

PREVENTABLE CAUSES AND  
ASSOCIATED FACTORS OF NEONATAL  
DEATH IN KOTA BHARU DISTRICT

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PREVENTABLE CAUSES AND  
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by

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# TABLE OF CONTENT

<b>ACKNOWLEDGEMENT .....</b>	<b>iii</b>
<b>TABLE OF CONTENT .....</b>	<b>iii</b>
<b>LIST OF TABLES.....</b>	<b>vi</b>
<b>LIST OF FIGURES.....</b>	<b>vii</b>
<b>LIST OF ABBREVIATIONS .....</b>	<b>viii</b>
<b>LIST OF APPENDICES.....</b>	<b>ix</b>
<b>ABSTRAK.....</b>	<b>x</b>
<b>ABSTRACT.....</b>	<b>xii</b>
<b>CHAPTER ONE: INTRODUCTION .....</b>	<b>1</b>
1.1 Background of the study.....	1
1.2 Justification, rationale and benefits of the study .....	3
1.3 Objectives.....	4
1.3.1 Research questions .....	4
1.3.2 General objective.....	4
1.3.3 Specific objectives.....	4
1.4 Research Hypothesis.....	5
<b>CHAPTER TWO: LITERATURE REVIEW .....</b>	<b>6</b>
2.1 Neonatal death .....	6
2.2 Preventable causes of neonatal death .....	8
2.3 Associated factors of neonatal death.....	11
2.4 Maternal related factors .....	11
2.5 Foetal related factors .....	16
2.6 Other associated factors .....	18
2.7 Available health services to improve neonatal health in Malaysia.....	18
2.8 Conceptual framework.....	20
<b>CHAPTER THREE: METHODOLOGY.....</b>	<b>22</b>
3.1 Study design .....	22
3.2 Study duration.....	22

3.3 Study location .....	22
3.4 Reference population.....	22
3.5 Source population.....	22
3.6 Study criteria.....	22
3.6.1 Inclusion criteria .....	22
3.6.2 Exclusion criteria for both cases and controls.....	23
3.7 Sampling frame .....	23
3.8 Sample size calculation .....	23
3.9 Sampling method .....	25
3.10 Data collection and research tools.....	25
3.11 Operational definition.....	26
3.12 Statistical analysis.....	28
3.13 Ethical Issue .....	30
<b>CHAPTER FOUR: RESULTS .....</b>	<b>33</b>
4.1 Socio-demographic characteristics of maternal and foetal related factors ...	33
4.2 Types of neonatal death in Kota Bharu district.....	36
4.3 Causes of preventable neonatal death in Kota Bharu district.....	36
4.4 Factors associated with neonatal death in Kota Bharu district.....	37
4.4.1 Simple logistic regression (Univariable analysis) .....	37
4.4.2 Multiple logistic regression.....	39
4.4.2.1 Preliminary final model and multicollinearity.....	39
4.4.2.2 Model fitness .....	39
4.4.2.3 Interpretation of final model.....	40
<b>CHAPTER FIVE: DISCUSSION .....</b>	<b>41</b>
5.1 Discussions.....	41
5.2 Types of neonatal death in Kota Bharu district.....	41
5.3 Causes of neonatal preventable death in Kota Bharu district.....	42
5.4 Factors associated with neonatal death in Kota Bharu district.....	47
5.5 Strengths and limitations .....	51
5.5.1 Strengths of study .....	51
5.5.2 Limitations of study .....	51
<b>CHAPTER SIX: CONCLUSIONS &amp; RECOMMENDATIONS.....</b>	<b>53</b>
6.1 CONCLUSIONS .....	53

6.2 RECOMMENDATIONS.....	53
6.2.1 Future research.....	53
6.2.2 Service improvement.....	55
<b>REFERENCES.....</b>	<b>57</b>
<b>APPENDICES.....</b>	

## LIST OF TABLES

<b>Table</b>	<b>Title</b>	<b>Page</b>
Table 3.1	Sample size calculation for objective three	24
Table 4.1	Maternal and fetal socio demographic factors in Kota Bharu district	32
Table 4.2	Maternal socio demographic factors of cases and controls in Kota Bharu district	33
Table 4.3	Socio demographic characteristic for fetal related factors for cases and controls in Kota Bharu district	34
Table 4.4	Types of neonatal death in Kota Bharu district	35
Table 4.5	Causes of preventable death in Kota Bharu district	35
Table 4.6	Factors associated with neonatal death in Kota Bharu district by simple and multiple logistic regression	37

## **LIST OF FIGURES**

<b>Figure</b>	<b>Title</b>	<b>Page</b>
Figure 2.1	Associated factors and causes of neonatal death	21
Figure 3.1	Selection of study sample	30
Figure 3.2	Flow chart of study	31
Figure 4.1	The ROC curve of the final model of fitness of factors associated with neonatal death	39



## LIST OF ABBREVIATIONS

MDG	Millennium Development Goal
U5MR	Under-five mortality rate
MOH	Ministry of health
JKNK	Jabatan Kesihatan Negeri Kelantan
PKD KB	Pejabat Kesihatan Daerah Kota Bharu
KK	Klinik kesihatan
GDM	Gestational diabetes mellitus
OR	Odd ratio
CI	Confidence interval
ROC	Receiver operation characteristic

## **LIST OF APPENDICES**

<b>Appendix</b>	<b>Title</b>
Appendix A	Stillbirth and Under-five Mortality Death Form
Appendix B	Proforma Form
Appendix C	Universiti Sains Malaysia Ethical Approval Letter
Appendix D	Ministry of Health (MOH) Ethical Approval Letter

# ABSTRAK

## **PENYEBAB-PENYEBAB KEMATIAN YANG BOLEH DICEGAH DAN FAKTOR-FAKTOR BERKAITAN DENGAN KEMATIAN NEONATAL DI DAERAH KOTA BHARU**

**Latarbelakang kajian:** Sasaran Matlamat Pembangunan Millennium untuk mengurangkan kadar kematian kanak-kanak di bawah umur lima tahun sebanyak dua per tiga dari tahun 1990 sehingga 2015 masih belum tercapai. Malaysia dijangka akan mencapai sasaran kematian kanak-kanak di bawah umur lima tahun menjelang tahun 2020. Kematian neonatal adalah penyumbang penting kepada kelewatan pencapaian kematian kanak-kanak di bawah umur lima tahun ini.

