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FACTORS ASSOCIATED WITH NEONATAL DEATHS IN KATIMA MULILO STATE HOSPITAL

BY

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Declaration

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I, CHRISTINA MULEMWA LIOMBA , hereby declare that:

FACTORS ASSOCIATED WITH NEONATAL DEATHS IN KATIMA MULILO STATE HOSPITAL.

Submitted for a Masters Degree to the Faculty of Medical and Health Sciences at University of Namibia in Windhoek, is my original work. It has nor been done before in our institution. All the sources that have been used or quoted have been acknowledged by means of complete references in the text and bibliography.

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ABSTRACT

The neonatal mortality rate is the most essential indicator of obstetric care as well as overall socio-economic development in any given country. It is also a sensitive indicator of the impact of programme intervention and for monitoring changes in quality care (MOHSS, 1996: 2).

The Health Information System (HIS) at Katima Mulilo State Hospital reported an increase in neonatal deaths of 8/1000 live births (0,8%) in 2001 to 39/1000 live births (3,9%)in 2002. Based on this problem, factors associated with neonatal deaths were investigated in an effort to improve mother and child health in Katima Mulilo Hospital.

In reviewing the literature, factors such as prematurity, low birth weight, infection, high parity/gravida, maternal age, birth intervals, hypothermia, lack of equipment, asphyxia and some obstetric related conditions such as placental pathologies, pregnancy-induced hypertension and birth injuries were identified. After applicable validation, these factors were also included in the instrument construction of this study.

A comparative, descriptive and retrospective study was conducted from cases and controls selected from the total population. Cases referred to mothers and their diseased neonates, while controls referred to mothers and their surviving neonates. Some statistically significant differences were found between the case group and the

control group with regard to certain variables that could be regarded as factors associated with neonatal deaths.

Recommendations that were formulated based on this research report include emphasis on improved maternal and child health education, in-service training for registered nurses, regular audits of patient records and discussion of audit results. In addition it is proposed that the in-service training of traditional birth attendants be enhanced. It is recommended that these traditional midwives be instructed in the early detection of complications and the correct referral to health facilities. Extension of outreach services to all corners of the region should be implemented. Revision of national policy guidelines with regard to treatment protocols is also proposed. Consideration should also be given to the establishment of hospital facilities to improve the care of premature babies, which should accommodate mothers for Kangaroo Mother Care.

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LIST OF ABREVIATIONS

AIDS   -Acquired Immunodeficiency Syndrome

ANC   -Antenatal care

ARV   -Antiretroviral

DHS   -Demographic Health Survey

CAA   -Catholic Aids Action

CMO   - Control Medical Officer

CPD   - Cephalo Pelvic Disproportion

HIS   -Health Information System

HIV   -Human Immune Virus

IUD   -Intra uterine death

IUGR   -Intra Uterine Growth Retardation

KMC   -Kangaroo Mother Care

LOA   -Left occipito anterior

mmHg   -Millimetre mercury

MOHSS   - Ministry of Health and Social Services

MTCT   -Mother to Child Transmission

NAPSAC   -International Association of Parents and Professionals for Safe

                              Alternatives in Childbirth

NAS   - Neonatal Abstinence Syndrome

NEC   -Necrotising Enterocolitis

NDHS   -Namibia Demographic Health Survey

NCP   -National Planning Commission

NRC   -Namibia Red Cross

NVDCP   -National Vector Borne Disease Control Programme

OIS   -Opportunistic Infections

PDA   -Patent Ductus Arteriosus

PE   -Pre-eclampsia

PIH   -Pregnancy-Induced Hypertension

PMO   -Principal Medical Officer

PS   -Permanent Secretary

RDS   -Respiratory   Distress Syndrome

RMT   -Regional Management Team

ROP	-Retinopathy of Prematurity
ROA	-Right occipito anterior
SGA	-Small for gestational age
TBA's	-Traditional Birth Attendants
UNAIDS	-United Nations Programme on HIV/AIDS
UNDP	-United Nations Development Programme
UNICEF	-United Nations Children's Fund
USA	-United States of America
USAID	-United States Agency for International Development
VCT	-Voluntary Testing and Counselling
WHO	-World Health Organisation

CHAPTER 1

1. Introduction

1.1 Background information

The neonatal mortality rate is an essential indicator of obstetric care as well as overall socio-economic development in any given country. It is also a sensitive indicator of the impact of programme intervention and for monitoring changes in quality care (MOHSS, 1996: 2). In all countries, as well as in Namibia, information on neonatal deaths is analysed and acted upon, by releasing it to different regions.

Over the years, a significant database has been compiled on neonatal deaths in different regions of Namibia. Katima Mulilo State Hospital, in the Caprivi Region, is the referral hospital in which this study on neonatal deaths was conducted.

The Caprivi Region is one of Namibia's thirteen regions situated in the North Eastern part of the country. It borders Angola in the north, Zambia and Zimbabwe in the northeast and Botswana in the east. The population of the Caprivi Region is sparsely distributed with a total catchments population of 79856 and population growth rate of 1.8%. The region is   divided into six constituencies namely Katima Mulilo rural area, Katima Mulilo urban area, Kabbe, Kongola, Sibbinda and Linyanti. Katima Mulilo urban area has a population of 14359 of which 22% are women of childbearing age (NPC, 2001: 15). These women of childbearing age are indirectly acting as indicators of health care efficiency when giving birth, as the health of their newborns will reflect on the efficiency of the healthcare of the Katima Mulilo urban constituency.

The Katima Mulilo State Hospital is the only district hospital located in the urban area where the

study was conducted on factors associated with neonatal deaths. The Hospital has one maternity ward that serves as a referral unit for all maternity cases from twenty-four clinics and three health centres. Most deliveries take place at Katima Mulilo State Hospital, and it is where neonatal deaths may occur, although some neonates born at home and at different clinics are also admitted at Katima Mulilo State Hospital.

To illustrate the concern regarding the neonatal deaths, it is necessary to compare them with other health directorates.

In this regard the neonatal mortality in the central and southern regions for the period 1991-1995 was 29/1000 live births. This is slightly lower than figures obtained for Katima Mulilo Hospital. It also has to be mentioned that Katima Mulilo is an integral part of the Northeast Directorate, where the neonatal mortality rate is 47/1000. It is clear that the mortality rate in the Northeast Health Directorate is significantly higher than in the south and the central regions.

The issue of neonatal deaths had been addressed by the Ministry of Health and Social Services. Numerous workshops and in-service training sessions on reproductive health aspects for registered nurses have been held in the Caprivi Region. The emphasis of these in-service training sessions was mainly on effective obstetric care to prevent neonatal deaths. Despite all these workshops and in-service training sessions, there was still an increase in the number of neonatal deaths, from 8/1000 (0,8%) in 2001 to 39/1000 (3.9%) in 2002 (HIS, Katima Mulilo State Hospital, 2001&2002).

The Katima Mulilo State Hospital management team also raised their concern on the high figures by initiating perinatal/maternal mortality meetings. These meetings involved the Control Medical Officer (CMO), the Principal Medical Officer (PMO), doctors and also nurses from maternity wards. The matron and other interested people were also involved. These meetings are being held on a monthly basis. During these meetings retrospective case studies on all neonatal deaths that occurred during that month are done, and suggestions are made on how the problems could have been prevented.

Pregnant mothers are also educated through ANC on how to care for themselves and for their unborn babies in order to have healthy babies and prevent neonatal deaths. These education sessions include the prevention of mother to child transmission of HIV/AIDS (PMTCT), the dangers of smoking, alcohol intake and narcotics in pregnancy, the importance of STI screening and treatment and good nutrition during pregnancy. Despite all the above being done, the neonatal death rate still increases. The impression obtained by the researcher was that more information needed to be collected. Information regarding the factors associated with deaths is of great importance to enable health workers and policy makers to give attention to mothers and the newborn babies' living style.

1.2. Statement of the problem

As has already been mentioned in the background information, the Health Information System (HIS) at Katima Mulilo State Hospital shows that in the year 2001 there were 1534 live births of which 8/1000 (0,8%) neonatal deaths were reported. In the year 2002 there were 1648 live births of which 39/1000 (3,9%) neonatal deaths were reported. The figures show a tremendous increase in

neonatal deaths within the two consecutive years, which triggered the researcher to do a study on the factors associated with the neonatal deaths in Katima Mulilo Hospital. These high figures present a worrying situation for a small region like Caprivi with a population of just 79856.

The high neonatal mortality rate is therefore a concern in the Caprivi. Any remedial action that needs to be implemented depends to a great extent on a detailed description of the situation to identify factors that could be linked to these neonatal deaths. The problem is that these factors are not known; as such a study to identify the factors has not been undertaken yet. These factors are epidemiological in nature and might indicate an interrelationship. This interrelationship has to do with the person, the time and the environment, and will also be used as a framework for this study. In addition this proposed interrelationship has lead to the formulation of three research questions, which are stated below.

1.3. Research Questions

- Is there a difference in the "person" of the women and their deceased neonates   (cases) and the women with their surviving neonates (controls)?
- Is there a difference in the "environment" of the women and their deceased neonates (cases) and the women with their surviving neonates (controls)?
- Is there a difference in the "time dimension" of the women and their deceased neonates (cases) and the women with their surviving neonates (controls)?

The study therefore aims to explore and describe the factors associated with the neonatal deaths in the Katima Mulilo Hospital within the framework of time, person and environment.

1.4. Purpose of the study

To explore and describe the factors associated with neonatal deaths in maternity and   pediatric wards at Katima Mulilo State Hospital within the framework of time, person and environment.

1.5. Specific objectives

1. To explore and describe the person related factors associated with neonatal deaths
2. To explore and describe the environment related factors associated with neonatal deaths
3. To explore and describe the time related factors associated with neonatal deaths
4. To make recommendations to improve the management of mother and child health services

1.6. Significance of the Study

Neonatal/infant mortality is a major public health problem affecting the health system as a whole as it is used to measure the health status of the infant population. It also affects mothers and family members who expect healthy live babies without complications of any nature on discharge. Death of a baby has an impact on the family and brings shock and disappointment, which may even lead to puerperal psychosis of the mother. Therefore the researcher would like to explore the factors associated with neonatal death at Katima Mulilo State Hospital.

Results from the study could help to generate new knowledge for the care providers. It could further help policy makers and health planners to understand the problem and may contribute to the   designing   of   intervention   programmes   countrywide.   The   study   will   also   make

recommendations to improve the quality of care for neonates or obstetric care as a whole at Katima Mulilo State Hospital, which could improve neonatal survival. The outcome of the study can serve as baseline information to address similar problems nationally.

1.7 Definitions of key terms

Cases: Refers to "people with a disease (or other outcome variable) of interest"(Beaglehole, Bonita & Kjellstrom, 2002:34). In this study "cases" refers to post partum mothers with their diseased neonates admitted during the same time as the controls (control group).

Controls: Refers to "a comparison or reference group of people unaffected by the disease or outcome variable" (Greenberg, Daniels, Flanders. & Boring. 1996: 34). In this study "controls" refers to post partum mothers with their surviving neonates admitted during the same time as the cases (case group).

Factors: Factors refers to "an element that contributes to a result" (Makins, Adams & Grandson, 1999:491). These factors were identified from the literature and validated by experts as variables that might influence neonatal survival. In this study they were categorised under time, person and environmental dimensions.

Neonatal Deaths: This refers to "those live born infants greater than 500grams who die within the first 28 days life" (Gormally, Dempsey, Foran & Watters, 2002. 1).

Neonatal Mortality rate: This refers to "the number of deaths in the first month of life per 1000

live births per year" (Gormally, et al.2002.1).

