (5.2%)	
Consanguinity			
-Not relative	60 (61.2%)	65 (66.3%)	0.609
-1st degree cousins	27 (27.6%)	21 (21.4%)	
-2nd degree cousins	11 (11.2%	12 (12.2%)	
Family history of siblings death			
-No	81 (84.4%	91(92.9%)	0.062
-Yes	15 (15.6%)	7 (7.1%)	
Positive Family history of sibling death, age of this child			
< 1 year	7 (77.8%)	5(83.3%)	0.792
>1 year	2 (22.2%)	1(16.7%)	

Working status of the fathers revealed that 96.9% of cases' fathers and 94.8% of controls' fathers are working, regardless of the job type, whereas 3.1% of the cases and 5.2% of controls were unemployed. Thus there is of no significant association between father work and neonatal mortality.

Positive family history of sibling death (Table-3): No previous sibling death was encountered in 84.4% of cases, and 92.9% of controls, while 15.6% of cases had a positive history of infant death. Of these, 77.8% were infants below 1 year old and 22.2% lost a child above 1 year old. 7.1% of controls experienced the death of their sibling, 85.3 % of these

infants were below 1 year old., This variable also shows no association with neonatal death, p=0.062.

The mean of father years of education was 11 years with SD 3.7, while of mother education the mean was 12 and SD 3.1. Both father years of education and mother years of education show significant association with NM at p-value <0.001. (Table -4).

Table (4) :Descriptive analysis for maternal and father # of yrs of education by one sample T-test

Variable	Case /Control	
	T (t-test)	P-value
Father educations in years	42.1	<0.001
Mother education in years	54.04	<0.001

4.3.3 Analysis of Maternal factor at current birth

The majority of mothers (61.2%) aged between 20-29 years for cases and controls followed by 28.6% of women who were 30-39 years of age, while those at the extremes represent minor percentages, with those below age 19 6.1% for cases and 8.2% for controls, and those older than 39 represent 4.1% for cases and 2% for controls. These results show that variable didn't show association, p- value=0.81.

Also, maternal employment had no association with NM where the p-value= 0.165. Most of the mothers in this study are house wives (cases 86.7%, controls 76.5%), while working mothers represent 10.2% of cases and 16.3% of controls. Mothers who were studying at time of this study accounted for 3.1% of cases and 7.1% of controls.

There was no big difference between the two groups regarding the number of parity except for those with parity >6, where the percentage of cases was (18.9%) was double that of controls (9.2%). No association was found between this factor and NM with p-value= 0.175. Similarly, the preceding birth interval had a p-value= 0.373. Nearly half of the mothers (52.1% cases, 48.5% controls) had <24 months between the pregnancy of neonates and the previous pregnancy.

Table (5): Descriptive Analysis of Maternal Factors Current Birth

Variables	Cases N (%)	Controls N (%)	P-value
Maternal Age at baby birth			
15-19	6(6.1%)	8(8.2%)	0.813
20-29	60(61.2%)	60(61.2%)	
30-39	28(28.6%)	28(28.6%)	
>39	4(4.1%)	2(2%)	
Maternal employment			
House wife	85(86.7%)	75(76.5%)	0.165
Working mother	10(10.2%)	16(16.3%)	
Student	3(3.1%)	7(7.1%)	
Parity			
1-2	41(41.8%)	45(45.9%0	0.175
3-5	39(39.8%)	44(44.9%)	
≥ 6	18(18.9%)	9(9.2%)	
Preceding birth intervals			
<24 month	50(52.1%)	47(48.5%)	0.373
24-36 month	16(16.7%)	24(24.7%)	
>36 month	30(31.3%)	26(26.8%)	

4.3.4 Analysis of Neonatal factors

Out of seven neonatal risk factors, four factors showed significant association at p-value<0.05, which was birth weight, time of birth, breast feeding, and time of breast feeding (Table-6).

A large difference was detected between cases and controls regarding birth weight. Low birth weight accounted for 53.7% of cases, and only for 18.4% of controls, whereas a majority of neonates with normal weight were among controls (74.5%). 68.4% of controls were term babies, 14.3% preterm and 17.3% post term birth neonates, in comparison to 45.9% of cases as preterm births, 50% as term births.

Results showed that a majority of controls' mothers (94.9%) breast fed their babies; 64.5% immediately after birth, and 32.3% within 24 hours, in contrast to cases, where the majority of mothers didn't feed their baby (74.5%). For cases who received breast feeding, the majority (87%) did so within 24 hours.

The other variables didn't show association with NM; Birth order of neonate (p-value=0.238), and if neonate was part of multiple pregnancy (p-value=0.278). Also, small differences were detected between case-control groups in the different categories for the two variables.

Table (6): Descriptive analysis of neonatal factors

Variable	Cases N (%)	Control N (%)	P- Value
Sex of neonate			
Male	52(53.1%)	52(53.1%)	1.000
Female	46 (46.9%)	46 (46.9%)	
Birth weight			
Low (<2500 grams)	51 (53.7%)	18 (18.4%)	< 0.001
Normal (2500-4000 grams)	41 (43.2%)	73 (74.5%)	
Large (>4000 grams)	3 (3.2%)	7 (7.1%)	
Time of birth			
Preterm	45 (45.9%)	14 (14.3%)	< 0.001
Term	49 (50%)	67 (68.4%)	
Post term	4 (4.1%)	17 (17.3%)	
Birth order			
1st baby	27(27.6%)	25(25.5%)	0.238
2nd baby	15(15.3%)	20(20.4%)	
3-5	38(38.8%)	44(44.9%)	
6 or more	18(18.4%)	9(9.2%)	
Breast feeding			
No	73 (74.5%)	5 (5.1%0	< 0.001
Yes	25 (25.5%)	93 (94.9%)	
Time of breast feeding (for those who answered Yes)			
Immediately after birth	2 (8.7%)	60(64.5%	< 0.001
Within 24 hr	20 (87%)	30(32.3%)	
After 24 hr	1 (4.3%)	3(3.2%)	
If neonate was part of multiple pregnancy			
Single	88 (90.7%)	84 (85.7%)	0.278
Part of multiple pregnancy	9 (9.3%)	14 (14.3%)	

4.3.5 Analysis of Health Care Services (Table-7)

Mothers of neonates who received antenatal care showed a strong association with decreasing NM (p-value<0. 0.001). 82.6% of controls had at least 4 visits in comparison to 53.1% of cases. Of those who received care, 16.8% of controls and 24.7% of cases did so in MCH clinics, 49.5% of controls and 32.5% of cases did so in the private sector, and those who

had both were 43% of cases and 30.5%of controls. There was a positive association (p=0.021).

Results showed no home delivery and the majority of cases and controls were born in governmental hospitals (cases: 84.7%, controls: 77.3%). Neonates who were born by normal vaginal delivery were recorded in 51% of cases and 63.3% of controls, where 49% of cases and 36.7% of controls were born by caesarian section. Both factors: place of delivery (p= 0.189), and type of delivery (p= 0.083) showed no association with NM.

Table (7): Descriptive analysis of Health Care Services

Variables	Cases N (%)	Controls N (%)	P-value
Received Antenatal care			
No visits	2 (2%)	3 (3.1%)	< 0.001
1-3 visits	44 (44.9%0	14 (14.3%)	
4 or more	52 (53.1%)	81 (82.6%)	
Place of antenatal care			
MCH	23 (24.7%)	16 (16.8%)	
Private	30 (32.5%)	47 (49.5%)	0.021
Other	0 (0%)	3 (3.2%)	
Mixed	40 (43%)	29 (30.5%)	
Place of delivery			
Home	0	0	0.189
Governmental hospital	83 (84.7%)	75 (77.3%)	
Non governmental	15 (15.3%0	22 (22.7%)	
Type of delivery			
NSVD	50 (51%)	62 (63.3%)	0.083
Caesarian Section	48 (49%)	36 (36.7%)	

4.3.6 Results of multiple Logistic Regression Analysis

All factors that showed statistical association in bivariate analysis were entered in a final logistic regression model as shown in Table -8. The

factors that remained statistically significant among all the other significant factors were mother education, breast feeding, time of breast feeding and ANC.