**Objektif kajian:** Kajian ini bertujuan untuk melihat sebab-sebab kematian yang boleh dicegah dan faktor-faktor berkaitan dengan kematian neonatal di Daerah Kota Bharu daripada bulan Januari 2013 hingga September 2015.

**Metodologi:** Kajian kes kawalan telah dijalankan daripada bulan Januari 2016 sehingga Mei 2016 melibatkan klinik kesihatan sekitar Daerah Kota Bharu. Kes adalah bayi yang meninggal semasa dalam tempoh neonatal manakala kawalan adalah bayi yang hidup selepas tempoh neonatal. Kajian ini dibuat dengan menggunakan data sekunder yang didapati dari borang kematian bayi dan kanak-kanak, dan buku daftar KIB 101 daripada klinik-klinik tersebut. Kaedah deskriptif, regresi logistic mudah dan regresi logistik berganda telah digunakan untuk menjawab objektif kajian.

**Keputusan kajian:** Sebanyak 503 orang subjek yang memenuhi kriteria inklusi dan eksklusi telah dikaji, di mana 361 subjek adalah kawalan, dan 142 subjek adalah kes. Kajian ini menunjukkan bahawa 14.8% kematian neonatal boleh dicegah, di

mana 38.1% berpunca daripada pesakit, 33.3% berpunca daripada hospital, dan 28.6% berpunca daripada bahagian kesihatan. Kajian selanjutnya mendapati kematian neonatal adalah dipengaruhi oleh faktor-faktor berkaitan seperti penyakit ibu sewaktu mengandung (Adj. OR 4.96, 95% CI: 2.09,11.75;  $p < 0.001$ ), berat lahir bayi yang rendah (Adj. OR 11.04, 95% CI: 6.15, 19.81;  $p < 0.001$ ) dan kelahiran pra-matang (Adj. OR 3.17, 95% CI: 1.62, 6.23;  $p = 0.001$ ).

**Kesimpulan:** Kajian menunjukkan kematian neonatal yang boleh dielakkan adalah berpunca daripada penyebab dari pihak hospital, pihak kesihatan dan pihak pesakit. Faktor-faktor seperti penyakit ibu semasa mengandung, berat lahir bayi yang rendah dan kelahiran pra matang adalah berkaitan dengan kematian neonatal. Walaupun hasil kajian menunjukkan kadar kematian bayi yang boleh dicegah adalah rendah, namun kelemahan dalam penjagaan ibu dan bayi di peringkat sebelum, semasa dan selepas kelahiran telah dikenalpasti dan diharap dapat membantu pengamal perubatan untuk memperbaiki mutu perkhidmatan dan mengatasi kelemahan dalam penjagaan ibu dan bayi.

**Key words:** Kematian neonatal, dicegah, faktor berkaitan

# ABSTRACT

## PREVENTABLE CAUSES AND ASSOCIATED FACTORS OF NEONATAL DEATH IN KOTA BHARU DISTRICT

**Background of study:** The Millennium Developmental Goal (MDG) target to reduce the under-five death rate by two-thirds from 1990 to 2015 was not achieved. Malaysia is expected to reduce the under-five death rate by year 2020. Neonatal death was an important contributor to the delay in reduction of overall under-five death rate.

**Objective:** The aim of the study was to study preventable causes and associated factors of neonatal death in Kota Bharu district from January 2013 to September 2015.

**Methodology:** A case control study was conducted between January 2016 till May 2016 involving health clinics in Kota Bharu district. Cases were babies who died during neonatal period and controls were babies who survived beyond the neonatal period. The study used secondary data derived from 'stillbirth and under five mortality form' and KIB 101 registration book as the source of data. The descriptive, simple logistic regression and multiple logistic regression analysis were applied to answer the objective of the study.

**Results:** A total of 503 subjects who fulfill the inclusion and exclusion criteria were studied, in which 361 subjects were control and 142 were cases. This study showed that 14.8% of the neonatal death was preventable, out of which 38.1% were contributed by patient causes, 33.3% due to hospital causes and 28.6% were due to health site causes. Further analysis showed that neonatal death was significantly

associated with maternal co-morbidities (Adj. OR 4.96, 95% CI: 2.09,11.75;  $p < 0.001$ ), low birth weight (Adj. OR 11.04, 95% CI: 6.15, 19.81;  $p < 0.001$ ) and prematurity (Adj. OR 3.17, 95% CI: 1.62, 6.23;  $p = 0.001$ ).

**Conclusion:** The number of preventable neonatal deaths is substantiated and it was caused evenly by hospital, health site and patient's causes. Factors such as maternal co-morbidities, low birth weight and prematurity were significantly associated with neonatal death. Despite the smaller percentage in preventable neonatal death, the shortfalls in the management of mothers and newborn specifically in the antenatal, intrapartum period and postnatal care were identified and hence may guide the health practitioners for future intervention and improve the overall performance as part of safe motherhood practice and newborn care.