1.8. Summary

Neonatal deaths are the most essential indicator of obstetric care in any country. Therefore information on the factors associated with this problem is needed for successful intervention. This chapter therefore gave an overview of the background information to the problem, as well as the objectives necessary to guide the study.

The aim of the study is to explore factors associated with the problem mentioned. The significance of the study is that the outcome can serve as baseline information to address similar problems nationally, and will benefit the care providers by generating new knowledge related to the problem.

The next chapter will cover the literature review and conceptual framework.

CHAPTER 2

2. LITERATURE REVIEW

2.1 Introduction

The previous chapter dealt with the problem statement, purpose and objectives of the study. The conceptual framework of the study, being the person, time and the environment was also alluded to. This framework is used to direct the discussion and organise the relevant topics in this chapter on the literature review.

For the purpose of clarity the conceptual framework will be presented next.

2.2 The conceptual framework of the study

A conceptual framework represents a less formal attempt to organise phenomena and deal with abstractions (concepts) that are assembled by virtue of their relevance to a common theme (Polit and Hungler, 1997:117). For this study on factors associated with neonatal deaths, the factors studied were organised in three categories namely the person, environment and time.

Figure 2.1 Conceptual framework: Factors associated with neonatal deaths
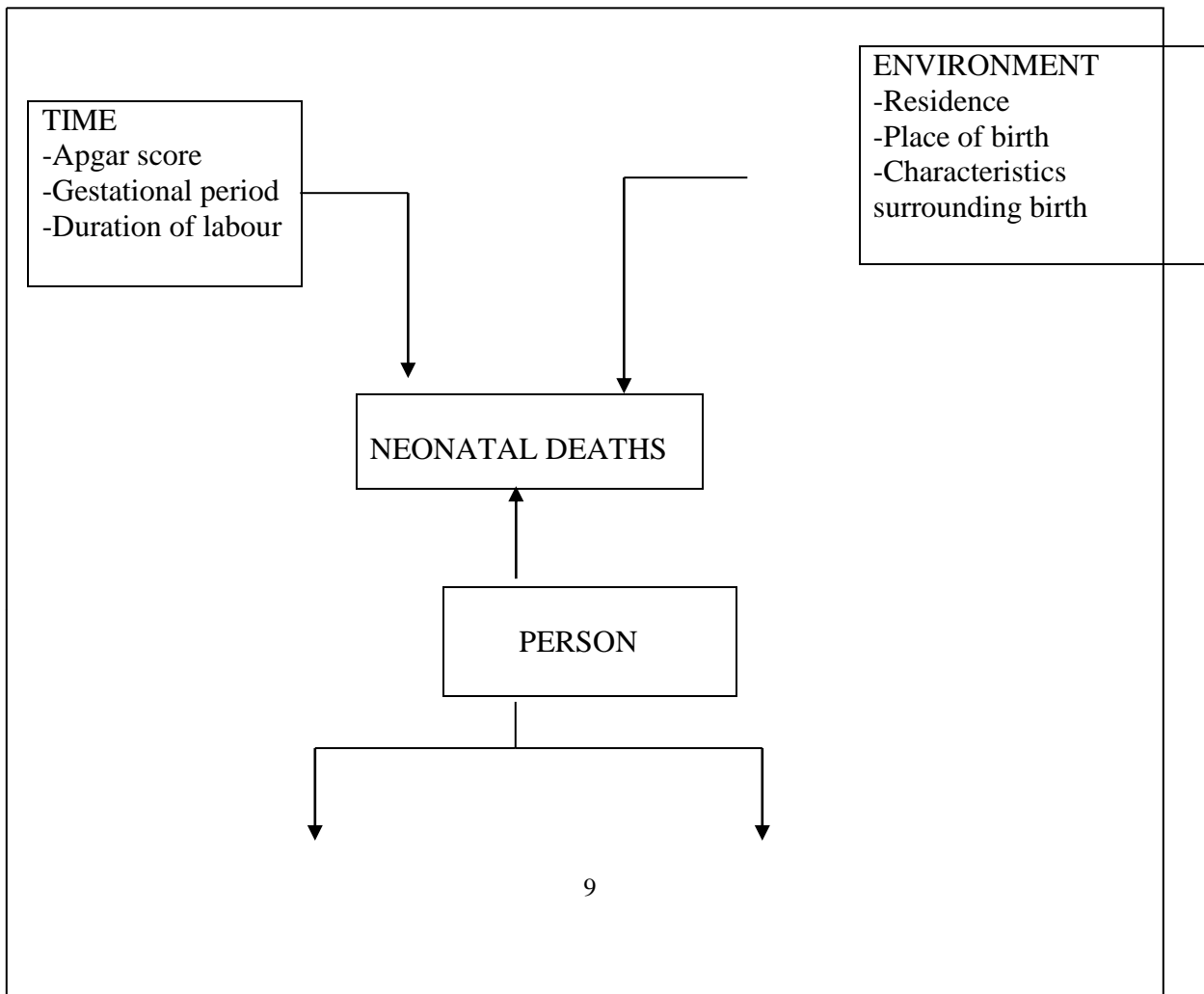
TIME
-Apgar score
-Gestational period
-Duration of labour

ENVIRONMENT
-Residence
-Place of birth
-Characteristics surrounding birth

NEONATAL DEATHS

PERSON

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┌─────────────────────┐          ┌──────────────────────────┐
│ NEONATE             │          │ MOTHER                   │
│ -Birth weight       │          │ -Controllable factors    │
│ -Gender             │          │ -Uncontrollable factors  │
│ -Complications      │          │                          │
│                     │          └──────────────────────────┘
└─────────────────────┘
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Adapted from Katzenellenbogen (1997:11)

2.2.1 Person

In this study 'person' refers to the mother who gave birth to a neonate who either died or survived. It also refers to the deceased or surviving neonate.

2.2.2 Environment

In this study environment means the residence of the mother, the place of delivery, and the characteristics surrounding birth, namely the personnel and equipment.

2.2.3 Time

Time is included to identify the possibility of possible linkages between periods of delivery and time of the year.

The factors are now discussed in terms of specified characteristics.

2.3 The person

In the framework, the concept 'person' refers to both the mother and the neonate. The survival

outcome of the neonate depends on characteristics inherent to the mother as well as characteristics inherent to the neonate.

2.3.1 The mother as a person

The association of the mother in the survival outcome of the neonate is classified under controllable and uncontrollable factors.

See Table 2.1 for an outline of these factors

Table 2.1 Mother-related factors associated with neonatal deaths[1]

Uncontrollable factors	Controllable factors
Age	Birth intervals
Gravida/Parity	Risk taking behavior
Multiple births	Maternal Complications -Malaria
Educational level	-Malnutrition
Mode of delivery	-HIV/AIDS
Placental pathology	-Pregnancy induced hypertension

2.3.1.1 Controllable factors

Controllable factors (WHO 2000:5) "refers to any event that contributed to the problem in question (deaths of the neonate) but which, by means of basic or low cost interventions, may have

been avoided or controlled".

These controllable factors are discussed as follows:

2.3.1.1.1 Birth Intervals

Birth interval is defined as, "the length of time between two successive live births" (NDHS, 2000:51). Short birth intervals adversely affect the health of the mother and the neonate's chance of survival.

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[1]This classification is based on the researcher's conceptualisation process. The researcher acknowledges that there may be different viewpoints.

Evidence indicates that in Namibia birth intervals range between 2-4 years, with 37% having intervals of four years or more and 86% births occurring with intervals of two years or less. Only one in seven births (14%) occur after an interval of less than 24 months (NDHS, 2000:51).

A survey done in the USA by the WHO reports that births that occur in quick succession often have poor outcomes for reasons related to maternal health and environmental factors such as maternal nutrition. In addition, research findings have shown that after about 48 months the benefits of a longer birth interval diminish. On average, the under five mortality for births within 24 months of a previous birth is 64 % higher than births with a 24-47 months interval (WHO, 2000:14).

In a survey done by Bicego & Ahmad (DHS) in 1996 on 20 countries, Malawi, Zambia, Nigeria

and Namibia included, it was discovered that a minimum of three years between births bears the following positive results:

- Neonatal, infant and child mortality: Intervals of three years or longer are associated with lower levels of infant and child death than shorter intervals.

- Maternal and child nutritional status: Spacing births allows women the needed time to recover their nutritional stores and is associated with decreased rates of low birth weight and less malnutrition in children.

- Reproductive Health: Very short birth intervals are associated with increased risks of complications of pregnancy and maternal deaths.

The next controllable factor to be discussed is the risk taking behavior, which can also be controlled by the individual after being aware of how it affects the health status of the individual (mother) and the neonate.

2.3.1.1.2 Risk taking behavior

Risk taking behavior is regarded as behaviour that is detrimental to the health of the mother and the neonate. Risk taking behaviour of the mother might have a negative influence on the unborn and later the neonate. These risk behaviour are smoking, alcohol use and narcotics.

Smoking

In a case control study, which was conducted in Northeastern Brazil, it was revealed that mothers who smoke or are exposed to second-hand smoke, are at risk of having babies with low birth weight and prematurity (Gray, Ferraz & Amorim, 1998:2). An increased risk of about 35% of early

neonatal deaths occurred in mothers who smoke.

These findings were opposed by the results from a study done in the USA on twenty-three factors, including maternal smoking. It showed that psychosocial stressors, limited duration of schooling, maternal age, incompetent cervix, previous preterm births and low weekly weight gain, are some of the factors associated with neonatal deaths and prematurity, instead of maternal smoking (Wisborg, Henriksen, Hedegaard, Secher, 1996: 103).

Although there is a controversy between the two mentioned studies, the NDHS, (2000:181) reported that more than 70,000 scientific articles revealed that prolonged smoking is an important cause of premature deaths worldwide. The report further showed that 70% of the reported deaths occurred in Africa. This gives us a clear picture of how dangerous smoking is to the life of the infant.

Alcohol

Alcohol intake in pregnancy has an adverse effect on both the mother's and baby's health, and may lead to the baby being born with congenital abnormalities or being born prematurely. Those who take certain drugs, for example cocaine or heroin, are at risk of having babies with congenital malformations (Bergstrom & Goodburn, 2001: 40).

In Namibia alcohol use is reported to be limited, with a reported 2.0% of women who use alcohol in the Caprivi Region (NDHS, 2000:183). It still remains a risky behaviour when pregnant.

Narcotics

The use of narcotics leads to Neonatal Abstinence Syndrome (NAS), which is referred to as, "a group of problems a baby experiences when withdrawing from exposure to narcotics" (Hamilton, 2003:2). Babies with NAS present with symptoms such as vomiting, diarrhea, fever, dehydration followed by seizures and high-pitched crying. These symptoms, if not attended to early, may lead to neonatal deaths. There is also a risk of contracting HIV and AIDS for babies born to mothers who use intravenous drugs.

The next controllable factor to be discussed is malaria, which affects a significant number of people in the northern parts of Namibia.

2.3.1.1.3 Mother's complications

Malaria

Malaria is a life threatening parasitic disease transmitted from person to person through the bite of a female anopheles mosquito, which requires blood to nurture her eggs (WHO, 1998: 1). The WHO (2003:4) reports 200 000 newborn babies dying each year in Africa where the women had been infected with malaria.

Malaria can be classified into two categories: namely, uncomplicated and complicated malaria. Confirmed uncomplicated malaria is any person with fever or fever with headache, back pain, chills, loss of appetite, sweats, myalgia, nausea and vomiting and diarrhea and with laboratory confirmation of diagnosis by a malaria blood film or other diagnostic tests for malaria parasites (MOHSS, 2005: 12). Complicated malaria is characterised by the following symptoms: excessive drowsiness, multiple convulsions, prostration, severe pallor, presence of jaundice, altered

consciousness or coma and passing of dark, little or no urine at all (MOHSS, 2005: 12).