Table (8): Logistic Regression of Study Variables among Study Population

Variable	P-value	Odd Ratio	CI (95%)
Father education (Yrs)	.342	1.098	1.905 - 1.332
Mother education (Yrs)	**0.042**	1.280	1.098 - 1.642
Birth Weight			
Normal (Ref)	0.981		
Low <2500gr	0.99	1.016	0.081 - 12.792
Large >4000gr	0.895	0.793	0.025 - 24.83
Time of Birth			
Term(Ref)	0.585		
Preterm	0.325	0.387	0.059 - 2.564
Post term	0.776	0.644	0.031 - 13.387
Breast feeding (Yes)	**<0.001**	1.18	1.007 - 1.55
Breast feeding Time			
Immediate after birth(Ref)	**<0.001**		
Within 24 hr	**0.027**	5.609	5.25 - 125.911
After 24 hr	**0.05**	1.17	1.003 - 1.5
Received ANC			
No visit (Ref)	**0.011**		
1-3 visit	**0.003**	1.24	1.032 - 1.72
>4 visit	**0.001**	2.980	2.504 - 6.656
Place of ANC			
MCH(Ref)	0.062		
Private	**0.007**	43.3	2.82 - 665.13
Other	0.359	1.91	0.447 - 7.694
Mixed	0.999	2.01	0.903 - 4.33

Chapter Five
Discussions

Chapter Five
Discussions

Neonatal death is a painful event that is influenced by many determinants. Many of these deaths can be prevented by implementing available cost-effective interventions and by strengthening existing maternal and child health services that target the main determinant of neonatal deaths [30].

Discussion of results of analyzed data

In general the findings of this study were almost similar and in line with other literature. It showed that neonatal factors and health care services were main important factors and that there was a significant association between mother education, time of birth, birth weight, breast feeding and time of breast feeding, ANC and place of ANC.

Also, distribution and percentages within study sample were close to data in Palestinian reports like PCBS 2006, 2010, MoH health report 2012, and similar to findings in other studies done in Palestine [12 ,18].

5.1. *Community level factors* & Social factors

No association was found between place of residence and NM (p-value =1). There was no difference between cases and controls due to 1:1 matching. However, there was a predominance of cases living in rural areas (villages). Although this risk factor was documented in other studies [79, 25], still we can't generalize this, because these cases represent only 37%

of cases that should be studied, which are the files of *"dead infant questionnaire"*, in which place of living was mentioned. However, for the other neonatal mortality cases reported in 2012 in the six districts-but with no *"dead infant questioner"* files -the researcher couldn't find distribution of deaths according to the living places; village, city, camp.

Results show also that only 7.1% of these cases are refugees. Refugees in the West Bank in 2007 represented 27.4% (624,000) of the total population and they represented 29.6% (272,000) of the total northern districts population [(140)]. Having this low number of cases could be due to underreporting, or according to the most recent retrospective survey performed by UNRWA in 2005-2006, infant mortality among Palestine refugees is among the lowest in the Eastern Mediterranean Region [(43)].

There was a slight difference between cases and controls in ***household size*****,** but it did not reach statistical significance (p= 0.662). Although other literature shows that living in large families and crowded homes has greater risks on mortality during the neonatal period [(108 ,123)], this study showed that there is no association with neonatal mortality, similar to the results of a Gaza study where there was a predominance of a household size of 2-6 among study participants, but there was no association with neonatal mortality [(18)].

These results are supported by a PCBS 2012 report, which shows a decrease in average household size. The average household size in the occupied Palestinian territories was 5.6 persons in 2012 compared with 6.4

in 1997 (5.3 persons in the West Bank and 6.1 persons in the Gaza Strip) [(141)]. This is further explained by the fact that there is a trend towards nuclear families, as reported by PCBS in 2006 [(13)]:The majority of Palestinians live in nuclear families (defined as families consisting of couples without children, married couples with unmarried children, or single parents with unmarried children), with only 18% living in extended families (defined as families consisting of at least one nuclear family with other relatives) and there was no difference in the distribution of household types by locality type.

There was no significant association between the ***father's work*** and neonatal mortality, similar to the results in a Gaza -2008 study [(18)] and a Bangladesh -2012 study [(110)], but different from an Indian study in 2011 [(25)], which found that father's occupation [OR 1.8] was a risk factor for neonatal mortality. In Indonesia -2008, [(94)] the combined parental employment status for neonates was a predictor for neonatal mortality; the odds of dying was significantly higher for infants whose parents were both employed (OR = 1.84, p=0.00) and for infants whose fathers were unemployed (OR = 2.99, p = 0.02).

In this study, the percentage of working fathers in live neonates was 94.8% while 5.2% were not working. These results were close to those published by the MoH in 2012 in which 97.6% of fathers of live infants were working and 5.2% were not working [(139)].

This study shows no statistical association between ***consanguine marriage*** and neonatal death (p=0.609) in contrast to other studies which found consanguinity to be a risk factor [89, 104, 105]. But similar to a Gaza 2008 study [18] and Pakistan 2002 [79]. In this study, parentage of parents with consanguine marriage was 36.2%, slightly lower than other results documented in previous studies and reports in Palestine, where the rates of total consanguinity reaching 45% of all marriages in 2004 [103], and 28% of ever-married women (aged15–54 years) are married to a first cousin and 17% married to other relatives within their *Hamula* (extended family) [12]. Explanation of this difference is that recently there was a slight drop in the rates of marriage among relatives in the West Bank and Gaza Strip, due to an increase in awareness campaigns about the risks and negative consequences of marriage among relatives and about the importance of checks before marriage especially for Thalassemia [13].

Consanguine marriage was also associated with an increased incidence of death in *previous siblings* [106]. The relation between consanguinity and previous sibling death *(Figure -2)* showed that 59.1% of the families who experienced previous sibling death were not relatives and only 40.5% were either 1st or 2nd degree cousins, while the percentage of those who had sibling death was higher in 1st cousins' category (36.4%).

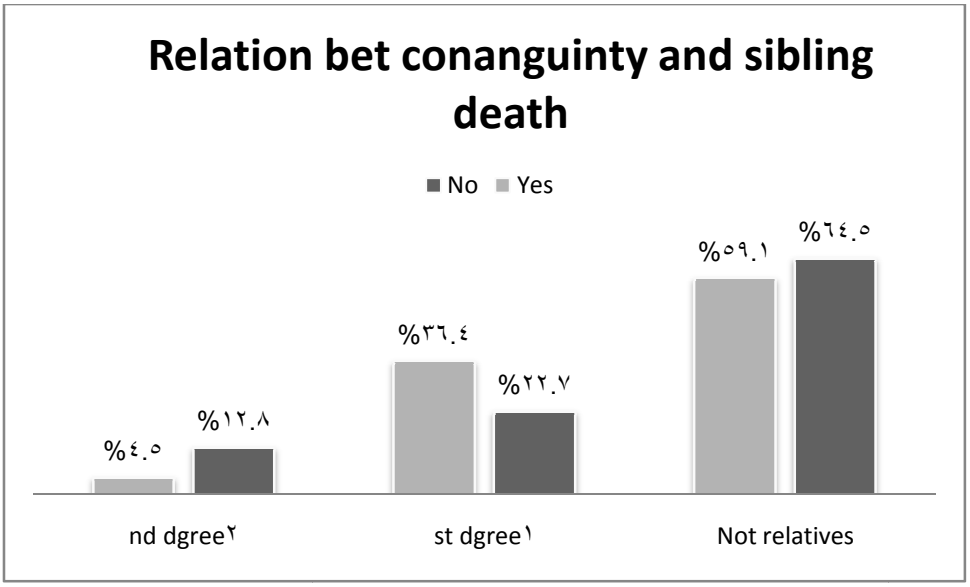

Figure (2): Relation between consanguinity and sibling death among study sample

Father years of education and mother years of education show strong significant association with neonatal mortality p=0.0001. When introduced into the final logistic model, the father's education lost its significance. The positive association between father's education on neonatal and infant death was documented in a study done in Gaza [(86)] where the researcher found that there was a significant association between father's education (*p*-value = 0.023) and infant mortality. The educational level of fathers can affect infant survival directly through increased knowledge regarding child development and growth and indirectly due to its correlation to type of the fathers' occupation, which in turn can affect income of the family.