**Key words:** Neonatal death, preventable, associated factor

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the study

Millennium Development Goals (MDG) targets to reduce under-five mortality by two-thirds between 1990 and 2015 globally. To achieve the target, more than 190 countries have committed to reach the eight goals of MDG that address poverty, hunger, education and health by 2015 (Lawn *et al*, 2010). Since 1990, the global under-five mortality rate has dropped from 90 deaths per 1,000 live births in 1990 to 46 in 2013 (UNICEF, 2014). By 2015, the target was to reduce child mortality to 31 of every 1,000 live births (UNICEF, 2013a).

In Malaysia, under-five mortality rate (U5MR) has declined from 17.2 per 1000 live births in 1990 to 9.5 in 2014 (UNICEF, 2008). However, in Kelantan, the U5MR was 8.7 per 1000 live birth in 2014, which is still above its target of 6.9/1000 live birth. Among 10 districts in Kelantan, Kota Bharu's under-five death rate was not achieved as its child death rates were noted to be steadily increased. Since year 2012, it was noted that the under-five mortality rate in Kota Bharu district has increased proportionately from 5.7 in 2012 to 7.0 in 2013 and later to 8.4 in 2014 (JKNK, 2015). As the current target for under-five death in Kota Bharu is 5.6/1000 live birth, more efforts need to be done to reduce the rate to its achievable target (PKD Kota Bharu, 2014).

Neonatal death which is death in the first 28 days of life becomes a recent attention under MDG for child survival because major contribution of under-five deaths were neonatal deaths. The proportion of worldwide child deaths in the early neonatal and late neonatal period has increased ranging from 33.4% in 1970 to 41.6% in 2013 (Wang *et al.*, 2014). In Malaysia, 54% of deaths were among neonatal and 28.7% were among post-neonatal in 2012 (MOH, 2013). In Kelantan state, neonatal mortality rate was the biggest proportion of under-five child deaths since the past five years, ranging from 51% to 63% (JKNK, 2015). Report from PKD Kota Bharu was shown more than one third of child death was neonatal death (PKD Kota Bharu, 2012).

Three major causes of neonatal deaths that accounts for 80% of all neonatal deaths globally were infections, complications of preterm birth and intra partum-related neonatal deaths (Black *et al.*, 2010). According to Wigglesworth's classification, causes of neonatal death in Kelantan for 2014 were majority contributed by congenital malformations (54%), followed by diseases of respiratory system (24%) and conditions from perinatal period (12%) (JKNK, 2015). In Kota Bharu district, based on ICD 10 classification the top five common causes for neonatal death for Kota Bharu district were congenital malformations (30%), respiratory conditions (23%), prematurity (20%), infections (16%) and asphyxia (5%) (PKD Kota Bharu, 2014).



## **1.2 Justification, rationale and benefits of the study**

Despite the reduction in U5MR in Malaysia, the target to reduce the under-five deaths by two-thirds is yet to be achieved (Asian Development Bank, 2015). In July 2013, a guideline for stillbirth and under-five mortality reporting system was introduced by Ministry of Health Malaysia (MOH) as a strategy to improve surveillance for under-five mortality (U5M) where all under-five deaths must be registered, reported and investigated. This guideline aims to monitor mortality and identify areas for intervention at national, state and district levels (MOH, 2013). U5M reporting system is to report under-five deaths including those from the private sectors and deaths outside hospitals using ICD 10 coding. All deaths need to be investigated and identified. Substandard care should there be any, be classified as preventable or otherwise.

However, as the new system of Under-five Death reporting was introduced, no actual study was done to investigate specifically on the neonatal death in Malaysia despite its biggest contribution to all under-five deaths. Many published and unpublished studies done only focused on perinatal death as it was a mandatory reporting under Ministry of Health surveillance for child death prior to 2013.

Most of the under-five deaths are caused by diseases that are readily preventable or treatable with proven, cost-effective and quality delivered interventions (UNICEF, 2013b). In Kelantan, preventable deaths account for 20.9% of all deaths, in which bigger proportion comes from non-hospital deaths (35.8%) (JKNK, 2015).

However, there is limited information on associated factors of neonatal death, and its preventable causes in Kota Bharu district such as hospital cause, health site cause and patient cause. Therefore, further analysis should be done to investigate the factors that could contribute to neonatal death in Kota Bharu and its preventable causes.

It is hoped that findings from this study would help to identify the shortfalls in the management of mothers and new-borns in the antenatal, intrapartum period and post natal care specifically in Kota Bharu District and hence would guide the health practitioners to improve the overall performance as part of safe motherhood practice and new-born care.

### **1.3 Objectives**

#### ***1.3.1 Research questions***

1. What is the type of neonatal death in Kota Bharu district?
2. What are the causes of preventable neonatal death in Kota Bharu district?
3. What are the factors associated with neonatal death in Kota Bharu district?

#### ***1.3.2 General objective***

To study preventable causes and associated factors of neonatal death in Kota Bharu district.

#### ***1.3.3 Specific objectives***

1. To describe the types of neonatal death in Kota Bharu district  
(preventable/non preventable)
2. To describe the causes of preventable neonatal death in Kota Bharu district

3. To determine the factors associated with neonatal death in Kota Bharu district

#### **1.4 Research Hypothesis**

Neonatal death in Kota Bharu district is significantly associated with socio demographic of maternal and foetal factors.