There are four types of human malaria of which the *Plasmodium falciparum* is the most common in Africa, south of the Sahara and accounts for the highest mortality in the region (WHO, 1998:1). In Namibia malaria is the most important public health problem. It is the leading cause of ill health and death among both children and adults, particularly in the northern regions where about 60% of the population lives (MOHSS, 1995: 3). It is seasonal and has some epidemic outbreaks when there are heavy rainfalls, like the one in 1990 that took more than 300 lives in all age groups. The Ministry of Health and Social Services reported that the North East Health Directorate (Kavango and Caprivi) has the highest rates of malaria illness and deaths, which accounted for 51% hospital admissions among children (MOHSS, 2005:1).

The MOHSS further reported an alarming picture in Namibia where 120 000 new cases of malaria in children under five years are recorded in a typical year. Due to this alarming picture the MOHSS implemented the National Policy and Strategy for Malaria Control in 1995. This Policy document describes the goals, malaria control strategies, and activities at all levels of the health care system. In addition to the National Policy, the National Vector borne Disease Control Programme (NVDCP) was established in 1991.The control strategies included disease management, disease prevention as well as prevention and control of epidemics (MOHSS, 1996: 9).

The WHO in collaboration with the UNDP, UNICEF and the World Bank also initiated the Roll Back Malaria Programme to try to reduce the deaths and damage being caused by malaria in Africa. Through the programme, four interventions/strategies were implemented which are

promoting insecticide-treated nets, protecting pregnant women, providing the right drugs at the right time and pre-empting epidemics (WHO, 2003:4).

In pregnancy, malarial infection is a major public health problem and a known factor associated with neonatal deaths in tropical and subtropical regions throughout the world.

In most endemic areas of the world (like the North East Health Directorate in Namibia) pregnant women are in a high-risk group for malaria infection, accounting for about 90% of the burden of neonatal deaths. Malaria complications during pregnancy differ in intensity based on the level of immunity the pregnant woman has acquired. The nulliparous are the ones mostly affected and often have more attacks due to their lowered resistance to malaria (WHO, 1998: 5).

Malaria infection in pregnancy is difficult to diagnose in that the parasites are present only in the placenta, unlike in non-pregnancy where the parasites are found in the peripheral blood. Due to the delay in diagnosing the disease, the pregnant woman becomes exposed to anaemia, which can be so severe that it weakens the muscles, including the heart muscles, thus causing them to fail to function properly (WHO, 2003:8).

Anaemia is a condition where the number of red blood cells is reduced, and/or the concentration of haemoglobin in the cells is reduced, with the result that the oxygen transport throughout the body is also reduced (Sellers, 2003:1019). A woman is said to be anaemic when the haemoglobin index is below 11g/dl and the woman needs treatment to correct the anaemia. A study in Pakistan on the "State of the World's Newborns" reported 40% of pregnant women to be anaemic and eventually deliver low birth weight babies, which is considered the main factor of neonatal deaths (Malik, 2001:3).

Some serious adverse effects have been noted, such as spontaneous abortion, neonatal deaths, low birth weights, intra uterine growth retardation (IUGR), fetal distress, increased preterm births, asphyxia neonatorum and increased perinatal mortality rate, congenital abnormality, intrauterine death (IUD) and congenital malaria, when a pregnant woman is infected with malaria (WHO, 1998:5).

Similar to malaria, maternal malnutrition also could lead to an increase in neonatal deaths.

Malnutrition

Malnutrition is a general lack of nutrients in the mother thus affecting the fetal growth leading to the baby being born small for its gestational age, thus making it at risk of dying during the first days after birth. Bergstrom, Hojer, Liljestrand & Tunnel (1997:16) in their writings mentioned that maternal malnutrition is one of the factors associated with neonatal deaths.

Bergstrom, et al. (1997:17) identified the following indicators of maternal malnutrition:

- Poor clinical condition of mother
- Low pregnancy weight detected on each ANC visit, which will show small weight increases per visit or no increase at some occasions
- Infection of the tongue and lips
- Small mid-upper arm circumference of less than 23cm.This is a very reliable indicator for malnutrition

Babies born to these malnourished mothers have an impaired immune defense mechanism, which thus makes them at risk for infections.

A more serious infliction and infection is HIV/AIDS, which will be discussed next.

HIV/AIDS

The term HIV/AIDS stands for Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome. It tells us about the characteristics of the disease, that the immune system of a person suffering from HIV/AIDS is weakened, and that his or her body has a limited capacity, or is left vulnerable to opportunistic infections (Preble & Piwoz, 1998:14). The immune system consists of lymphoid organs and tissues such as the bone marrow, which are responsible for the production and development of lymphocytes (B and T-lymphocytes). The T-lymphocytes (T-cells) have surface markers such as the CD4+ (helper cells) that activate the B-cells, killer cells, and the macrophages when a specific antigen is present. They further promote cell growth, activate phagocytes and destroy target cells by secreting cytokines (chemicals that kill cells) (UNAIDS 2003:10).

In neonates the T-cells, which contain the CD4 (helper cells) are present in early gestation although they are not mature enough to produce the cytokines that help with the B-cell and bone marrow stimulation and differentiation. This means that the less developed the CD4 (helper cells) are, the less developed the neonate's immune system is. These T-cells increase in number as the infant grows, that is from birth up to the age of six months (Bellig, 2004:3). She further states that the cytotoxic function of the neonatal T-cells is 50–100% as effective as adult T-cells.

AIDS

Nettina defines AIDS as, " the most severe form of a continuum of illnesses associated with human immunodeficiency virus (HIV) infection" (1996:815). It causes a slow degeneration of the immune system with the development of opportunistic infections and malignancies.

HIV

HIV, which stands for Human Immunodeficiency Virus (Nettina, 1996:815) implies the entire course of HIV infection from a symptomatic infection and early symptoms to AIDS (simply it is the virus that causes AIDS). This virus destroys the body's natural resistance against infections, thereby making it difficult for the body to fight against infections.

Epidemiology of HIV infection

According to Cronje & Grobler (2002: 24), it is estimated that there are 50 000 HIV children whose HIV transmission was contracted primarily through transmission from mothers to their infants in Southern Africa. Most infants acquire their infection close to delivery or by breastfeeding. The risk of the baby acquiring the virus from an infected mother ranges from 25% to 35 % (in the absence of interventions). A similar description is provided by the WHO/AFRO (WHO/AFRO: 2004:2) This organisation reported that 20-30% of pregnant women are infected with HIV in the Southern, Eastern and Central Regions of Africa with the risk of mother to child transmission being 25-40%.

The NDHS for 2000 reported that Katima Mulilo has the highest number (33%) of HIV positive pregnant women in the region. The 2002 National HIV Sentinel Survey also reported a large

increase in the HIV prevalence among pregnant women in Katima Mulilo, from 14% in 1992 to 43% in 2002 with a slight decline in 2004 to 42.4%. In the same survey in Namibia it is indicated that there were about 4.2% HIV positive pregnant women in 1992, which increased to 22% in 2002. This however declined to 19.7% in the 2004 sero-sentinel survey.

It can be assumed that HIV/AIDS is a contributing factor to neonatal deaths in Katima Mulilo Hospital. It can however not be determined in this study because the HIV test for pregnant women is not compulsory in Katima Mulilo. This could also be due to the unavailability of voluntary counseling and testing (VCT) services in the region. The services only started in the year 2003 while the study was already in progress. The other reason for mothers not knowing their HIV status is due to the nature of services provided at the laboratory. People have to wait for a considerable time for their results, which could discourage them from returning for their results, resulting in mothers delivering without knowing their HIV status. Only a few volunteers are tested, giving rise to a possible false result in the sense of the very low number of HIV positive mothers being identified to deliver in the hospital. However, since malnutrition and other opportunistic infections (OIS) are found to have contributed to neonatal deaths, it could be that most of these malnourished women were HIV positive.

The transmission of HIV to the unborn baby

An HIV positive pregnant mother, depending on the level of HIV virus (the viral load) in the body, has one chance in three of passing the virus to her baby. The higher the viral load, the higher the risk of HIV transmission to the baby (Preble & Piwoz, 1998:8).

Risk factors for mother to child transmission of HIV (MTCT)

Behavioural factors such as cigarette smoking, drug use and unprotected sexual intercourse during pregnancy have been associated with an increase in the risk of MTCT.

Obstetric factors such as placental infection, genital infections and the prolonged rupture of membranes during labour increase the chances of mother to child transmission (MTCT) of HIV. The mode of delivery may also influence the risk of MTCT especially for those who deliver vaginally. Elective caesarean section births are recommended and have shown to reduce the risk of MTCT.

Infant factors such as breastfeeding have also shown to be risk factors. HIV is present in breast milk, and the baby can become infected if he/she has a sore in the mouth or inflammation in the throat. Fetal traumatic births, where the fetal skin is traumatised from obstetrical procedures, also increase the risk of MTCT (Cronje and Grobler, 2002: 25).

The importance of the HIV test

The earliest the mother knows her HIV status, the more options she will have for her and her baby, and it is important for her health and for the health of her unborn baby. The pregnant woman will be able to get medication, which can help to reduce the chances of passing the HIV virus to her baby, and she will be able to make decisions to better plan for her future. If the pregnant woman is HIV negative she will be informed on how to stay negative and take good care for herself to give birth to a healthy baby (USAID, 2003:2).

The last controllable factor is pregnancy-induced hypertension, which is also known to be associated with neonatal deaths.

Pregnancy induced hypertension

Pregnancy induced hypertension is also known as preeclampsia (PE). The term is used to describe a disorder of pregnancy characterised by hypertension, proteinuria and often oedema, usually manifesting after the 20th week of gestation. Schwab (1999:1) defines hypertension in pregnancy as "a systolic pressure above 140mmHg or 30mmHg above pre-pregnancy levels, or a diastolic pressure above 90mmHg or 15mmHg above pre pregnancy levels". Eclampsia is the presence of convulsions or coma in addition to signs and symptoms of PE.

Preeclampsia may be mild or severe. Severe preeclampsia affects the mother's blood system, kidneys, liver, brain, and other organs. It consists of a systolic blood pressure higher than 160mmHg or diastolic blood pressure higher than 110mmHg as well as significant proteinuria (McKesson, 2003:3). The neonatal problems associated with hypertensive disorders commence intrauterine. These problems are growth retardation, which could lead to immature respiratory functions, renal dysfunction at the time of birth, fetal distress due to vasoconstriction reducing the blood supply across the placenta, and placental abruption (Duley & Henderson-Smart, 2000:2) These problems were found to increase neonatal deaths, as researched by Liu (1996:22) who reported that obstetric related conditions like pregnancy-induced hypertension contribute to an increased number of neonatal deaths.

2.3.1.2 Uncontrollable factors

Uncontrollable factors are factors which an individual has no control over, but they have adverse effects on the neonate's health. These factors are inter alia, the mother's age, birth order/parity, multiple birth, mother's complications, educational level, mode of delivery and the placental pathologies.

2.3.1.2.1 Mother's Age

It is reported that the mother's age at the time of giving birth plays a very big role in the death or survival of an infant (Mahy 2003:11). When women give birth at a young age, they have an increased risk of complications, and the baby has an increased risk of low birth weight and prematurity. There is also an increased risk of pregnancy-related complications when women give birth at an older age. Their babies are more likely to have congenital anomalies, which increase the risk of dying in early childhood. The mother's age appears to have the greatest impact in the first month of life. Infants born to mothers under 20 years of age are 45% more likely to die during the first month of their lives while those born to mothers who are 40 years and above are 30% more likely to die in the first month of their lives.