Maternal education has been accepted almost unanimously as a major socio-economic factor in infant, neonatal, and child mortality in many studies throughout the world [(25,83 , 90, 93, 94)] . This was also the case in

this study,where this variable kept its significance after it was introduced in the final modle at p-value =0.042, CI (1.098 - 1.642).

Maternal education became universally implemented, and Palestinians relatively have a high educational level by regional and global standards. According to PCBS 2012, the literacy rate among women aged 15 years and over has grown three-fold during 2001- 2011; for those married woman with 15 years and who were enrolled in education, 7.4% are illiterate, 35.6% of them hold a preparatory certificate and 22.1% of them hold a high school diploma and 10.5% a Bachelors degree or a higher diploma.

For more comparison of study results with other Palestinian reports, the researcher catogorrized maternal years of education into those who completed less than 10 years of education at the primary and prepatory level, those who completed 10-12 years as secondary, and above 12 years as higher education (Diploma, Bachelors, or higher studies). This showed that 21% had primary, 42 % had secondary and 37% had a higher education. The researcher further assesed the relation between each level and neonatal survival *(Figure -3)* and found a positive impact of increased educatin on neonatal survival, where higher percentages of live neonates (43.9% compared to 30.6%) were found among higher educated motherswhile among primary and secondary level percentage of dead neonates was higher (69.4% compared to 56.1%).

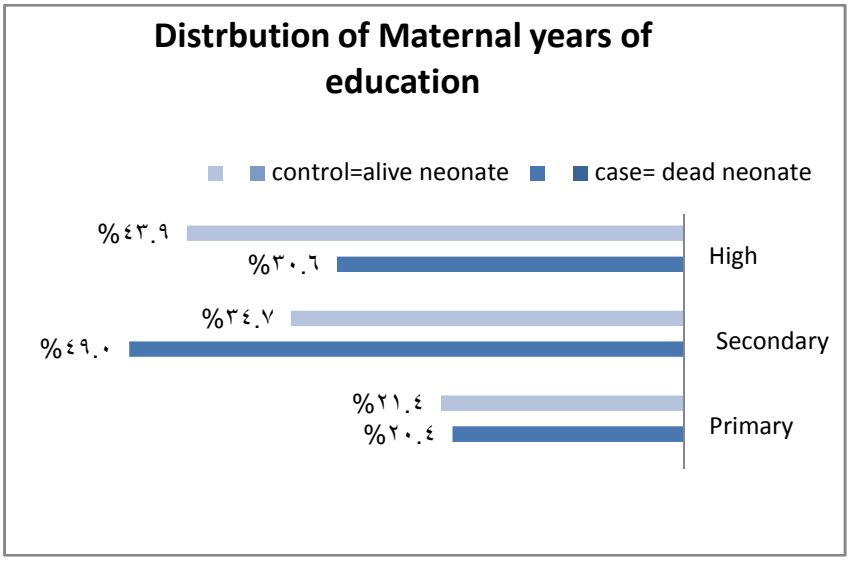

Figure (3) :Distrbuton of Maternal years of education within study sample

This raises concerns to steakholders about the importance of educating future mothers in school about mother and child health, and about the quality of this education. Also, it presents the need for further researches about the attiudes and knowledge of mothers regarding child health and sources from which they recieved and got their knowledge and information.

5.2. Maternal related factors

Age of the mother

Mothers at age extremes are often associated with higher mortality due to the higher risk of obstetric complication. In our study, a total of 14.3% of mothers were less than 19 years old and only 6.1% were above 39 years old. The majority of mothers (87.8%) aged between 20-39 years. These result were in line with other Palestinians' reports and studies [12,13,41]. Although many literatures showed association between mother age

at pregnancy and *NM* [83,90 ,109-111], this study didn't, due to close percentages between cases and controls, but the results were consistent with other studies in Gaza [18], Jordan[135], and Indonisia [94] .

Regarding the ***working status of the mother***, the majority of the mothers in both groups were housewives, which coincided with the report of the MoH 2012[139],which showed that 93% of Palestinian mothers are housewives, 5.4% are working and only 1.6% are students.

This factor didn't reach statistical significance (p-value =0.165), which is similar to a Gaza study of 2008 [18], *Egypt* [83]. In fact, the relation between mother's work and NM is still not well established, but other researches in developing countries found that there is a negative relationship between maternal work and infant and child survival [114, 115] ,and in Swaziland it was found that working mothers had a 38% increased likelihood of experiencing childhood mortality compared to mothers who are not working [116].

Results of this variable percentages showed a higher percentage of cases (neonatal death) were in the housewife mothers category, and percentage of living neonates were higher in the working and students mothers category. This could be due to the working mother having economic benefits that favor of the child's survival and the fact that working mothers are more likely to have a higher level of education.

In this study *(Figure -4)* 88.9% of mothers who completed 12 years (secondary level) or more of education were working mothers, whereas

74.4% of housewives have below 12 years of education; However, in another study in the occupied Palestinian territories, only 39% of women with post-secondary education contributed to the labor force in 2006 [12].This could be due to the increasing unemployment state in Palestine in general, or can reflect the tendency of Palestinian society towards mother unemployment.

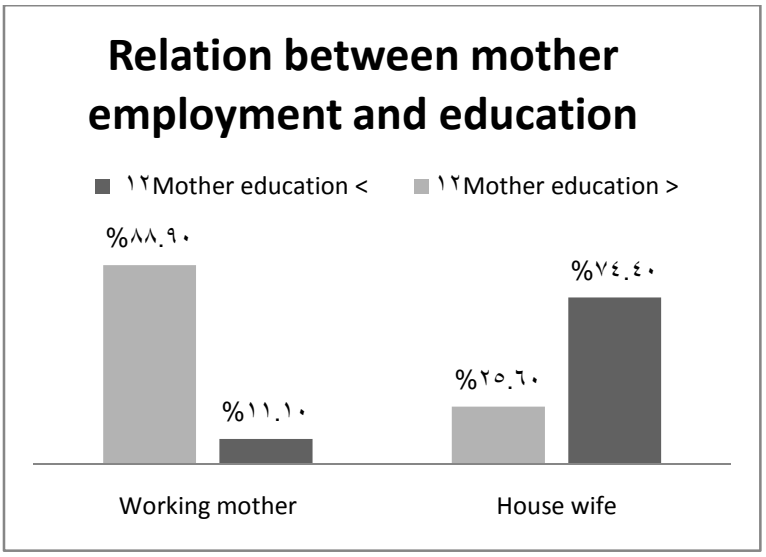

Figure (4): Relation between mother employment status and mother education

The majority of women in this study (85.3%) gave birth to less than 6 children, whereas only 13.6 % were considered as high parity >6. With obvious differences between the two groups, (cases 18.9% and controls 9.2%). These percentages are in line with a PCBC report [141] that states that the average Palestinian woman gives birth to 4.2 children throughout her reproductive life.

Although this variable showed no association with N*M (p-value= 0.175)* as in other studies[18,79,135], it was similar to these studies in that the high parity group have higher risk for NM.