# CHAPTER TWO

## LITERATURE REVIEW

### 2.1 Neonatal death

Neonatal death is defined as death occurred before 28 days of life (MOH, 2014). Neonatal death rates reflect economic and social conditions for the mothers' health and the newborn, as well as the effectiveness of health systems (Khadka *et al.*, 2015). It is estimated that neonatal death comprises at least 41-44% of under-five deaths (Black *et al.*, 2010; Rajaratnam *et al.*, 2010; Liu *et al.*, 2015) whereas 75% occur in the first year of life (UNICEF, 2014).

Global reduction in child deaths have been due mostly to reductions in post neonatal death (Feng *et al.*, 2011). Neonatal mortality rate has reduced from 36 deaths per 1,000 live births in 1990 to 19 in 2015, however the decline in neonatal death has been slower than that of post-neonatal under-five death (Lawn *et al.*, 2010). Despite the slow reduction in neonatal mortality rate, child surviving programmes and funding continue to focus on important causes of death in post neonates, particularly on malaria and vaccine-preventable conditions (UNICEF, 2015).

On the other hand, maternal health programmes have focused primarily on the mother (Lawn *et al.*, 2010). Three major causes of neonatal deaths that accounts for 80% of all neonatal deaths globally were neonatal infections, complications of preterm birth and intra partum-related neonatal deaths such as birth asphyxia (Black *et al.*, 2010; Liu *et al.*, 2015). Liu *et al.* (2015) reported 51.8% of 6.3 million

children died due to infectious diseases such as pneumonia, diarrhea and malaria in 2013. However, this number has decreased compared to year 2000.

The top 10 countries that have the greatest neonatal mortality rates ranging from 45 to 61 per 1000 live births are African countries such as Somalia, Republic of Congo, Mali, Nigeria, Central African Republic, Angola and Guinea-Bissau. Other countries are Pakistan, Afghanistan and Myanmar (Black *et al.*, 2010). Many countries that involved with high number of newborn deaths have experienced wars or other disasters which hinder the implementation of newborn survival programmes in their settings (WHO, 2010).

The aim of MDG 4 to reduce the child mortality by two-thirds between 1990 and 2015 was achieved by 27 of 138 developing countries (Liu *et al.*, 2015). These countries include Armenia, Bahrain, Bangladesh, Benin, Bhutan, Brazil, Burma, China, Egypt, El Salvador, Federated States of Micronesia, Iran, Lebanon, Liberia, Libya, Maldives, Nepal, Nicaragua, Oman, Peru, Saudi Arabia, Sri Lanka, Thailand, Timor-Leste, Tunisia, Turkey, and United Arab Emirates (Wang *et al.*, 2014). Malaysia is still off the track and is expected to achieve the MDG target by 2020 (Asian Development Bank, 2015).

Progress on reducing child death has been substantially slower with averaged of 2.0% than the target annual rates of 4.4% reduction (Bhutta *et al.*, 2014; Rajaratnam *et al.*, 2010). As such, UNICEF has proposed for a continued post-2015 focus on further reductions in child mortality to eliminate all child deaths from preventable causes by 2035 (UNICEF, 2013). This global goal is motivated by the huge

disparities between and within nations in child mortality and by the fact that child death can be reduced even in low-resource settings (Jones *et al.*, 2003).

In June 2012, world leaders met during the global launch of Committing to Child Survival: A Promise Renewed (APR), to renew their commitment for a continued post-2015 focus to end preventable child deaths (You *et al.*, 2015). The international community has launched a new framework known as the Sustainable Development Goals (SDGs), and formulated a new set of country targets. These targets include ‘A Promise Renewed’ target of 20 or fewer under-five deaths per 1000 live births by 2035, and the ‘Every Newborn Action Plan’ target of ten or fewer neonatal deaths per 1000 live births by 2035 (Liu *et al.*, 2015).

This new framework aims to guide and motivate future global and national action, to continue the unfinished business from MDGs and also working towards setting new goals that will constitute an integrate set of global priorities for sustainable development (UN, 2014). SDG under goal three, aims to end preventable deaths of newborn babies and children younger than five years by 2030, with all countries are aiming to reduce neonatal deaths to at least as low as 12 deaths per 1000 live births (UN, 2015).

## **2.2 Preventable causes of neonatal death**

More than half of under-five death are due to diseases and conditions that are preventable with proven, cost-effective interventions (UNICEF, 2014). Delay in delivering appropriate care especially around the time of birth or at the onset of sepsis can pose a significant threat to the newborn (Lawn *et al.*, 2010). Thus,

newborn death can be reduced by care within the existing maternal and child health program and providing a good intervention approach targeting at the main causes of neonatal death such as neonatal infections, complications of preterm birth and intra partum-related neonatal deaths such as birth asphyxia (Lawn *et al.*, 2010; Black *et al.*, 2010; Liu *et al.*, 2015).

A few approaches towards reducing the three important causes of neonatal mortality has been outlined by Lawn *et al.* (2010). Neonatal infections which is mainly due to sepsis, meningitis, pneumonia and diarrhoea caused about 963,000 deaths globally (Darmstadt *et al.*, 2008). This deaths can be prevented by identifying and treating the maternal infection, having a clean and hygienic childbirth practices and encourage breast feeding among the mothers (Darmstadt *et al.*, 2008).

Intra partum related death e.g. birth asphyxia caused deaths in about 814,000 globally (Lawn and Kerber, 2006). This death is very common during the first day of life and best prevented by provision of good antenatal care, especially identifying and managing hypertension in pregnancy and pre-eclampsia, having a well trained birth attendant during the delivery process, and having a good emergency obstetric care for complications e.g. during obstructed labour and haemorrhage (Lawn and Kerber, 2006).