Bergstrom & Goodburn (2001:57) also view age as a factor, in that women who are 19 years old and younger have an increased risk of developing anaemia during their pregnancies. At the time of giving birth they develop the risk of cephalo-pelvic disproportion as well. This is because their body pelvises are not yet fully developed and they are still too narrow to bear the struggle of childbirth. Those who are between 20-30 years have the lowest obstetric risks, and those above this age again have an increased risk. These age groups (less than 19 years and above 30 years) need special antenatal care and are advised to deliver at the hospital and not at home. Sellers (2003:

1240) has a similar opinion to Bergstrom & Goodburn (2001:57) and refers to the age groups at risk as those who are less than 17 years and those above 35 years, which may contribute to neonatal deaths.

Gravida/parity is an equally contributing factor associated with neonatal deaths and is to be discussed next.

2.3.1.2.2 Gravida/Parity

Gravida/parity refers to the number of pregnancies that a woman has had and the number of live births that she has had. Primigravidas, women with first pregnancies, have a higher risk than women with 2nd and 3rd pregnancies, because they have not yet tested their birthing capacity. Women with two to four pregnancies have a lower risk. A high risk of neonatal deaths is associated with a rising parity of five or six and above. High parity risks lead to atypical positioning at birth, uterine inertia (with more difficult labour and more postpartum bleeding), more hypertension, renal problems, and severe anaemia (Mahy, 2003:14)

There is a correlation between short birth intervals and high gravidity, because women who have had many children are more likely to have short birth intervals leading to high parity. Mahy (2003:14) in his studies reported that, of the neonatal deaths that occurred, 43% were born after six other births had occurred by the same mother. Generally it is viewed that, "The neonatal period poses the greatest risk for high gravidity with an average of 47% excess risk"(Bicego & Ahmad, 1996:50).

The gravidity and the parity will be discussed under three categories, namely, grande multipara, primigravidas and elderly primigravidas.

Grande multipara

Grande multipara refers to "women who have had five (5) or more viable babies" (Sellers, 2003: 1246). The grand multipara is known as the dangerous multipara, and a woman in this situation is one of the high-risk patients in a maternity/obstetrics department.

Effects of grande multipara on the neonate

A grand multipara woman is more susceptible to premature rupture of membranes and a cord prolapse. Premature rupture of membranes results in acute fetal distress, while cord prolapse results in cerebral damage to the neonate if delivery is uncontrolled from the precipitate labour. These women are more likely to have shoulder girdle dystocia due to large babies, which may cause death of the baby, if not properly managed (Sellers, 2003:1246). The grande multipara women need close observation and conscientious management to prevent these potential complications.

Primigravidas

Primigravidas refers to, "a woman who is pregnant for the first time in her life" (Sellers, 2003: 1242). Elderly primigravidas refers to, " a woman who is having her first baby / child when she is over the age of 35 years" (Sellers, 2003:1242). According to the NDHS (2000:53) child bearing in Namibia begins at an early age. About 20% of women have their first child before the age of 18 years, and about 1/5 have their first child above the age of 25years.

Effects of elderly primigravidas on the baby

Elderly primigravidas suffer from anxiety, fear and prolonged labour due to stiff joints and not being able to stretch during labour. This may result in maternal distress and further fetal distress. Operative deliveries and manipulations are commonly considered for elderly primigravidas, but they increase the risk of birth injuries to the baby (Sellers: 1242).

2.3.1.2.3 Multiple Births

Multiple births refer to the condition of two or more fetuses being in the uterus at the same time (Sellers 2003:1247). These children are not fully developed in the womb, resulting in low birth weight, which is a known risk factor for neonatal deaths. Complications at delivery and competition for resources after birth often result in a greater risk of dying. In some countries, bad luck and misfortune are associated with twins, and can lead to neglect and higher mortality for multiple births. (Mahy 2003:17).

The high mortality occurs mostly with the second twin, due to a reduction in the placental circulation when the volume of blood is reduced after the birth of the first twin. Some other effects may include twin transfusion syndrome, birth injuries particularly due to manipulations which maybe necessary for malpresentation, fetal malformations, conjoined twins and locked twins, leading to neonatal death if not properly managed. (Sellers, 2003:1247).

Another important uncontrollable factor associated with neonatal death is the level of education.

2.3.1.2.4 Level of education

The NDHS (2004:2) refers to the level of education, "as the highest year of schooling completed".

According to this report, better educated women have a better understanding of hygiene and are

more likely to seek medical attention and make use of modern facilities, which reduces the risk of

infant death, than those born by   less

educated mothers. However findings from the Demographic Health Survey done in Nigeria

indicated that less educated mothers had a lower infant mortality rate (Adetunji, 1996:25).

Although there is a controversy between the two studies above, the majority of other research

studies support the importance of education of the mother on neonatal survival. In this regard, in a

study by Mantel (1998:56), the author revealed that limited duration of schooling appeared to

influence preterm delivery because mothers lack knowledge of how to prevent premature births,

which puts babies at a high risk of dying. Similar conclusions were arrived at by Curtis and Steel

(1996:11), who used Demographic Health Survey data from Bolivia, Peru, Kenya and Tanzania in

their study of neonatal mortality. They found that the level of maternal education was highly

significant in all the countries except Tanzania, where place of residence was more important.

This was also found by Desai and Alva (1998:13) who used data from 22 countries and who

participated in the first round of the DHS programme by reporting lower neonatal mortality in

educated women. Although this effect attenuated with the inclusion of other socioeconomic

factors in their model, maternal education remained significant.

2.3.1.2.5 Mode of delivery

A report from a study done in South Africa on neonatal mortality showed that neonates with

breech presentations and who were born vaginally suffered twice the mortality rate compared to infants born by caesarian section. This same study further showed a 100% survival of infants with a low birth weight of 1,500g and delivered by caesarean section, compared to 63% for those delivered normally (Levitt, 1999:101).

A retrospective study done in Mauritius found that babies born by caesarian section had a higher risk of dying than those who were born vaginally, which contradicts the findings of Levitt, (1999:12). The report further states that babies born through a caesarean section also have different experiences compared to those born vaginally. Apart from the cranial moulding from the birth canal, these babies experience a sudden pressure change as the uterus is surgically opened. This causes shock in the baby, which may result in death. It is however necessary to view the above Mauritius study in context. Some data is lacking, like the health history of the mother, which by itself introduces a confounding variable, and also the skills of the health team.

Interventions such as forceps and vacuum extractors are used to make the birth process easier and are also necessary for the safety of both the mother and baby. However, they have negative effects on the neonate in the sense that they may cause birth injuries, as these babies experience more extreme moulding patterns. This may lead to brain damage and eventually death (Kennedy, 1995:4).

 The last uncontrollable factor is placental pathology, which has also been found to be associated with neonatal deaths.

2.3.1.2.6 Placental pathology

The placenta is the lifeline and support system to the fetus. It is the temporary organ that provides fetal respiration, elimination and maintains metabolic and nutrient exchange between the maternal and fetal circulation. The placenta protects the fetus from many harmful substances and infectious agents. The fetus relies on the placenta to function at an optimal level to provide normal fetal development. When placental function is disrupted, as in placenta previa, there are consequences for both mother and fetus. The baby may be born prematurely which is a risk factor for neonatal death (Nichols & Zwelling, 1997:2).

The most common placental pathologies are placenta previa and placenta abruptio, which will be discussed next.

Placenta previa

Placenta previa occurs when the placenta is implanted in the lower segment of the uterus, near or over the internal os. It is characterised by repetitive, painless vaginal bleeding. It is the most common cause of bleeding during the later months of pregnancy (Reeder, Martin, and Koniak, 2002:15). It is also one of the most acute, life-threatening emergencies in obstetrics practice. The potential maternal and neonatal mortality associated with this condition have generated a lot of concern amongst practicing clinicians (Archbong &Ahmed, 2001:1).

Collins (2002:2) identified the following factors associated with placenta previa (see Table 2.2) for an outline of these factors.

Table 2.2 Factors associated with placenta previa

Factor	Description
Maternal age over 35 years.	• An older uterus is not as vascular as a younger uterus, thus the embryo may not implant in the normal uterine area.
Multiparity	• Placenta - previa can occur in 80% of multiparity (those over two pregnancies). • Previous gestations may have caused permanent damage to the endometrium where the placenta was located causing the new placenta to find a new area, not always the most suitable

Placenta abruptio

Placenta abruptio is the premature separation, either partial or total, of a normally implanted placenta after 20 weeks of gestation (Dickason, Silverman & Kaplan, 1998:15). The woman presents with bleeding, uterine contractions and fetal distress. It is the major cause of bleeding in the third trimester and is associated with fetal deaths.

Factors associated with placenta abruptio are pregnancy induced hypertension (PIH) or chronic hypertension (Blood pressure 140/90 mmHg and more). Premature rupture of membrane, less than 34 weeks gestation, maternal age over thirty-five years, uterine anomaly or fibroids and vascular

diseases such as diabetes mellitus or collagen disorders may also contribute to placenta abruptio. In addition external traumas from a blow, a motor vehicle accident or a puncture from amniocentesis can also lead to abruptio placenta (Dickason et al., 1998: 18). The same authors (Dickason et al., 1998:18) are of the opinion that behavioural risk factors such as cigarette smoking and tobacco abuse prior to pregnancy increase the mother's risk of placental abruption by 40%, which further increases the risk of neonatal deaths.

The effect of the placental pathologies on the neonate

The effects of placental pathologies disrupt the maternal and fetal blood exchange resulting in neurological damage to the infant, prematurity, death due to prematurity or severe fetal distress, anaemia and small for gestational period (Dickason et al., 1998:18).

The next discussion point is the neonate as a person.

2.3.2 The neonate as a person

The concept of neonate as a person is concerned with certain specific intrinsic characteristics or situations that cause a neonate to be more vulnerable to death. The intrinsic characteristics or situations of the neonate that are regarded as contributory to neonatal mortality are: birth weight, gender and complications.

2.3.2.1 Birth weight

Birth weight refers to "the weight of a newborn baby, obtained preferably within 1 hour of birth, before significant post natal weight loss has occurred" (Bergstrom & Goodburn 2001:156).

The birth weight of an infant has two categories, namely a normal and an abnormal birth weight, the abnormal being a low birth weight or a high birth weight. These two categories increase the risk of neonatal deaths and such infants require special care. A normal birth weight for an infant is 2500g to 4000g, and low birth weight babies refers to "babies with a birth weight of less than 2500g" (WHO, 2001:3), while high birth weight babies refers to "babies with the birth weight above 4000g" (Wood, 1996:3).

Low birth weight babies are also divided into two categories, namely those infants who have grown normally for their gestational age and are born pre-term (normal intra uterine growth) and those infants who are light or small for their gestational age (intra uterine growth retardation) (Bergstorm & Goodburn, 2001:4). Ramji & Gera, (2000:1) in their study done in India on the Early Predictors of Mortality in Low Birth Weight Neonates reported 30% of neonatal mortality as being contributed by low birth weights.

The incidences of low birth weight are recognised indicators of the well being of the neonate, because weight at birth is an important determinant of the survival chances of the newborn (NDHS, 2000: 123). The NDHS (2000:124) shows that in Namibia 12% of babies are born with low birth weights, and about 4.0% of the 12% are being reported in Caprivi Region.

Bergstorm & Goodburn (2001:4) report that in third world countries the most common denominator in the neonatal pathology is low birth weight, and this dominates the death statistics. This problem is found to be associated with a combination of factors such as maternal

malnutrition, anaemia, malaria, placental insufficiency, pre-eclampsia and some infections.