Preceding birth intervals within the dead neonates group showed that 52.1% had a birth interval of less than 24 months. This interval was documented by many researches [119-121] as a high risk interval between subsequent pregnancies, but it didn't show a significant association in this study (p-value= 0.373), in contrast to other studies [18,79,95,135] which found an association. In fact, percentages within each group were similar to the results in Gaza [18], but differed in result of association, most probably due to the smaller sample size in this study; these results reflect weakness of birth spacing concepts in Palestine, and the need to improve family planning programs, which is already part of the applied health care services in all primary health care institutes.

5. 3. Neonatal factors

Age of the neonate

The mean age of the live neonate was 8 months with SD 2.4, while in the cases group, which was divided into early neonatal death < 7 days (64.2%) and 35.7% for the late neonatal death (7-28 days). In general, these results were in line with other literatures that documented high percentages of neonatal death during the early neonatal period [6]. While the relation of neonatal death with ***neonate sex*** couldn't be elicited in this study due to the 1:1 matching, other literatures [18, 94,123] showed that a male baby was at a higher risk for death than a female. However, from another view, percentages of males among cases was 54%,which was similar to the MoH health report in 2012 [139] in which 201 male (55.3%), and 168 female

(46.2%) neonates died in 2012 in the West Bank. Similarly, a PCBS survey (2006) [13] reported that more males (50.7%) are born than females (49.3%), but males have higher mortality rates than females.

Because the percentage of low birth weight was higher in cases than in controls and the percentage of normal birth weight was higher in controls than in cases, ***Birth weight*** showed strong statistical significance with NM (p-value=0.00). The result was in line with other literature[18,79], many of which considered low birth weight as a major risk factor for NM, while others considered it as one of the causes either with or in separation from prematurity[11 , 18,35]. However, this variable lost its significance when introduced into the final model.

Large difference between percentages of **time of birth** was noticed between cases and controls, where a higher percentage of preterm birth neonates was seen among cases, and a higher percentage of term birth among controls, which led to strong statistical association (p-value=0.00) with NM. However, it lost significance after being introduced into the final logistic model. These results were supported by a huge number of studies that document prematurity as a main cause and a main risk factor for NM [6, 18,45. 47, 49.50, 85].

The effect of prematurity is often combined with low birth weight. In this study, a strong positive association was found between prematurity and low birth weight in dead neonates (p-value=0.00). Figure 5 shows that 88.1% of those neonates who were premature had a birth weight of less than 2,500 gram.

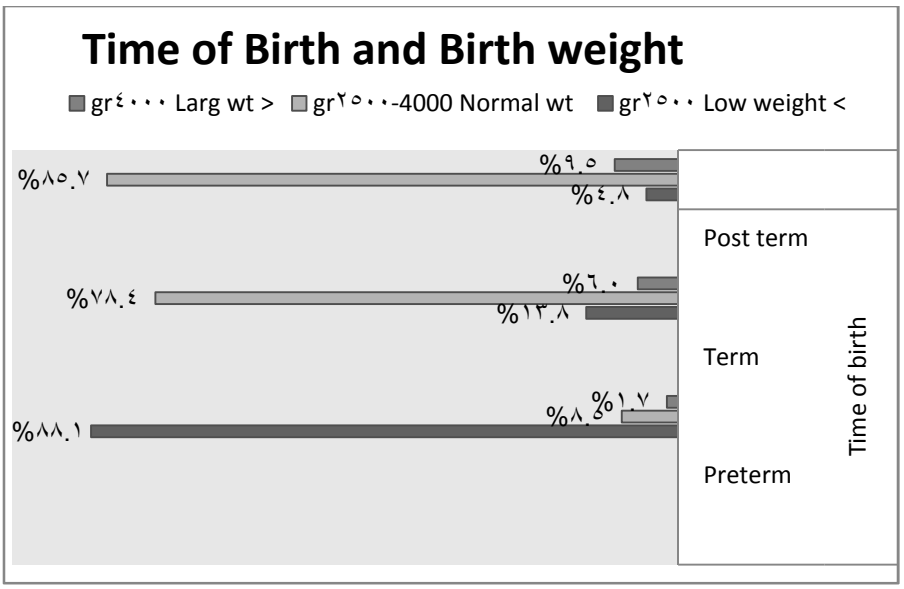

Figure (5): Relationship between birth weight and time of birth in study sample

Further, more specified research must be done regarding this problem in Palestine to figure out its main risk factors, and create suitable solutions for better outcomes.

Birth order

This factor was weakly associated with NM and the difference did not reach statistical significance (p-value = 0.23), a result which is similar to a Gaza study [18], but different from other studies which showed statistical significance between birth order and neonatal mortality but with a variation between results. Some studies found that the 1st baby was at a higher risk of NM **[15, 123]**, while others found that a rank >3 **[25, 90]**, and > 4 **[94,109]** was a risk factor for NM while yet other studies found both low and high birth order to be risk factors for neonatal mortality **[80,134].**

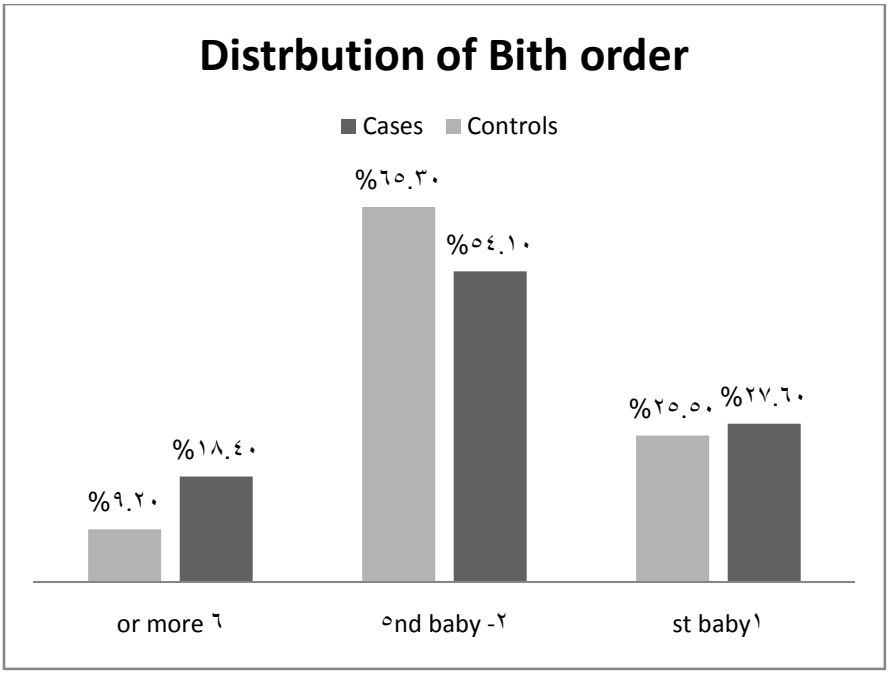

Figure (6): Distribution of birth order among study sample

Most of these literatures focus on either 1st baby or higher rank babies as risk factors for NM. In this study, high birth order (>6 category) showed a huge difference (Figure 6). This could be due to the fact that births of very high order may have mothers who are physically depleted at the time of conception and also have a higher risk of obstetrics complications.

If a neonate was part of a multiples pregnancy

No significant association was found between this factor and NM (p-value = 0.278), while in Jordan,[135] a researcher found that the occurrence of multiple births has a decisive negative impact on neonatal survival, and the multiple born neonates have more than 7.5 times the odds of dying than those born single. Our result could be due to the small number of cases.

Breast feeding and Time of initiation of breast feeding

Breast feeding showed strong significant association with NM (p-value=0.00), which agreed with other studies [18, 83,90, 94, 135]. This significance was continued in the final multiple logistic model with p-value**<0.001**, CI (1.007 - 1.55). The odds of neonatal mortality was 1.18 lower in neonates who were breastfed.