Complications of preterm birth caused most of the neonatal death amounting to 1,033,000 deaths and occurred mostly during the first week of life (Darmstadt *et al.*, 2008). This cause of death could be prevented by treating the maternal infections, providing good nutrition including iron and folic acid supplements, preventing

malaria in pregnancy such as in African countries and providing steroids to the mothers to prevent neonatal complications (Darmstadt *et al.*, 2008).

In Malaysia, the new reporting system for U5M provide details on the causes of death by using the ICD 10 criteria as a way of diagnosis. Each death will be investigated into details on the preventive aspect at each level including at the health site (including private practitioner or private hospitals), at the hospital level or at the patient level. Thus the remedial action will be focused on the preventive aspect at the indicated level.

A recent report by JKNK (2015) showed that there were few causes that could be contributed to the preventable child death i.e. patient causes, hospital causes and health site causes. Among all the causes, patient causes contributed the biggest number (62.8%) followed by hospital causes (27.1%) and health site causes (10.1%). Few explanation of child death that were associated with patient causes include non compliance to advice/treatment and refuse admission (37.0%), delayed in seeking treatment (29.7%), inadequate visit (22.2%) and others (11.1%).

Hospital causes that lead to preventable death were inadequate management (40.0%), failure to appreciate severity (23.0%), failure to diagnose (17.0%), failure of communication (14.0%) and others (6.0%). Among the reasons that contribute to health site causes include inappropriate therapy (30.7%), failure to appreciate severity (15.4%), delayed referral (15.4%), failure to diagnose (15.4%), failure of communication (7.7%) and others (15.4%) (JKNK, 2015).



### **2.3 Associated factors of neonatal death**

Neonatal death has been discussed extensively in the literatures and was associated with many risk factors. Among the risk factors include maternal socio-demographic risk factors such as maternal age, maternal race, educational level, socioeconomic factors, number of parity, co-morbidities, antenatal follow-up status, maternal nutritional status and complications during ante partum and post partum.

Foetal related factors also contribute to neonatal death such as sex of foetus, number of foetus, foetal birth weight, gestational age, place of delivery, mode of delivery and APGAR score. Other factors that contributes to neonatal death were geographical area, birth spacing duration, breastfeeding status, trauma or injuries during pregnancy and past history of neonatal death.

### **2.4 Maternal related factors**

Maternal age has been related to neonatal death in many studies. For example, studies done in Egypt, Nigeria and Bangladesh showed that the risk of neonatal death increased among the mother in younger age group (Hassan *et al.*, 2012; Kamal *et al.*, 2012; Ezeh *et al.*, 2014). However, the risk is decreasing with increasing age, (Kamal *et al.*, 2012) and increasing again in the very old age group (Hassan *et al.*, 2012).

Maternal race is another factor that has been associated with the neonatal death. Claydon *et al.* (2007) did a study to identify the risk factors for neonatal death in neonatal intensive care unit (NICU) and revealed that South Asian infants had significantly greater odds of mortality in NICU. Studies in Vietnam, Netherlands

and Brazil also have shown that there is risk of increasing neonatal mortality in minority ethnic group (Hoa *et al.*, 2007; Matijasevich *et al.*, 2008; Ravelli *et al.*, 2010).

Higher birth rank order which is defined as more than five deliveries was identified as a significant risk factor contributing to neonatal death (Kamal *et al.*, 2012; Chaman *et al.*, 2014; Debelew *et al.*, 2014; Ezeh *et al.*, 2014). This is consistent with other studies that showed grandmultiparous as higher risk of neonatal death compared to the other group i.e. nulliparous and multipara (El Awour *et al.*, 2012; Hassan *et al.*, 2012; Kayode *et al.*, 2014; Li *et al.*, 2015; Nakimulli *et al.*, 2015).

Maternal co-morbidities have been associated with neonatal deaths in previous literatures. A five year study on perinatal mortality rates in Pasir Mas, Kelantan in 2008 found that the rates associated with maternal morbidity were 15.8% for hypertension, 13.2% for anemia and 7.5% for diabetes mellitus (Bachok *et al.*, 2008).

Worldwide prevalence of diabetes mellitus in pregnancy is 37 per 1000 pregnancies. About 90% of them are classified as gestational diabetes mellitus, 7% as previously diagnosed type 2 diabetes mellitus, and 4% as type 1 diabetes mellitus (Dim *et al.*, 2012). Diabetes complicates two to six percent of pregnancies and is associated with a number of adverse outcomes including birth trauma, neonatal hypoglycemia, macrosomia and pre-eclampsia. Those with pre-existing diabetes mellitus have the additional risks which include congenital defects and increased perinatal mortality (Wilmot *et al.*, 2014). Study by Mahalakshmi *et al.* (2014) showed that half of

mothers who had diabetes mellitus during pregnancy developed diabetes within five years after delivery and over 90% within 10 years of delivery.

Shand *et al.* (2007) and Mahalakshmi *et al.* (2014) did some studies comparing neonatal outcome in both gestational diabetes mellitus (GDM) and non GDM mothers and concluded that major infant morbidity or mortality occurred more frequently in infants born by GDM mothers. However, study by Gasim *et al.* (2012) showed no difference between GDM and control in term of congenital anomalies and perinatal mortality. On the other hand, study by Poolsup *et al.* (2014) concluded that no significant difference observed between GDM mothers with therapeutic intervention versus usual antenatal care in terms of perinatal or neonatal death.

Obesity has been shown to be a risk factor to the development of GDM. The risk of GDM increases with rising maternal body mass index (BMI). Thus, GDM is common in maternal obesity and has consistently been associated with an increased rate of fetal and neonatal death (Ramachenderan *et al.*, 2008).