The size of a child at birth provides an important predictor of its chances of survival during infancy. The NHDS (2000:109) showed that newborns conceived by their mothers who are small or very small are more likely to die in the first year of life (71 per 1000 live births) than those who are average or larger in size (28 per 1000 live births).

High birth weight in an infant can occur if the mother is obese or the mother is suffering from diabetes mellitus. These babies are also at risk of dying in their early weeks after birth due to birth traumas from cephalopelvic disproportions (CPD). Those born to diabetic mothers are at risk of hypoglycemia, respiratory distress and congenital abnormalities (Wood, 1996:6).

In addition to birth weight, the gender of the neonate also has an effect on the survival of the neonate.

2.3.2.2 Gender

In a demographic health survey that was done in the USA on childhood mortality in the developing world, Mahy (2003:15) reports that male infants have a higher mortality rate during the first six months of life for genetic reasons because they are highly vulnerable to infections. The risk reduces at 1-4 years after birth.

Curtis & Steel (1996:11) reported that sex differences have been observed universally, and showed that in the majority of the regions of the world there is a lower mortality in girls at least in the first

few months of life. Exceptions have been noted in some Asian countries and India where 30% of girls were more likely to die in their neonatal period than boys. This was thought to be a result of male preference, which is manifest in lower spending on health for girls and higher prevalence of immunisation among boys (Claeson, Bos, Mawji & Pathmanathan, 2000: 14).

However in Namibia male neonates are more vulnerable. The NDHS (2000:109) shows a rate of 28% neonatal deaths in male infants compared to 16 % in female infants. The WHO (2000:53) supports the fact that male infants have a higher rate of dying by reporting a 40% higher neonatal death rate among male infants than among female infants in Pakistan. In a study being done in Zambia, similar conclusions were drawn. In a demographic health survey on infant mortality in this country (Zambia), the central statistics reported figures between 67% and 84% higher in male infants dying than female infants. The high male mortality rate has been documented by many researchers and has been attributed to the biological weakness of male neonates at birth. Boys are more vulnerable to prematurity, malformations, and birth injuries, and also are more susceptible to respiratory diseases that can eventually cause death (LeGrand & Mbacke, 1995:25).

Following is a discussion on the complications that may develop in the neonate as a person, which can lead to the death of that neonate.

2.3.2.3 Neonatal Complications

The identified complications for discussion are hypothermia, neonatal infections, prematurity and asphyxia.

2.3.2.3.1 Hypothermia

Hypothermia refers to "an abnormally low body temperature, because of exposure to cold weather" (Makins, et al.1999: 388). Mahy (2003: 22) revealed that neonatal deaths due to hypothermia were found to be 67% and were mainly from deliveries outside the hospital. Investigations of body temperature of babies in several developing countries have shown that 2-12 hours after birth about 80% of babies have a rectal temperature of less than 36°C, and that a body temperature between 32°C and 34°C is particularly common in babies with low birth–weights (Bergstrom, et al. 1997:101). It is further documented by the same authors that pre-term babies with a rectal temperature of less than 36°C had a mortality rate of 80%.

Causes of hypothermia in the neonate

A decrease in heat insulation occurs in underweight babies. This results in decreased temperature and contributes to all types of heat loss. A limited metabolic response to exposure to cold and to cooling will increase the risk for hypothermia (Bergstrom, et al 1997:103).

Like hypothermia, neonatal infection is also a factor associated with neonatal deaths, which will be discussed next.

2.3.2.3.2 Neonatal Infection

Examples of these neonatal infections for discussion are neonatal tetanus and pneumonia.

Neonatal Tetanus

An organism called *Clostridium tetani* causes neonatal tetanus. It manifests usually in a newborn baby who, at between 3 and 28 days of age, still cannot suck normally and becomes stiff or has convulsions or both, often resulting in death (MOHSS, 2004:23)

Neonatal tetanus is a leading cause of neonatal deaths (mortality) in the poorest parts of the world and is responsible for 14 % of all neonatal deaths. The disease is not correctly reported, since most of the deaths occur at home before the baby reaches two weeks of age. This condition occurs as a result of unhygienic birth practices e.g. during the cutting of the umbilical cord after delivery. This condition can occur in hospitals if instruments are not properly sterilised or at home where the baby is just delivered under unhygienic conditions. Newborns between ages 4-14 days are mostly affected and usually die within a few days (UNICEF 1997:12).

A survey done in Ethiopia by the WHO (1994:8) estimated that 126 000 (21 %) of neonatal deaths were due to neonatal tetanus in developing countries. The above figures were due to sepsis from unclean deliveries and poor cord care. Pre-term neonates of malnourished mothers have poor defense mechanisms that result in a high risk of acquiring infection due to umbilical catheterisation; unclean feeding procedures, overcrowded neonatal units and unclean umbilical cords.

Bergstrom, et al. (1997:121) state that neonatal tetanus is the most common cause of neonatal deaths in the third world, resulting in about 800 000 deaths each year. A baby gets infected at delivery, or during the first days of life, mostly through the umbilicus. Out of the 27 countries that account for 90 % of all neonatal and maternal cases world wide, 16 countries are in the African region. This indicates that Africa still has a lot to do in the elimination of neonatal tetanus, by improving the availability of health services as well as improving the immunisation coverage.

In a study done in Pakistan, the report indicated that it has the third highest burden of death owing

to neonatal tetanus in the world. This is because only 52% of all pregnant women are receiving anti-tetanus immunisation. It is also believed that certain newborn care practices such as cord cutting and cord care are unhygienic, thus contributing to neonatal tetanus which leads to a high neonatal mortality (Malik, 2001:1).

Bergstrom, et al. (1997:124) identified the following factors contributing to the high incidence of neonatal tetanus and maternal tetanus:

- Women lack access to antenatal services, including routine immunisation
- Deliveries, which take place in the home, often attended by unskilled birth attendants (untrained TBA's, relatives or neighbors) and under unclean circumstances. This may include lack of clean water.
- It could also be due to high illiteracy rates where mothers may not have knowledge of the causes of infection.
- Low family income, which may hinder women from seeking medical care

The situation and implications are identical for Namibia and for the Caprivi Region, the region where the hospital is located that is used in this study.

Similar to neonatal tetanus, pneumonia is another infection that has an effect on the health of the neonate.

Pneumonia

Pneumonia is one of the lung diseases in the newborn that might be transferred from the mother during birth. In other cases swallowing of infected material from the birth canal or infections after

delivery may also result in pneumonia (Bergstrom, et al.1997:136). About 755 000 newborn infants die of pneumonia in developing countries. Lack of hygiene, hypothermia and inadequate feeding are important risk factors contributing to the problem (WHO 1994:22). The neonate may present with respiratory difficulties and general weakness depending on the extent of the infection, and these signs may not be recognised at an early stage until it is too late.

The fourth neonatal complication that could be associated with neonatal deaths is prematurity.

2.3.2.3.3 Prematurity

Prematurity and low birth weights are globally known risk factors leading to a high number of neonatal deaths. These neonates are likely to be at risk for a number of serious and life-threatening health problems in the early weeks of life. Premature babies are defined as "babies who are born before 37 weeks of pregnancy" (UNICEF, 2002: 23).

The WHO (1999:4) in their report on reducing perinatal and neonatal deaths, mentioned that low birth weight was one of the principal contributors to neonatal morbidity and mortality worldwide and accounted for 70% of neonatal deaths in some countries. They also revealed that of those babies who were born with low birth weights, 60% were premature.

A study done in South Africa by Odendaal, Theron, Norman, Steyn and Smith, (1997:3) towards reducing perinatal deaths, reported that prematurity was the most common cause of neonatal deaths in the Western Cape Region, accounting for 24.8% neonatal deaths. It was also found that it was the most common reason for admission of neonates to the neonatal intensive care units. They

further stated that the earlier a baby is born, the less developed its organs will be, the less it is likely to weigh, and the greater its risk for a variety of problems.

Von Der Pool, (1998:19) from a study done in Birmingham at the University of Alabama School of Medicine on preterm labour, reported that preterm delivery affects one in ten (10) births and is the cause of 75% of neonatal deaths in the United States.

Some risk factors that are associated with preterm births were identified by Scolls (1996:1). They are fetal defects that result from genetic conditions, environmental factors that limit normal development, multiples (twins, triplets or higher), prenatal substance abuse (e.g. alcohol, smoking and some drugs), low pregnancy weight or low weight gain during pregnancy, maternal medical conditions (preeclampsia, certain infections, heart, kidney or lung problems) as well as an abnormal uterus or cervix.

The problems suffered by premature babies that were identified in a study done in Ireland by Gormally (2002:5) on pregnancy and birth outcome are illustrated in Table 2.3

Table 2.3 Problems suffered by premature babies

Problem	Description
Respiratory distress syndrome (RDS)	This occurred in 10 to 50% of very low birth weight infants
Peri and intraventricular haemorrhage	Bleeding in the brain
Patent ductus arteriosus (PDA)	A dangerous heart problem

Necrotising enterocolitis (NEC)	A dangerous intestinal problem leading to feeding difficulties and swelling of the abdomen
Retinopathy of prematurity (ROP)	An abnormal growth of blood vessels in the eye
Lack of enough fat to maintain a normal body temperature	This slows the growth of the neonate

The fourth neonatal complication that could be associated with neonatal deaths is asphyxia neonatorum.

2.3.2.3.4 Asphyxia Neonatorum

Asphyxia Neonatorum literally means being born 'without a pulse'; in practice it implies " a failure to establish adequate sustained respiration by one minute after birth" (Woods, 1996:1). Kibel & Wagstaff (1997:61) defined asphyxia as "lack of oxygen at tissue level resulting in the baby failing to maintain adequate cardio-respiratory function within one minute at birth". This can be associated with fetal hypoxemia which can result in death, respiratory depression, meconium aspiration or brain damage.

In developing countries up to three percent of births result in severe asphyxia requiring resuscitation. In this case the majority of births takes place at home assisted by a traditional birth attendant (TBA) or a relative. These people do not have the knowledge, skills or technical tools needed for the management of asphyxia, resulting in neonatal deaths. This may also even occur in hospitals where equipment is frequently out of odder (Bergstorm, et al. 1997:78).

A study done in Pakistan supports the above, where the findings indicated that the high rate of birth asphyxia is compounded by the fact that around 82% of babies are generally born at home. Even if parents take their newborns to health facilities, most of them are not equipped to treat birth asphyxia owing to lack of equipment and medication (Malik (2001:1).

The common causes of asphyxia were identified by Bergstrom, et al .1997:79) as:

- Infections such as congenital pneumonia secondary to amniotic fluid infection
- Severe immaturity and aspiration of meconium or thick mucus that may impair respiration despite normal nervous stimulation
- Drugs given to mother e.g. pethidine or anesthetics that may depress the respiratory centre in the infant
- Malformations of the central nervous or respiratory systems

The literature is thus clear on the role of characteristics inherent in the neonate and the complications experienced by the neonate, towards neonatal mortality. The neonate and the mother reside in an environment, and the environment has an influence on the health of the neonate.

The influence of the environment will be discussed next.

2 .4. ENVIRONMENT

The environment encapsulates a space in which the mother and neonate find themselves during the period of conception, embryonic period [organogenesis] the fetal period [growth and

development] and the period of delivery followed by the first 28 days post delivery.

The environment is therefore different things and different places, depending on the development stage of pregnancy in which the mother finds herself. All of these development stages and different places have the potential to be detrimental to the neonate's health.

In figure 2.2 an outline of the environmental aspects that have potential detrimental effects on the mother and neonates is displayed.