There were obvious differences in timing of breast feeding, where the percentage of feeding within the first hour is higher in controls than in cases, and also among the first 24 hours feeding group, which reached statistical significance (p-value**<0.001**). In the final model babies who had breast feeding immediately after birth showed a strong association with NM, and emerged as a protective factor, while the odds for NM was higher in neonates who were fed within 24 hours(odd=5.6, CI: 5.25 - 125.9), and those who were fed after 24 hours (odd=1.17, CI: 1.003 - 1.5).

These results show the importance of breast feeding and early initiation of breast feeding. However, still Palestine shows low percentages of exclusive breast feeding, which was reported as 27% in 2009[12], and 22% in the MoH health report in 2011[62] . This is far from the WHO target to increase, by 2025, the rate of exclusive breastfeeding for the first six months up to at least 50%. Thus, further effort must be done to improve this variable as one of major risk factors for NM.

5. 4. Health care Services factors

Antenatal care and visits

The majority of the mothers of both cases and controls received antenatal care, but with marked difference in those who received 4 or more antenatal visit *(Figure 7),* which led to strong statistical association with NM (p-value<0.001). These findings were consistent with other studies in Indonesia [132], Jordan[135], Gaza [18], Egypt [83,93] , India [123], and Pakistan [80,125]. All these studies showed a protective effect of antenatal care variables on neonatal deaths, where the risk of NM decreased with an increase in the number of visits, reaching best results with 4 or more visits (the minimum number recommended by WHO [133] .

Although this study clearly demonstrated the importance of ANC, where NM is 2.98 lower for neonates whose mother received >4 ANC (CI: 2.504 - 6.656), it also reflects that there is a good percentage of mothers who didn't receive the recommended number of ANC (4 or more) *(Figure7).*

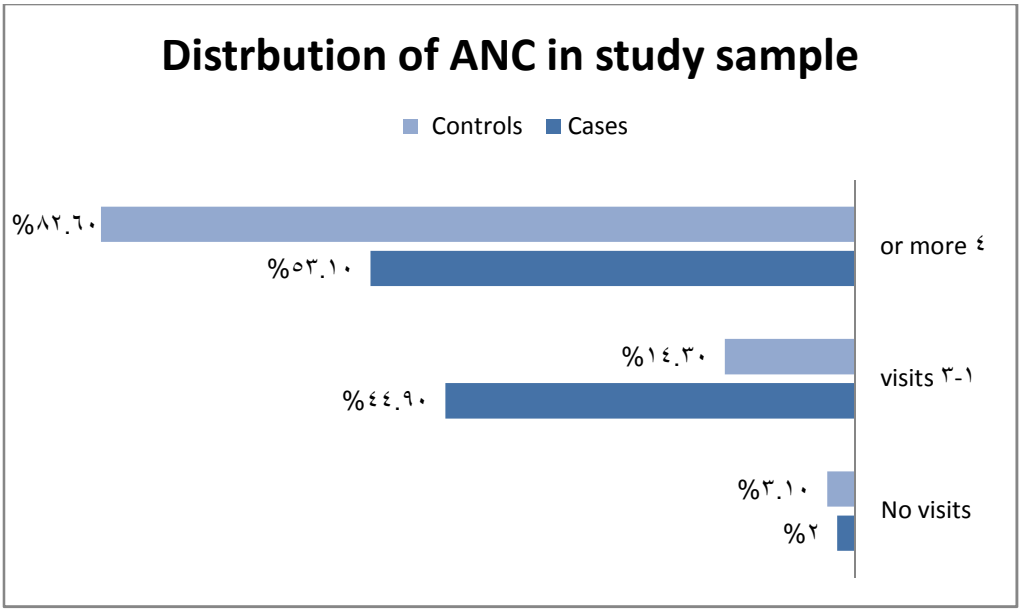

Figure (7): Distribution of ANC among study sample

This raises concern about the time at which mothers started attending their first ANC, the quality of ANC received and also the ***place where they received ANC***. This variable showed statistical significance in this study (p-value=0.021), however, it lost its significance in the final logistic model.

There was noted a difference among mothers who received their ANC at each sector (F*igure 8)*, with the private sector occupying the first rank in providing ANC, and with a positive statistical association in final logistic model (p-value= 0.007**,** odd=43.3**).** This finding is aligned with a PCBS 2006 [13] report in which 46.5% of ANC was received at a private physician's clinic. Still, further studies must be done to evaluate the quality of services applied at each sector in our country, and reasons behind not going to MCH clinics.

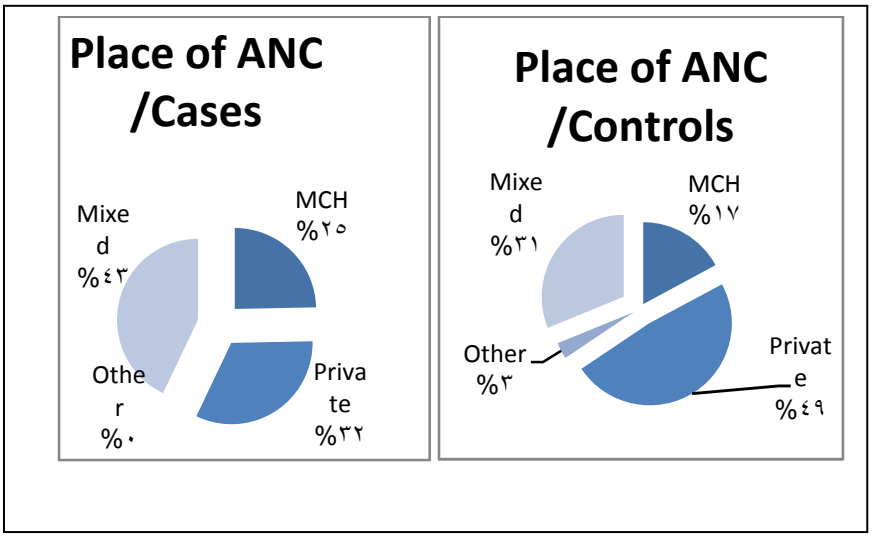

Figure (8) :Distrbution of place on ANC amonge cases and controls

Place of birth

Place of birth was associated with NM in other studies in developing countries such as Bangladesh [132,134], Egypt [83,93], and Pakistan [79] , due to the fact that many births still take place at home, which wasn't the case in our study as all the births took place at hospitals, and so didn't show statistical significance (p-value=0.189). These finding are supported by PCBS in 2011 [14], which reported that 99.4% of deliveries in 2010 occurred under safe conditions in health facilities in the West Bank.

The majority of the study sample had deliveries at governmental hospitals, with a small difference between cases and controls. This could be due to the financial and economic situation of the Palestinian community in general, and the fact that the majority of people carry health insurance, which enables them to receive different health services in the governmental sector.

Results of this study also showed that 84.7% of dead neonates were born in governmental hospitals. These results were consistent with (Kalter et al) study in the Gaza Strip and the West Bank, who found that term delivery in a government hospital was associated with prenatal mortality [15], However, we still can't come to conclusions based on these percentages due to the small size of the study sample.

Another important factor is the ***type of delivery*****,** which didn't show significance (p-value =0.083) with NM in our study in contrast to others [18,79,83,123,132,134,135]. However there were noted differences between the study sample, where percentages of C/S was higher in cases (49%) in comparison to controls (36.7%), and percentages of NSVD was higher among controls. This study also showed a high rate of caesarean sections, which accounted for 42.9% of the whole sample, in comparison to a PCBS 2006 [13] report where NSVD accounted for 75.9%, and 15.0% of births were C/S. The rise in the C/S rate was also discussed in a study by (Abdul Rahim et.a l) [12] which stated that there is a rise in the rate of caesarean sections from 6.8% to 15.0% of all births in the past decade in the occupied Palestinian territory. These findings are much higher than the UN recommendation of a C/S rate of 5–15% to optimally minimize maternal and neonatal mortality rates. These recommendations presume that these C/S are performed in a timely manner on appropriate women[142].