Chronic hypertension is strongly associated with serious maternal complications such as pre-eclampsia, gestational diabetes and placental abruption in mothers, and small for gestational age (SGA) in fetus which associated with increased perinatal mortality (Zetterstrom *et al.*, 2008). A study by Madi *et al.* (2012) found that chronic hypertension in pregnancy was significantly associated with maternal age more than 30 years, non-white race, low educational level, parity more than three, preterm babies and neonatal mortality.

On the other hand, pregnancy induced hypertension (PIH) is a major cause of maternal and early neonatal morbidity and mortality in developing countries. Early onset PIH had an almost seven-fold increased risk of early neonatal deaths compared to cases of late onset PIH or eclampsia (Ebeigbe *et al.*, 2010).

Anaemia in pregnancy is a major public health and economic problem worldwide which contributes to both maternal and foetal morbidity and mortality (Masukume *et al.*, 2015). Study by Rahman *et al.* (2016) showed a significant high risk of low birth weight, preterm birth, perinatal mortality and neonatal mortality in pregnant mothers with anaemia (RR 2.72; 95% CI: 1.19,6.25). Thus, adequate maternal nutrition has shown to be important factor that reduce the neonatal death (Owais *et al.*, 2013).

Another study by Nisar *et al.* (2015) showed use of iron-folic acid supplement during antenatal period significantly reduced the risk of early neonatal deaths by 45% and total neonatal deaths by 42%. This is consistent with studies done in Indonesia and Vietnam (Dibley *et al.*, 2012; Passerini *et al.*, 2012). However, a study in low risk pregnant mothers with anaemia in early pregnancy found no statistically significant effect of anaemia on adverse pregnancy outcomes such as SGA, pre term birth, mode of delivery and low birth weight (Masukume *et al.*, 2015).

Other maternal factors contribute to the neonatal death are previous history of neonatal death, frequency of antenatal visit, complications of pregnancy, mode of delivery, reduce birth spacing and maternal education level. Past history of neonatal death was found to increase the risk of neonatal death in subsequent pregnancy (Hassan *et al.*, 2012). Study done in Gaza, Egypt and Ethiopia found that frequency

of antenatal visit (less than four times) has an increased risk of neonatal morbidity and mortality (Hassan *et al.*, 2012; El Awour *et al.*, 2012; Debelew *et al.*, 2014). This is further supported by Li *et al.* (2015) that showed higher neonatal death in women who did not receive antenatal care during the first trimester of pregnancy.

Few literatures had discussed about complications of pregnancy as contributing factors for neonatal death. Hassan *et al.* (2012), Nakimulli *et al.* (2015) and Owais *et al.* (2013) found that maternal complications during antepartum such as ante partum haemorrhage, ruptured uterus, severe pre-eclampsia and eclampsia significantly attributed to neonatal death. Baby delivered by caesarean-section was noted to have higher risk of neonatal death based on study by Chaman *et al.* (2014) and Ezeh *et al.* (2014). Interestingly though, breastfeeding during first hour post-delivery was found to have protective effect on neonatal death (El Awour *et al.*, 2012; Kayode *et al.*, 2014).

Another study by Kayode *et al.* (2014) and Chaman *et al.* (2014) shows that poor birth spacing which is less than two years was a significant risk factor for neonatal death. In terms of educational level, studies done in China, Uganda, Australia and Bangladesh showed that another maternal protecting factor found to reduce risk of neonatal death was higher educational level (Kamal *et al.*, 2012; Titaley *et al.*, 2012; Li *et al.*, 2015; Nakimulli *et al.*, 2015).

Nevertheless, adequate utilization of antenatal, delivery and postnatal health services also reduce the risk of neonatal death based on study by Kayode *et al.* (2014). On

the other hand, mothers who involve in domestic violence have an increased risk of neonatal death (El Awour *et al.*, 2012).

## **2.5 Foetal related factors**

Male neonates have higher risk of neonatal mortality compared to the female neonates as consistently reported in several studies in Nigeria, Brazil and Australia (Titaley *et al.*, 2012; De Castro *et al.*, 2014; Ezeh *et al.*, 2014). However, study by Rosenstock *et al.* (2013) showed that boys were at 20% greater risk of early neonatal death whereas girls at 43% greater risk of late neonatal death. Biological factors, respiratory depression and unconsciousness at birth explained early neonatal death among boys whereas environmental interaction between ethnicity, sex and prior sibling composition explained the neonatal death among girls (Rosenstock *et al.*, 2013).

In terms of birth weight, previous studies consistently found low birth weight as a significant risk factor contributing to neonatal death (El Awour *et al.*, 2012; Chaman *et al.*, 2014; De Castro *et al.*, 2014; Kayode *et al.*, 2014; Nakimulli *et al.*, 2015). Interestingly though, study by Ezeh *et al.* (2014) in Nigeria found that mother who perceives their baby as smaller than the average size has a higher risk of neonatal death.

Risk of neonatal death increased greatly in premature babies than in babies born at term (El Awour *et al.*, 2012). Similar findings were noted in studies done by Welaga *et al.* (2012), Chaman *et al.* (2014) and De Castro *et al.* (2014). Zhang *et al.* (2009) studied in Canada however found that neonatal death decreased with increasing

gestational age from 37 to 39 weeks, remained stable from 39 to 40 weeks, and then increased at 41 weeks.