Figure 2.2 Environmental aspects affecting the health of the mother and the neonate

Characteristics surrounding birth

-Personnel

-Equipment

Residence

-Urban

-Rural

-Peri Urban

ENVIRONMENT

Place of delivery

-Home birth

-Hospital birth
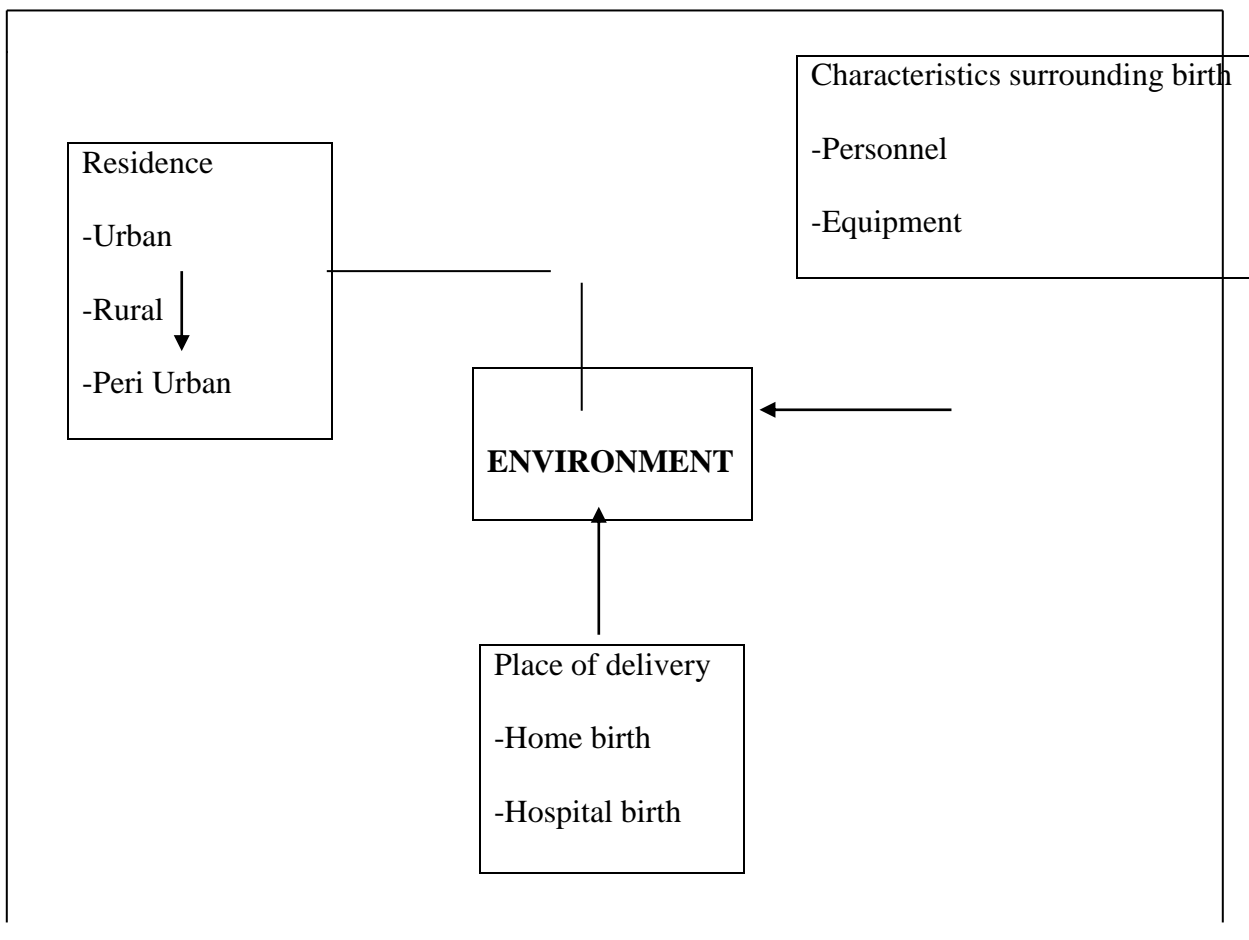
2.4.1. Residence

The residence means a place where a person resides, a person's home or house where he/she lives. In a study done in Botswana and Namibia on the mortality estimates of children under five, Noymer (1998:4) reported that infants residing in urban areas have, on average, better survival chances than those residing in rural areas. The advantage is assumed to be related to better infrastructure and access to services in urban areas. Rural areas have poorer access to health care, including vaccination programmes, and poorer access to communication including health care messages. Rural areas also have less well served infrastructure such as access to clean water and sanitation.

According to the NDHS (2000:185) about one quarter of Namibian households live within 10 kilometers of a government health facility. This particularly refers to the urban distances. The distances in rural areas falls within 25-59 km to the nearest health facility. It is not easy for mothers to utilise these services frequently, since most of them have to walk to the health facilities. The walking distances take more than 3 hours to the nearest government health facility. This is a major contributing factor to neonatal deaths related to where a pregnant woman resides, as mothers become discouraged and may decide not to attend ANC during their pregnancies.

The types of transport used to get to health facilities also have an impact on the health of the mother and the neonate. The report indicates that two women out of every three households have to walk to the nearest government facilities. This occurs in both rural and urban households

(NDHS, 2000:188).

The information on access, costs, distances, time and the type of transport people use to get to the nearest health facilities contributes greatly to neonatal deaths in the sense that women fail to report for ANC in order for them to be examined for risk factors e.g. hypertension, leading to pre-eclampsia and eclampsia, anaemia and malnutrition which are known risk factors for neonatal deaths. In these cases women decide to deliver at home, some in unhygienic places, and they end up with babies who will be admitted and may die due to infection. Those who decide to deliver in a hospital only admit themselves when they are in labour without having attended any ANC due to the long distances.

The place of birth also seems to have an adverse effect on the health of the neonate and needs to be analysed.

2.4.2. Place of delivery

There are two places where a mother can give birth to her baby, namely at home or in a hospital. The International Association of Parents and Professionals for Safe Alternatives in Childbirth (NAPSAC) states that since science cannot prove home births to be less safe than hospital births (Lewis, 1995:4), it is thus believed that each family has the constitutional right to choose where to give birth. It is up to the medical professionals to support families in their decision by giving them full information on the dangers /risks involved on both home and hospital births, in order for them to have an informed decision so that the experience can be as safe as possible.

2.4.2.1 Home delivery

In some studies it shows that home birth is considered to be safer due to low risks. This is possible when a trained experienced midwife attends to the birth, and the mother is in good health. The mother has to be screened before hand for risk factors or health problems such as hypertension, cephalo-pelvic disproportion, untried pelvis, incompetent cervix and an efficient pelvis, or any problem that could be dangerous during labour and delivery.

The WHO, (1994:3) reported that two-thirds of deliveries in developing countries (Namibia included) occur at home, and trained birth attendants attend to only half of them. Bergstrom, (1997:23) also reported that the majority of deliveries in third world countries that occur at home are being attended by TBA'S. These mothers believe that since TBA'S are always with them during labour and delivery, their presence allows them to feel more relaxed and secure, which reduces stress and fear that can cause fetal problems leading to the death of the neonate. The mother will have more confidence and trust in the TBA attending to her. The risk of complications and infections is reduced because all routine vaginal examinations are avoided, and the place of delivery is prepared for a single delivery (one woman). In this way it is believed to lower the risk of complications and infections, which may help to reduce the risk of neonatal deaths.

Kitzinger, (1997:1) a British child birth expert, states that planned home birth with an experienced lay midwife has a neonatal death rate of 3-4/1000 live births, while hospital births carry a neonatal death rate of 9-10/1000 live births. The report was supported by the results from a study done in the Netherlands on women who were having their first babies. It indicated that for the 41,861 women who delivered in hospital, the neonatal mortality rate was 20, /1000 live births, while for

the 15,031 women who delivered at home with trained midwives, the rate was 1.5/1000 live births. However a study done in Washington contradicts Kitzinger's findings by reporting that planned home births were associated with an increased risk of neonatal mortality and very low Apgar score at 5 minutes. It showed an incidence of neonatal mortality of 3, 5/1000 live births for planned home birth and 1, 7/1000 live births for hospital births. The risk of having a very low apgar score at 5minutes was associated with a two-fold increase when delivering at home, while the risk of neonatal respiratory distress was 5/1000 per live births also for when delivering at home (Jenny, Pang & Greg (1996:8).

2.4.2.2 Hospital delivery

Hospital deliveries are considered to be safer since they are attended by qualified professionals and take place in hygienic conditions. They can reduce the risk of complications and infections that may lead to neonatal death. They also promise the quality of services provided to a pregnant mother to be of an acceptable standard.

The NDHS (2000:122) indicated that 75% of births in Namibia occurred in health facilities, while 24% take place at home, indicating an increase in hospital deliveries if compared with the 67% of hospital deliveries in 1992. This shows that pregnant mothers are becoming aware of the importance of delivering in health facilities.

It is further reported that of the 75% women delivering in health facilities, the majority are young mothers; primigravidas and they are mostly residing in the urban areas.

The WHO (2001:3) states that it has never been scientifically proven that the hospital is a safer

place than home for a woman who has had an uncomplicated pregnancy to have her baby. Studies of planned home births in developed countries have shown death rates for mother and baby equal to or better than hospital birth statistics for a woman with an uncomplicated pregnancy. No evidence exists to support the claim that a hospital is the safest place for women to have normal births.

The last concept to be discussed under the environment of the person as a contributing factor to neonatal deaths is the characteristics surrounding birth.

2.4.3. Characteristics surrounding birth

2.4.3.1 Personnel

Obstetric care needs personnel who are qualified and experienced to render the services involved, such as antenatal care services, delivery services which include neonatal resuscitation and post delivery /post natal services. All staff that conduct deliveries should be able to provide immediate care to newborn infants and be able to identify those that require resuscitation. They must be proficient in basic neonatal resuscitation (Cronje & Grobler, 2003: 40). This set of personnel will include obstetricians, gynecologists, nurse-midwives and in addition also trained TBA's. Scarcity of this manpower will lead to an increase in neonatal deaths since some risk factors will not be detected early and complications will not be managed properly.

In Katima Mulilo Hospital, where this study took place, the situation is complicated in that there are only a few trained staff in the perinatal education programme (Newborn Care), a programme that equips staff with knowledge and skills in basic resuscitation of the newborn baby. The few

trained are not allocated to maternity wards/units or departments. There is only one doctor (a pediatrician) and one gynaecologist/obstetritian, and they are not available at all times. It may take some time for them to arrive when called to assist during deliveries and resuscitation.

In Namibia TBA's conduct some deliveries in the villages, but most are health facility deliveries. The NDHS (2000:122) reported that in Caprivi 67.4% of deliveries, were conducted by Nurse/midwives, 2.2% by TBA's and 28.1% by relatives. The involvement of the relatives is quite significant.

A study done in the USA on midwifery care, social and medical risk factors and birth outcomes indicates that the risk of experiencing infant death was 19% lower for certified nurse-midwives attending births versus physicians attending births. The risk of neonatal mortality was 33% lower and the risk of delivering a low birth weight infant was 31% lower. This indicates that the midwives have excellent birth outcomes in their approaches to delivery care when compared with physicians (Mac Dorman & Singh, 1998:52). This was also reported by Oakley, Murray, Murtland &Anderson, (1996:88) where a number of post delivery complications were found to be lower in the nurse midwifery provider group than in the obstetrician group.

 Personnel alone cannot ensure optimum care; equipment is also needed for the care to be of an acceptable standard.