Since C/S delivery carries high risk for NM mortality**,** this finding calls for further research, because we do not know if the C/S were planned

or emergency, medically necessary or not. Therefore, more questions about C/S need to be addressed including the relation between place of delivery and type of delivery (Figure 9). In this figure, a higher rate of C/S was noticed in private hospitals, which raises a question about the extent of follow-up and monitoring of the private sector, and adherence of all health institutions to the health recommendations and protocols.

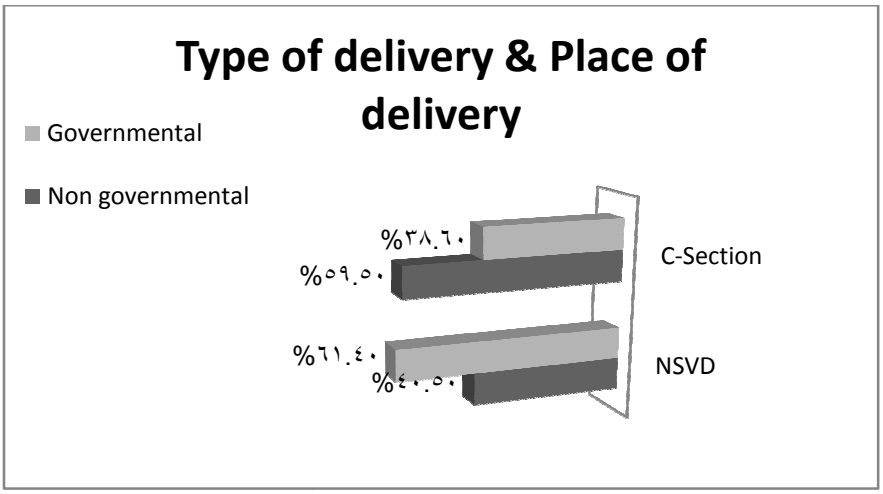

Figure (9): Distribution of type of delivery and place of delivery among study sample

5.5. Causes of death among study cases

The causes of death that were reported for each dead neonate were categorized in Table 9. The most common cause of NM *in this study* was prematurity with 36% of total reported causes, followed by congenital malformation with 31.5% (in this category causes were reported either as Chromosomal/Genetic 3.6 % or due to Congenital heart disease 17.1 %). The third cause was sepsis (19.8%), then Asphyxia (6.3%); Aspiration represented 2.7%, and sudden infant death and Metabolic causes 1.8%.

Table (9): Causes of death among study cases (98 case)

Cause of death	% of death cause Within 98 cases
Aspiration	2.7 %
Sudden Infant Death	1.8 %
Asphyxia	6.3 %
Metabolic	1.8 %
Premature	36 %
Sepsis	19.8 %
Congenital malformation	**31.5 %**
Chromosomal/Genetic	**3.6 %**
Congenital heart disease	**17.1 %**

These results, which represent the study sample (98 cases) were compare to the MoH health report of 2012, which presented cause of death for all dead neonates in the West Bank , where differences in percentages were shown *as follows*:

Pneumonia & Other Respiratory Disorders 36.7%

Prematurity and Low Birth Weight 17.5%

Septicemia 8.8%

Congenital Malformations14.1 %

Congenital Heart Disease & Circulatory System 9%

Sudden Infant Death Syndrome (SID) 5%.

Chapter Six

Conclusion & Recommendations

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Conclusion & Recommendations

The current study was designed to explore the risk factors determining neonatal mortality in the northern Districts in of the West Bank; these factors contribute to development and planning intervention to improve mother and infant health in the Palestinian community.

The neonatal mortality rate in Palestine it still contributes to a big share of infant mortality. In this study it contributed to 65.4% of total infant mortality for 2012 in these districts. Crucial to evaluate this problem is an efficient and effective data collection system. This study explores the defect in the health reporting system regarding NM in different aspects; these include poor commitment from health workers in general towards reporting cases, filling and completing necessary data and information for each dead neonate, where only 37.5% of reported files were found in the six districts studied. Also, there was found to be bad communication between primary health care units and the health information system, a lack of health information data base for analyzing and interpreting those reported cases, so to build and develop strategies according to community needs and defects.

The occurrence of neonatal deaths is a multifactorial process that is related to a number of factors at the community and family level (socio-economic) and biological level (maternal and neonatal) and health services level.

This study showed that a higher level of mother education, higher numbers of antenatal visits (more than 4 visits), and having the ANC in the private sector were associated with fewer neonatal deaths. Breast feeding and early initiation of breast feeding immediately after birth were protective factors for neonatal survival, whereas prematurity and low birth weight increased the risk of neonatal death .

Although other determinants didn't show an association with NM, interesting findings were the following:

- Consanguine marriage was encountered in 38.8% of cases, and 33.6% in controls, and it was associated with higher percentages of those who had sibling death in the 1st cousins' category (36.4%).

- Nearly half of the mothers had a birth interval between pregnancy of neonates and previous pregnancy as <24 months. This high risk interval between subsequent pregnancies was found in 52.1% of cases.

- In this study, a strong positive association was found between prematurity and low birth weight in dead neonates(p-value=0.00), where 88.1% of those neonates who were premature had a birth weight of less than 2,500 grams,

- High rates of caesarean sections, which accounted for 42.9% of the whole sample, and percentages of C/S were higher in cases (49%) than in controls (36.7%).

- A higher rate of C/S was noted in private hospitals in comparison to govermental hospitals.

Important also to understanding this health problem is studying different cases of neonatal death and exploring main causes related to these deaths, in order to control these causes and modify conditions and factors leading to these causes.

Main causes related to the death of neonates in this study were prematurity (36%); congenital malformation (31.5%), from which 17.1% was due to Congenital heart disease and 3.6 % as Chromosomal/Genetic disorders; sepsis (19.8%); Asphyxia (6.3%); Aspiration (2.7%); and Sudden infant death and Metabolic causes (1.8%).

Recommendations

A- Recommendations for Improving the Health Information System:

*** Regarding reporting NM data:**

- Clear rules and laws should be distributed for all primary health care centers about official responsible persons or unite for reporting NM cases, including a clear description of how to complete and write official files of these cases, and finally, mechanisms of transferring these data to the PHIC.

- Follow up by managers of the commitment of each health care department of reporting NM cases, and obligatory completion of the "dead infant questionnaire" for each reported case.

- At the level of PHIC, building a suitable information data base for analyzing reported information, and interpretation of results, in order to be able to use it in improving health policies or building new heath strategies according to outcome results.

- Creation of a new database for NM data, which must stand on a good tool for collecting these data, which is in the Palestinian MoH official files "*dead infant questionnaire*"**.** This is used for all dead infants of less than 1 year old.

*** Regarding improving the "dead infant questionnaire" files:**

- Reform a new questionnaire for the neonatal period, or perinatal period , separate from the post neonatal period , due to the fact that there are great differences between risk factors and determinants for neonatal for these periods.

- The currently-used questionnaire lacks many important determinants such as:

  - Economic status of family (monthly income).

  - Mother's age at marriage, mother's health status: nutrition, chronic disease, disease at current pregnancy (infections), received medication, smoking habit.

  - Antenatal care visits, number of visits, when the mother started her 1st visit, immunization, supplement (Folic acid, Iron).

- Complications during or after delivery, whether delivery was attended by a physician, midwife, or trained birth attendant.

- Condition of neonate after delivery, conscious, crying, needing resuscitation or Neonatal ICU. Did neonate suffer from obstetrics complication (trauma)?.