Place of delivery also posed an important risk for neonatal death. According to a study done by Bachok *et al.* (2008) in Pasir Mas Kelantan, 92.1% of all deliveries occurred in hospital, 5.7% at home, 0.8% health clinic and 0.8% at private clinic. However, the place of delivery for neonatal death was not studied. Haraldsdottir *et al.* (2014) and Li *et al.* (2015) did some studies comparing deliveries in urban and rural areas and noted higher neonatal death outside the capital area.

According to Lawn *et al.* (2010), more than fifty percent of the new-born who died in low-income countries died at home. For example, only 13-15% of neonatal death occurred in hospital in developing countries such as Bangladesh and Ghana (Lawn *et al.*, 2010). However, studies in developed countries such as in US and Netherlands revealed a lower rate of neonatal death which was contributed to proper planned home birth (Cheney *et al.*, 2014; Jonge *et al.*, 2014).

Number of foetus or multiple gestation increase the risk of neonatal death as demonstrated by a few studies done in Ghana, Africa, Brazil and Ethiopia (Welaga *et al.*, 2012; Debelew *et al.*, 2014; De Castro *et al.*, 2014; Gebremedhin *et al.*, 2014; Kayode *et al.*, 2014). However, a different study by Imaizumi *et al.* (2013) in Japan showed that early neonatal and neonatal mortality rates in twins were significantly higher in the oldest maternal age group than in the youngest maternal age group.

As mentioned earlier, one of the causes of neonatal death is intra partum complication such as birth asphyxia. Study by El Awour *et al.* (2012) in Gaza strip found that poor APGAR score or unconscious post-delivery significantly increased risk of neonatal death.

## **2.6 Other associated factors**

Poor socio economic status was found to be a significant risk factor for neonatal death in developing countries such as Nepal and Ghana (Khadka *et al.*, 2015; Kayode *et al.*, 2014). In terms of geographical distribution, mothers who reside in rural or mountainous area had an increased risk of neonatal death (Khadka *et al.*, 2015; Ezeh *et al.*, 2014).

## **2.7 Available health services to improve neonatal health in Malaysia**

In Malaysia, many services were made available targetting at improving maternal and neonatal health (MOH, 2015). Such services can be divided into pre pregnancy, antenatal, intra-partum, and post natal care for mothers and the new-borns. Pre pregnancy care involves screening, identifying and modifying any factors in mothers that would give adverse outcomes during the ante natal, intra partum and post partum period. Thus services range from family planning, promoting healthy nutrition, optimising medical illness when present and advice on healthy lifestyle, for example stop smoking and alcohol intake.

Ante natal care involves screening for Human Immunodeficiency Virus (HIV), sexually transmitted diseases (STD), screening for diabetes in high risk group, treat any sign of infections e.g. urinary tract infection, provide advice on nutritional



support and adequate and proper management of illnesses during pregnancy. During the ante partum period, availability of skilled birth attendants, effective management of preterm labour especially provision of antenatal corticosteroids and proper management of obstetric complications is provided with the advance management in obstetric care services (MOH, 2015b).

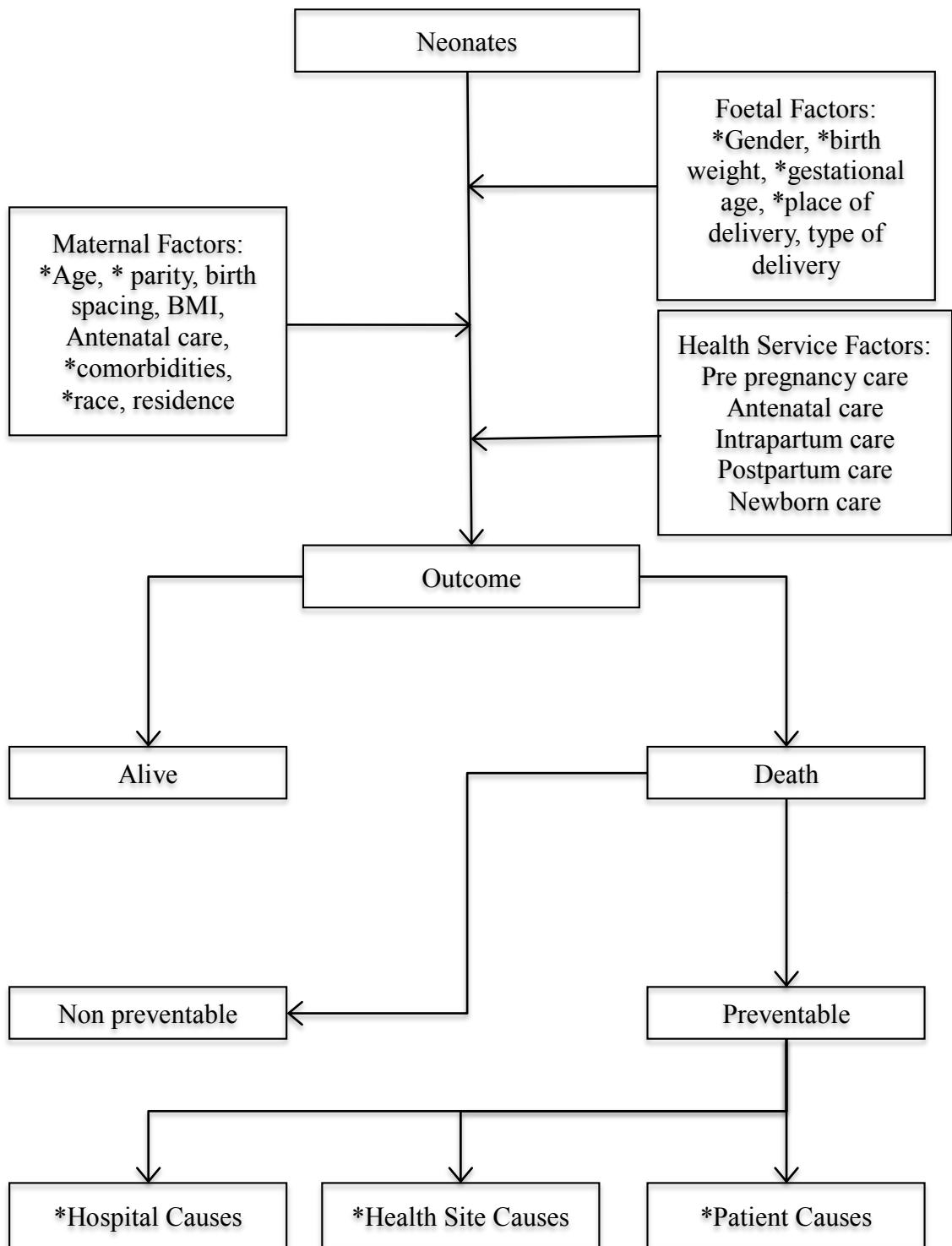
During the newborn period, adequate and proper thermal care, proper hygiene, neonatal resuscitation, early breastfeeding initiative and care for preterm babies for example kangaroo mother care is essential to avoid complications during the postnatal period. Subsequent follow-up in the health clinics require a thorough assessment on growth and development, provision of complete immunisation, prevention and management of infection by early intervention using the integrated management of childhood illness (IMCI) (MOH, 2015b).