2.4.3.2 Equipment

In order to have excellent or good pregnancy outcomes, the obstetric units should be properly

equipped. The appropriate equipment for neonatal resuscitation and delivery must at all times be immediately available and should be in good working order. All staff should be able to use them properly. A neonatal unit should be equipped with resuscitation apparatus including suctioning machines, oxygen supplies, neonatal ventilation bags and masks, incubators, laryngoscopes and endotracheal tubes. At delivery the fetal well being is continually monitored using a cardiotocograph. 0xygen supply should also be available to correct any fetal distress before delivery, especially during the usage of forceps and vacuum extractors in the case of difficult deliveries.

During ANC visits it is of great importance for the mother to be examined using special apparatus such as sonar, in order to detect risk factors such as placenta previa/ abruption, multiple pregnancies and the fetal growth and well being where there is doubt (Cronje & Grobler 2003:42). Lack of this equipment will contribute to a high number of neonatal deaths, which could be the case in Katima Mulilo Hospital where most of the above equipment is not available.

The following discussion will be on the influence of time on the neonate.

2.5 Time

In the study, time will involve the linkages between the period of delivery and the time of the year. This will include the gestational periods, duration of labour and the Apgar score at time of delivery. All these different periods have the potential to influence the health of the neonate. Figure 2.3.Indicates the aspects of time that might affect the mother and the neonate.

Figure 2.3 Time and its effects on mother and the neonate

DURATION
OF LABOUR
-Prolonged
-Normal

GESTATIONAL
PERIOD
-At time of booking
-At time of delivery

TIME

APGAR SCORE
-At one minute
-At five minutes

All these components will be discussed separately.
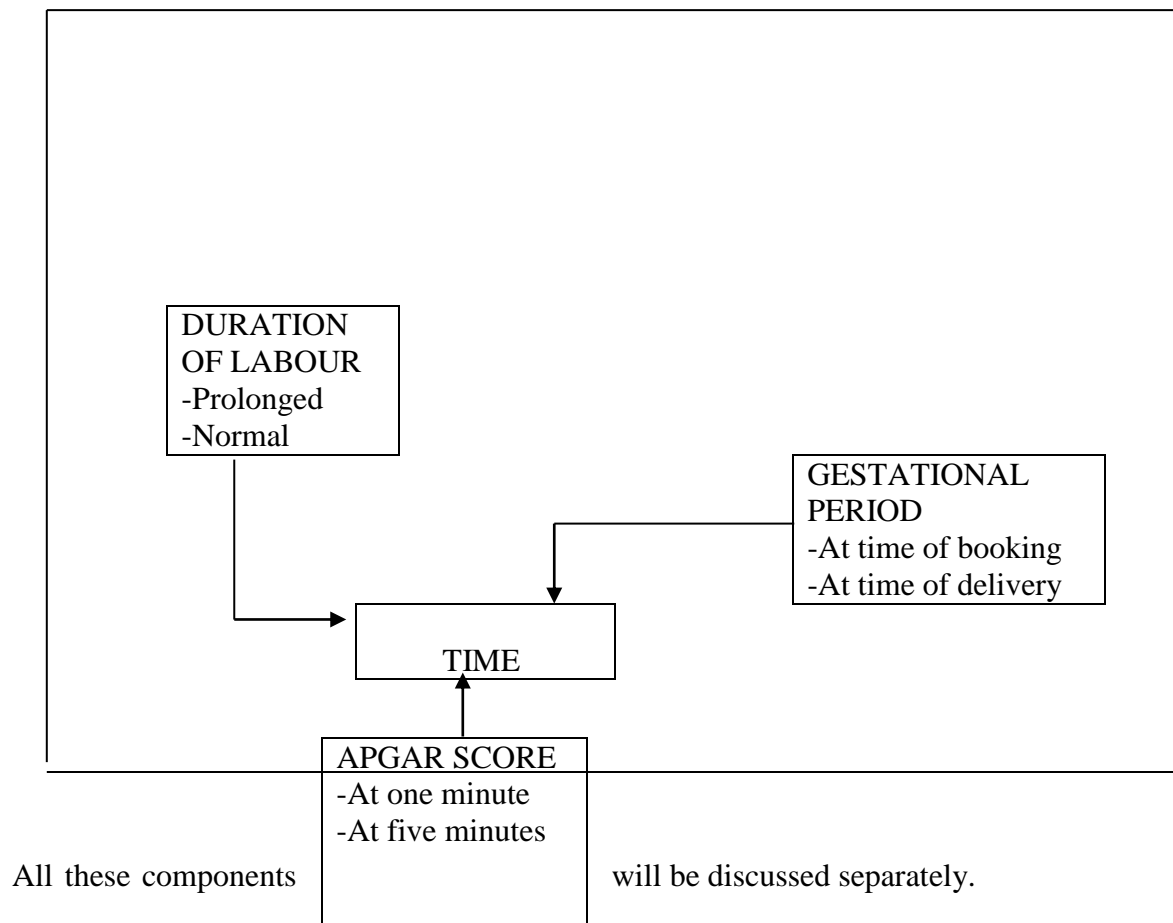
2.5.1 Duration of labour

Labour is defined as the process whereby a viable fetus and the placenta and membrane are expelled from the uterus, into the pelvic or birth canal and through the vaginal orifice (Sellers, 2003:328).

Duration of labour will be discussed under normal and prolonged labour.

2.5.1.1 Normal labour

A normal labour in primigravidas /nulliparous lasts about 12-14 hours and 6-8 hours in women who have delivered a baby in the past (multipara). When these hours are exceeded, it may create a negative effect on the health of a neonate. The averages vary considerably from one woman to another and also from first delivery to each succeeding delivery. Primigravidas /nulliparous women have longer first and second stages than women who have already delivered. This is due to the fact that the tissues of the cervix, vagina, vulva and other soft tissue of the pelvis have not previously been subjected to the stretching that occurs when the baby passes through the birth canal (Hughey, 2001:2).

2.5.1.2 Prolonged Labour

Prolonged labour is "labour in which the first stage exceeds 10-12hrs in primigravidas and 6-8 hrs in any subsequent labour" (Sellers, 2003:1357). This was also described by Hughey, (2001:4) as, "labour that lasts longer than 20 hours in a woman having her first baby (primigravidas) or more than 14 hours in other women (multipara)". Ackloo Abdool, S., Sungkur, J. & Soobem, M. 1999. in their study done in Mauritius , on factors contributing to high infant mortality rate reported that prolonged labour (12-25 hours) occurred in 24% of hospital deliveries which resulted in a high rate of asphyxia, as well as perinatal and neonatal deaths.

The effects of prolonged labour on the neonate are fetal distress, asphyxia neonatorum, and intracranial injury due to anoxia or due to trauma during birth, and intra-uterine infection of the fetus leading to pneumonitis, meningitis, pyelonephritis and septicemia (Sellers: 2003:1353).

The causes of prolonged labour which were identified by Sellers (2003:1354) are illustrated in

Table 2.4

Table 2.4 The causes of prolonged labour

Causes	Action
Disordered uterine action	Uterine exhaustion
Anaemia	Uterine atony
Over sedation /Analgesia	Hypotonic uterine action
Impacted &Edematous cervix	Failure of the cervix to dilate
Post maturity	Failure of the head to mould
Short umbilical cord	Inhibit the descent of the head
Uterine constriction ring	Inability to bear down

The duration of labour might also have a bearing on the neonate's Apgar score.

2.5.2 Apgar score

The Apgar score is the common method used to assess the newborn's status or the clinical condition after delivery and the need for continuing treatment (Woods, 1996:1). It is assigned at 1minute after birth and again at 5minutes after birth. A normal infant in good condition at birth will achieve an Apgar score of 7-10 and more. A score below 7 indicates a degree of asphyxia, which necessitates some form of resuscitation. If not properly or actively managed, the baby may end up dead. Immediately after birth, the baby's condition is assessed by considering the five signs and the degree to which they are present or absent (Osmond & Murphy, 1998:2).

2.5.3 Gestational Age

The gestational age at the first time of an ANC booking influences the health of the neonate. The earlier the woman attends an ANC, the higher the chances of the neonate's survival. The more a pregnant woman delays her ANC booking, the higher the risks of neonatal deaths are, as complications will not be detected early.

In a study done in Canada on infants born between 26-36 weeks of gestation compared to infants born at 37weeks of gestation and more, Casey, McIntire & Leveno, (2001:12) reported a higher neonatal death rate in infants born between 26-36 weeks of gestation.

A low birth weight premature baby is at greater risk of developing breathing problems. According to the American Lung Association, about 25000 babies a year, most of whom were born before the 34th week of pregnancy, suffer from Respiratory Distress Syndrome (RDS). These babies with RDS lack a substance called surfactant that keeps the alveoli in the lungs from collapsing (Scholl, 2003:13).

2.6 Summary

In this chapter the literature was reviewed and presented accordingly. The framework that guided the study was described. The person, the environment and the time related factors being the framework of the study were followed. The next chapter presents the design and the methods used in the study.

CHAPTER 3

METHODLOGY

3.1 Introduction

The focus of this chapter is on the research design and the methods used in this study. The aim of this study was to explore and describe factors associated with neonatal deaths in Katima Mulilo Hospital.

3.2 Research design

In this study a comparative descriptive retrospective design was used to compare two groups:

- A case group[1] of mothers whose infants have died during the first 28 days, plus their deceased infants (neonates[1])

- A control group of mothers, whose infants have survived during the first 28 days. plus their surviving infants (neonates)

This study was also retrospective and contextual in design.

A Comparative/ design compares the scores of two groups, only one of which was affected by the event or treatment (Bless& Higson, 1997:70). In this study two groups were compared, namely the case group and the control group. The one group consisted of mothers who were affected by the death of their neonates, including the deceased

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[1] The term "case group" is used in this study as it describes a specific focus group the best.
[2] The terms neonates and infants are sometimes used as synonyms. The choice depends on the context of the discussion

neonates. The second group consisted of mothers who were not affected by the death of their neonates as they survived the first 28 days of their lives. These two groups were then compared to identify any variable(s) that may be associated with the differences in neonatal outcomes.

Descriptive studies have as their main objective the accurate portrayal of the characteristics of a person, situation or groups, and the frequency with which certain phenomena occur (Polit & Hunger, 1997: 613). This study is descriptive as it describes the factors associated with neonatal deaths as stated in the objectives.

Retrospective research refers to the investigation of events that have already happened (Commack; 1998: 30). This study collected data that deals with the past (retrospectively) which are records of mothers with their deceased neonates and records of mothers with their surviving neonates from 2001 and 2002.

In this study the case group are mothers and their neonates, where the neonates had died before the 28th day post delivery. The control groups in this study are mothers and their neonates that survived the first 28 days post delivery.

More information will be presented on this aspect in the discussion on population and sampling.

3.3 Study population

Two population groups were utilised. The first population in this study consisted of all the mothers who had delivered and their neonates, where the neonates had died before day 28-post delivery, during the period January 2001 up to December 2002, in Katima Mulilo Hospital. A total of seventy- five (75) cases were identified, but only the records of fifty- eight (58) cases could be retrieved. All these fifty- eight (58) cases were included in the study.

The second population consisted of all the mothers who had delivered and their neonates, where the neonates had survived the first 28 days post delivery, during the period January 2001 up to December 2002, in Katima Mulilo State Hospital. The total sencond population numbered 3124.

3.4 Sampling size and sampling procedure

As has been explained under " first" population, all the women whose infants died and whose records could be retrieved were included in the study. No sampling was therefore necessary. This total "first" population will be referred to in this study as the "case" group.

For each case (a woman whose neonate had died before the 28th day post delivery), the record of a control (a woman whose neonate did not die before the 28th day post delivery) was retrieved.