- Postnatal care: did neonate receive postnatal care, immunization, supplement (A&D), was baby examined by physician?.

B- Recommendations for Health Policy makers and planners

- Promotion of family *planning programs,* which is already part of the applied health care services in all primary health care institutes. From different aspects:

1- Importance of conducting population-based programs about the importance of spacing between pregnancies.

2- Importance of educating the mother about planning for further pregnancy and receiving preconception folic acid both in MCH and in the private sector.

3- Importance of encouraging pregnant women to receive additional supplements of iron to prevent Iron deficiency anemia.

- *Antenatal Care Visits*

1- Increase awareness about the importance of ANC visits of at least four visits and focus on the time of the 1st visit, and its importance in

recognition of danger signs for mother and newborn, birth preparedness, safe deliveries and postpartum care.

2- Development of a unified protocol to follow pregnant women through care visits, in both the governmental and the private sector to ensure good quality of care provided for these women.

3- Further supervision of the antenatal care offered, and assessment of factors that enhance utilization of antenatal services, especially at MCH centers.

- Examining the causes of the high and rising prevalence and performance of C/S in Palestine, according to the UN recommendation of a Caesarean section rate of 5–15%. Further evaluation and follow up is needed especially for private sectors to assess the extent of compliance to heath indication for performing C/S delivery.

- Ensure that there are frequent update trainings for physicians on neonatal resuscitations and managements of delivery complication.

- Encourage postnatal care and the importance of following up on both the mother and the newborn.

- Increase the awareness of the mothers on the importance breast feeding, and early initiation of breast of feeding immediately after birth, either during ANC or via awareness campaigns, or media. Also supporting and implementing breast feeding strategies at the hospital.

- Education of mothers and increases their knowledge about their health and the health of their children through the media, also starting this early at different stages of study.

- To work on increasing community awareness about consanguine marriages and its association with a number of health problems.

C- Recommendations for Further Research Studies

- The researcher advises to conduct more studies on the C/S delivery in Palestine, and the reason behind its increasing rate, indication, complication, and place where it occurs the most.

- More research should be done on prematurity, which is the major cause of death among neonates.

- Studies regarding ANC in Palestine, and the quality of care provided should be augmented.

- Further studies can be done to explore the effect of socio demographic determinants, specific to the Palestinian community, on neonatal mortality.

- Studies which deal with evaluation of existing health policy set for improving child, infant, and neonate health.

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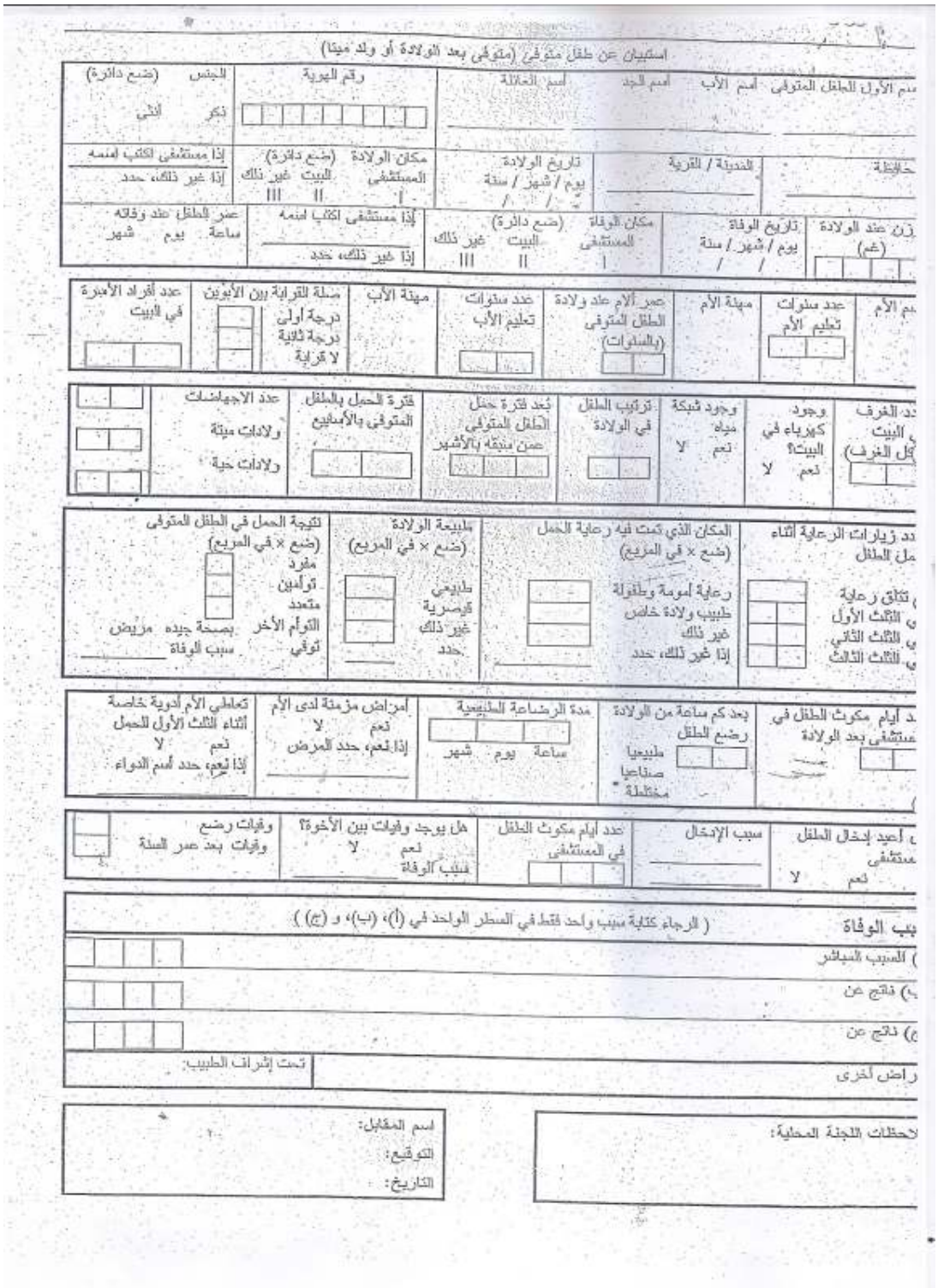
Appendices

Appendix (1)

MoH: "dead infant questioner"



استبيان عن طفل متوفى (متوفى بعد الولادة أو ولد ميتا)

اسم الأول للطفل المتوفى | اسم الأب | اسم الجد | اسم العائلة | رقم الهوية | الجنس (ضع دائرة) ذكر / انثى

ملاحظة | المدينة / القرية | تاريخ الولادة يوم / شهر / سنة | مكان الولادة (ضع دائرة) المستشفى I، البيت II، غير ذلك III | إذا مستشفى اكتب اسمه / إذا غير ذلك، حدد

وزن عند الولادة (غم) | تاريخ الوفاة يوم / شهر / سنة | مكان الوفاة (ضع دائرة) المستشفى I، البيت II، غير ذلك III | إذا مستشفى اكتب اسمه / إذا غير ذلك، حدد | عمر الطفل عند وفاته ساعة / يوم / شهر

اسم الأم | عدد سنوات تعليم الأم | مهنة الأم | عمر الأم عند ولادة الطفل المتوفى (بالسنوات) | عدد سنوات تعليم الأب | مهنة الأب | صلة القرابة بين الأبوين درجة أولى / درجة ثانية / لا قرابة | عدد أفراد الأسرة في البيت

عدد الغرف في البيت (كل الغرف) | وجود كهرباء في البيت؟ نعم / لا | وجود مياه نعم / لا | ترتيب الطفل في الولادة | بُعد فترة حمل الطفل المتوفى عمن سبقه بالأشهر | فترة الحمل بالطفل المتوفى بالأسابيع | عدد الاجهاضات / ولادات ميتة / ولادات حية