Malaysia is planning to focus on a few strategies to reduce the preventable neonatal death by less than 12 per 1,000 live birth by year 2030 (MOH, 2015a). More emphasize will be given to improve the service of early essential new-born care with the aim early intervention for the premature deliveries and hence reduce premature death. A few initiatives by government such as personalised care program and family doctor concept will help the health staffs to pay greater attention to the needs of the patients at community level and plan appropriate management plans for them (MOH, 2015b).

## **2.8 Conceptual framework**

Figure 2.1 shows conceptual framework of associated factors and causes of neonatal death. Among the maternal factors associated with neonatal death are age, parity, birth spacing, body mass index (BMI), antenatal care, co morbidities, race and residence. Foetal factors include foetal sex, birth weight, gestational age, place of delivery and type of delivery. Health service factor includes pre pregnancy care, antenatal care, intrapartum care, postpartum care and newborn care.

Those mark with \* were factors that were included in this study. Other factors such as birth spacing, BMI, antenatal care and type of delivery were not included due to incomplete data. Causes of preventable death include hospital causes, health site causes and patient causes. The aim of this study was to identify preventable causes and associated factors of neonatal death in Kota Bharu district.



**Figure 2.1: Associated factors and causes of neonatal death.**

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Study design**

A case control study was conducted.

#### **3.2 Study duration**

This study was conducted between January 2016 till May 2016.

#### **3.3 Study location**

The study was conducted in Kota Bharu district

#### **3.4 Reference population**

The reference population in this study was all live births in Kota Bharu, Kelantan

#### **3.5 Source population**

The source population for this study was all live births born from January 2013 to September 2015 registered to the health clinics in Pejabat Kesihatan Daerah Kota Bharu.

#### **3.6 Study criteria**

##### ***3.6.1 Inclusion criteria***

1. Cases were babies who died during neonatal period.
2. Controls were babies who survived beyond the neonatal period.

### ***3.6.2 Exclusion criteria for both cases and controls***

1. Babies whose mothers had antenatal follow up in health clinics outside Kota Bharu.
2. Non Malaysian babies.
3. Records with absence of at least one of information required in the proforma.

### **3.7 Sampling frame**

The sampling frame for this study includes all cases and controls who fulfilled the inclusion and exclusion criteria.

### **3.8 Sample size calculation**

1. Objective 1 (to describe the types of neonatal death in Kota Bharu district) was not calculated for because data were descriptive
2. Objective 2 (to describe the causes of preventable neonatal death in Kota Bharu district) was not calculated because data were descriptive.
3. Objective 3 (to determine the factors associated with neonatal death in Kota Bharu district) was calculated by using the Power and Sample Size Calculations (PS software) version 3.0 (Dupont WD, 2009). The calculation for sample size are shown in table 3.1

Table 3.1: Sample size calculation for objective three

variables	$\alpha$	power	m	$P_0$	$P_1$	Case: control (n)	n +10%
Young maternal age	0.05	0.8	2	0.09 (Chaman, 2014)	0.18	162:324	486+49= 535
Multiparity	0.05	0.8	2	0.23 (Chaman, 2014)	0.35	163:328	491+49= 540
Premature	0.05	0.8	2	0.04 (Chaman, 2014)	0.11	155:310	465+47=512
Male fetus	0.05	0.8	2	0.46 (El Awour, 2012)	0.6	149:298	447+45= 492
Low birth weight	0.05	0.8	2	0.08 (El Awour, 2012)	0.44	15:30	45+5= 50

$P_0$  = Proportion of exposure among control group obtained through literature review

$P_1$  = Expected proportion of exposure among cases (estimated by expert opinion)

m = Ratio between cases group and control group

The calculated sample size chosen for objective three was from multiparity variable which was the largest sample size (n=540, cases=179, controls= 361)

After calculation for objective 3, the sample size was added to 10% due to possibility of data entry error, missing form and outlier. As this study is a retrospective study and any absence of at least one information required in the proforma was excluded from the study, the calculation for drop-out and missing data was not included. Thus the biggest sample calculated for this study is 540.