عدد زيارات الرعاية أثناء حمل الطفل | المكان الذي تمت فيه رعاية الحمل (ضع × في المربع) رعاية أمومة وطفولة، طبيب ولادة خاص، غير ذلك، إذا غير ذلك، حدد | طبيعة الولادة (ضع × في المربع) طبيعي، قيصرية، غير ذلك، حدد | نتيجة الحمل في الطفل المتوفى (ضع × في المربع) مفرد، توأمين، متعدد، التوأم الأخر بصحة جيده / مريض، توفي، سبب الوفاة

عدد أيام مكوث الطفل في المستشفى بعد الولادة | بعد كم ساعة من الولادة وضع الطفل طبيعيا / صناعيا / مختلطة | مدة الرضاعة الطبيعية ساعة / يوم / شهر | أمراض مزمنة لدى الأم نعم / لا، إذا نعم، حدد المرض | تعاطي الأم أدوية خاصة أثناء الثلث الأول للحمل نعم / لا، إذا نعم، حدد اسم الدواء

أعيد إدخال الطفل المستشفى نعم / لا | سبب الإدخال | عدد أيام مكوث الطفل في المستشفى | هل يوجد وفيات بين الأخوة؟ نعم / لا، سبب الوفاة | وفيات رضع / وفيات بعد عمر السنة

سبب الوفاة (الرجاء كتابة سبب واحد فقط في السطر الواحد في (أ)، (ب)، و (ج))

أ) السبب المباشر

ب) ناتج عن

ج) ناتج عن

أمراض أخرى | تمت إشراف الطبيب:

ملاحظات اللجنة المحلية:

اسم المقابل:
التوقيع:
التاريخ:

Appendix (2)

Study Questionnaire filled in by researcher

Serial #:

Type of research category 0=case 1=control

District: **1**=Nablus **2**=Jenin **3**= Tulkarem **4**=Qalqelia **5**= Tubas **6**=Sulfet

***Community level factors**

1- 0= Village: 1= City: 2= camps:

***Socioeconomic Variables:**

2- Parental education: number of years of education

3- Parental occupation:

4- Maternal education: number of years of education:

5- Consanguinity:

0= not relatives

1=1st degree relatives

2= 2nd degree relatives:

6- Family history of previous sibling death: 0= No 1=Yes

7-If yes; Sibling death: at age: 0= < 1 year: **1= >** 1 year:

8- House hold size: family members: 0= 2-3 1= 4-6 2= >6

*** Maternal factors**

9 -Mother Age at baby birth: categorized into

0=15-19 1= 20-24 2= 25-29: 3=30-34

4= 35-39 5= 40 +

10- Maternal employment: 0= Housewife 1= working mother 3=student

11- Parity (#of live birth, dead baby, abortions): measured as

1- 2 children=0 3-5 children=1 6+=2

12- Preceding birth intervals measured:

0=24 months or less: 1= 24-32 months: 2= 32months or more

***Neonatal factors**

13a- Age (date of death- date of birth): 0= < 7 days of life 1= 7-28 days:

13b-Age of live neonate.

14- Sex: 0= Male: 1= Female

15- Birth weight:

0= normal wt {2500-4000} g 1= low wt< 2500g 2= large wt >4000g

16-Time of birth (duration of pregnancy in weeks):

Preterm=1 Term=0 Post term=2

17- Birth order:

1st baby=0 2nd baby=1 3-5=2 >6=3

18- Breast feed: Ever breastfed the child: No=0 Yes=1

19-Time of breastfeeding (who answered yes)

Immediately after birth=0 within 24 hr=1 after 24 hr=2

20 -If neonate was part of multiple pregnancy: No=0 Yes=1

*** Health care service:**

21- Antenatal care and visits: number of antenatal visits

No visits=0 1-3 visits=1 4 visits +=2

22- Place of antenatal care:

MCH centers=0 private sector=1 other=2 mixed=4

23-Place of delivery:

Home=0 Nongovernmental hospitals=1 Governmental hospitals=2

24- Type of delivery: C-section=1 normal vaginal delivery=0

Cause of death(cases):

جامعة النجاح الوطنية
كلية الدراسات العليا

محددات وفيات الرضع (أقل من شهر) في فلسطين عام 2012 – شمال الضفة الغربية

إعداد
راوية إبراهيم عيسى اللحسة

إشراف
د. أميرة شاهين
أ. د. أنور دودين

قدمت هذه الأطروحة استكمالاً لمتطلبات الحصول على درجة الماجستير في الصحة العامة بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين.
2014م

محددات وفيات الرضع (أقل من شهر) في فلسطين عام 2012–شمال الضفة الغربية

إعداد

راوية إبراهيم عيسى اللحسة

إشراف

د. أميرة شاهين

أ. د. أنور دودين

الملخص

شهد العالم حديثا انخفاضا هاما في معدلات وفيات الرضع والأطفال دون الخمس سنوات، لكن هذا الانخفاض كان اقل وضوحا في وفيات الرضع دون عمر الشهر، حيث تشكل هذه الوفيات ما نسبته 40% من مجموع وفيات الأطفال في العالم، و67% من وفيات الأطفال دون عمر السنة في فلسطين.وعليه فان من المهم دراسة عوامل الخطورة لهذه الوفيات

الهدف من هده الدراسة: تحديد عوامل الخطورة المؤدية لوفاة الرضع دون عمر الشهر في ست من محافظات الضفة الغربية لعام 2012، كذلك وصف النظام الصحي الخاص بالتبليغ عن هذه الوفيات وتوثيقها.

نوع هده الدراسة: هي عبارة عن مقارنة محددات وعوامل الخطورة، بين98 حالة: هي وفيات الرضع من عمر ما بعد الولادة حتى 28 يوما، المبلغ عنهم رسميا في المحافظات الشمالية في الضفة الغربية لعام 2012، أخذت معلوماتها من الملفات الرسمية. مع 98من الرضع الذين ولدوا في نفس العام. حيث تم اخذ المعلومات عن طريق عمل مقابلات مع الأمهات مباشرة وتعبئة استبيان حول هذه العوامل.

نتائج الدراسة

أولا: أظهرت هذه الدراسة خللا في النظام الصحي المتعلقة بالتبليغ وتوثيق وفيات الرضع في جوانب مختلفة. أيضا تم العثور على ضعف في التواصل بين وحدات الرعاية الصحية الأولية ومركز المعلومات الصحية. وكذلك عدم وجود قاعدة بيانات للمعلومات الصحية لتحليل وتفسير تلك الحالات المبلغ عنها.

ثانيا: وأظهرت هذه الدراسة ارتباط كل من مستوى الأم التعليمي، عدد زيارات الأم لتلقى الرعاية خلال فترة الحمل (أكثر من 4 مرة)، تلقى الحامل الرعاية في القطاع الخاص، بمعدل اقل لوفيات الرضع. كما أظهرت الدراسة أن الرضاعة الطبيعة والبدء بها مبكرا مباشرة بعد الولادة تعد عوامل وقائية من أجل البقاء للرضع. في حين تزيد الولادة المبكرة وانخفاض الوزن عند الولادة من خطر وفاة الرضع.

كما أظهرت الدراسة أن الولادة المبكرة والخداج كانت سبب الوفاة في 36% من حالات وفيات الرضع في هذه الدراسة، يليها التشوهات الخلقية بنسبة 31.5%.

الخلاصة: هنالك حاجة لتطوير استراتيجيات و سياسات صحية مبنية على الأدلة لمنع وفيات الرضع في فلسطين، بحيث تكون على جميع المستويات وتستهدف عوامل الخطورة المؤدية لهذه الوفيات. كذلك تقوية و تعزيز نظام المعلومات الصحية كخطوة رئيسية في تطوير هذه الاستراتيجيات.