The retrieval was done by means of probability sampling. All 3124 records of 2001and 2002 were taken; excluding the 58 cases (women whose neonates died before the 28th day post delivery). By means of a lottery 58 women was selected to be included as the control group. The lottery was done by numbering all the records from 1 up to 3124 and randomly selecting 58 records to be used as controls.

This control group was not matched exactly control to case. The motivation was that by means of probability sampling the influence of extraneous variables would be minimised.

3.5 Research instrument

Data collection was done by means of a structured checklist. The following aspects regarding the checklist will be discussed:

- The development and compilation phase
- The refinement of the checklist

- The confirmation phase

3.5.1   The development and compilation phase

A thorough literature review was conducted in order to assess the aspects that had to be included in this checklist. The research framework of the study also was used to focus the items and integrate the checklist within a broader adapted epidemiological framework.

The checklist consisted of 3 sections. The layout of the checklist is described in Table 3. 1 on page 63. The section was based on the main dimension of the research framework, namely person (mother and neonate), time and environment.

Table 3.1 Layout of the checklist

Section	Sub-division	Question numbers
Section 1 A		
Person (Mother)	Age	Question 1
	Parity	Question 2
	ANC Booking	Question 3
	Mode of delivery	Question 4
	Mother's complications	Question 5
Section 1B		
Person (neonate)	Gender	Question 6
	Birth weight	Question 7
	Neonatal complications	Question 8
Section 2		
Environment	Residential area	Question 9
	Place of delivery	Question 10
	Personnel assisting with delivery	Question 11
Section 3		
Time	Gestational age at first booking	Question 12
	Gestational age at delivery	Question 13
	Duration of labour in hours	Question 14
	Apgar score in one minute	Question 16
	Apgar score in five minutes	Question 17

The content of the items in the checklist was derived from the literature, and further validation was done, as will be discussed under "validity".

3.5.2   Refinement of the checklist

The refinement of the checklist was accomplished by means of completion of the following:

- Determining of the validity of the instrument

- Determining of the reliability of the instrument

- Pilot testing of the instrument

3.5.2.1 Determining the validity of the instrument

Validity refers to "whether or not a method measures what it sets out to measure" (Burnard et al, 1994:74) while De Vos et al. defined validity as "doing what it is intended to do, as measuring what it is supposed to measure and as yielding scores whose differences reflect the true difference of the variable being measured rather than random or constant errors" (2001:83).

In this study face validity and content validity were determined.

- **Face validity**

Face validity refers to "the way the instrument appears to the participant" Bless & Higson-Smith, 1997: 139). In this study the researcher ensured face validity by submitting the instrument to three (3) colleagues and supervisors, who agreed that the items appeared to be representative of the purpose of the study. The items included in the instrument were assessed, and modifications made accordingly.

- **Content validity**

Content validity is "concerned with the adequacy of the content area being measured" (Polit et al., 1997:300). De Vos et al. state that content validity "is concerned with representativeness or sampling adequacy of the content (e.g. topics or items) of an instrument" (2001: 84). In this study, content validity was ensured by the researcher through a literature review and through the guidance of experts in developing the checklist. These included three nursing supervisors one of which is a qualified midwifery lecturer at the University of Namibia.

3.5.2.2   Determining the reliability of the instrument

Reliability is referred to by De Vos et al. as "the accuracy or precision of an instrument or the degree of consistency or agreement between two independent derived sets of scores; and as the extent to which independent administrations of the same instrument yield the same results under comparable conditions" (2001:85). For this study, stability was tested by means of equivalence.

- **Equivalence**

The equivalence approach is when different observers or raters are using an   instrument to measure the same phenomena (Polit and Hungler, 1997:248). They afterwards compare the results. In this study the obstetric records of two cases (population under study), and two controls, were retrospectively reviewed. The researcher and an independent assistant (nurse) reviewed these four obstetric records separately and compared results. Both the researcher and the independent assistant obtained the same results. This aspect was done as part of the pilot study. Due to the limited number of cases, the two (2) cases used for reliability had to be used in the main study as well.

3. 5.2.3 Pilot testing the instrument

A pilot study according to De Vos "is the process whereby the research design for a prospected survey is tested" (2001: 179). This was done to determine whether the intervention was going to work.

The checklist (instrument) was used on four (4) obstetric records of women, as described under "equivalence" included in the main study. During the pilot study the focus was whether the required data could be obtained, as well the as how much time was required for completing the checklist.

Following the pilot study it was decided that all the required data could be retrieved by means of the checklist, and that it takes about 35 minutes to complete, which was regarded as acceptable.

3.6 Data collection method

The data was obtained by means of the checklist (See annexure C). Information was retrieved from the admission records during the period May-August 2004. The records were used retrospectively as only the information for the years January 2001- December 2002 were collected.

The cases' and controls' hospital numbers were identified from the admission register. This information enabled the retrieval of the cases' and the controls' obstetric records as well as the infant's medical records.

An unmatched design was used. A motivation for this was that any case or control that cannot be

"matched" must be discarded (Greenberg, et. al, 1996:126). This can be viewed as a wasteful process, especially as there were only 58 cases.

The typed data of the two groups (cases versus controls) that were compared are the subcategories as is indicated in the outline of the instrument, Table 3.1 on (page 63) (See also annexure C)

3.7 Data analysis

The data was organised for analysis under mothers with their neonates that died within 28 days (cases), and mothers with their neonates who survived within the first 28 days (controls).

First a description of the data was done. Averages (Means) were calculated. The study was also based on exploration and describing the factors which could be associated with neonatal deaths. To obtain these findings, correlation statistics were implemented specifically the Pearson Correlation Coefficient (x^2 chi-square). The strength of association was determined by means of the chi-square test. This test merely indicates whether there is a statistically significant difference between certain factors.   (Katzenellenbogen, Joubert & Karim, 1997:116-117).

3.8 Ethical issues

Overall permission was sought from the Permanent Secretary (PS) of the MOHSS (see annexure B). After obtaining this, the researcher wrote to the hospital management team and the Regional Management Team (RMT) to ask permission (see annexure A for the relevant documentation in this regard). The purpose of the study was clearly explained in the letter. Issues concerning death are very sensitive to human beings; therefore confidentiality was maintained at all times.

The researcher was assisted by an independent person to retrieve only the files with no input in data analysis. This person was informed about aspects of confidentiality, which she agreed to adhere to. Each file was given a number, which matched with the one on the checklist to avoid repetition of information. Health personnel from the two wards were also informed about the study, even if the hospital management had previously informed them.

3.9 Summary

In this chapter the research design and methods were discussed. A discussion on how a comparative descriptive design could assist in identifying applicable factors was provided. The relevant data collection method and process of data analysis was outlined. The chapter ended with a discussion on ethical issues.

The next chapter, namely chapter 4, will be on data analysis.

DATA ANALYSIS

4.1. Introduction

In this chapter the analysis of the data will be presented. The data was organised for analysis under case groups and control groups. Seventy-five neonatal deaths were recorded as the total neonatal deaths from January 2001 to December 2002. Of the records targeted among the cases, seventeen records could not be traced, thus they were excluded from further analysis. This brought the number of reviewed cases to fifty-eight and fifty-eight controls, amounting to a total of 116 records that were analysed.

Using a checklist, which consisted of close-ended questions designed by the researcher, all relevant data were collected. The data obtained were analysed following the format of the instrument. The analysed data were discussed to compare and describe the factors associated with neonatal deaths in Katima Mulilo Hospital.

In this study the type of statistical analysis used was the "measure of strength of association" in conjunction with the general descriptive statistics. The strength of associations was determined by means of the chi-square test. This test merely indicates whether there is a statistically significant difference between certain factors. It provides no information on how strong such a relationship is.

4.2 Results

The results will be discussed following the format of the checklist and are as follows:

- The person related factors
- The environment related factors
- The time related factors

4.2.1. The person related factor

In this category two sub-categories are discussed, namely, the mother as the person and the neonate as the person.

Variables categorised under the "mother as person" are as follows:

- Age
- Gravida/Parity
- Marital status
- ANC bookings
- Mother's complications
- Mode of delivery

Variables categorised under the "neonate as person" are as follows:

- Gender

- Birth weight

- Neonate's complications

4.2.1.1 Age of mother in years (Cases: N=58. Controls: N=58)

In this study, for the majority of neonatal deaths, i.e. 52(89.7%) in the case group the mothers were

between 17-35 years, while for 53(91, 4%) of the controls the mothers were within the same age

group. The results as depicted in figure 4.1 basically indicate a normal distribution with regard to

the expected age for child bearing.

Figure 4.1 Ages of mothers (Cases: N = 58. Controls: N=58)
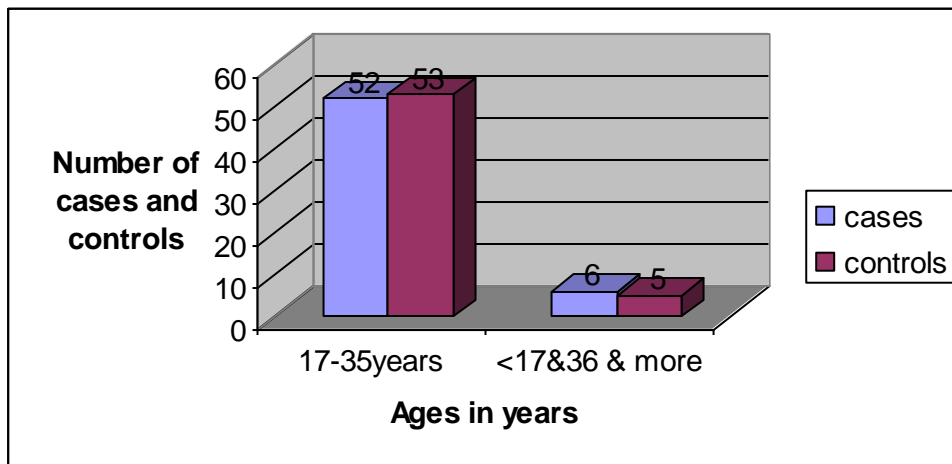
No significant statistical differences were found between the ages of cases and controls. Thus in

this study the results indicate that age of the mother is not a factor associated with neonatal deaths

($x^2 = 4.143$, p= 0.042).

4.2.1.2 Gravida/Parity (Cases: N=58. Controls: N=58)

In this study the majority of neonatal deaths, i.e.36 (62, 1%) occurred in the primigravidas[1] and grand multiparas[1] with regard to the case group. In the control group, 29(58%) of the mothers could be categorised as primigravidas or grand multipara.

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[1] For the purpose of data analysis, primigravidas and multiparas were grouped together and compared with women who were not primigravidas or multiparas

This finding is partly contradicted by Bergstrom et al. (1997:10), who stated that primigravidas have a higher risk of neonatal deaths. The difference in the findings between Bergstrom et al. (1997:10) and this study could be due to the contextual nature of this study, as well as the relatively small sample.

Based on the above, no statistical difference could be found between the case group and the control group with regard to gravida or parity. It is therefore concluded that in this study gravida/ parity cannot be regarded as a factor that is associated with neonatal deaths (x^2= 2.850, p= 0.241).

4.2.1.3 ANC booking status (Cases: N=58. Controls: N=58)

With antenatal clinic (ANC) visits it is assumed that the gestational and growth process of the fetus and the health of the mother will be assessed, and should any deviations be detected, corrective actions will immediately be implemented. The importance of these visits is documented in the literature. Vintzileos (2002:5) reported that women with a history of no antenatal visits are

associated with a 40% increased risk that their children, or they themselves, might experience

complications during the period of delivery.

In this study 39 (67, 2%) of the women in the case group attended antenatal clinics and 51(87, 9%)

of the women in the control group attended antenatal clinics. (See figure 4.2).

Figure 4.2 ANC Booking (N=58)
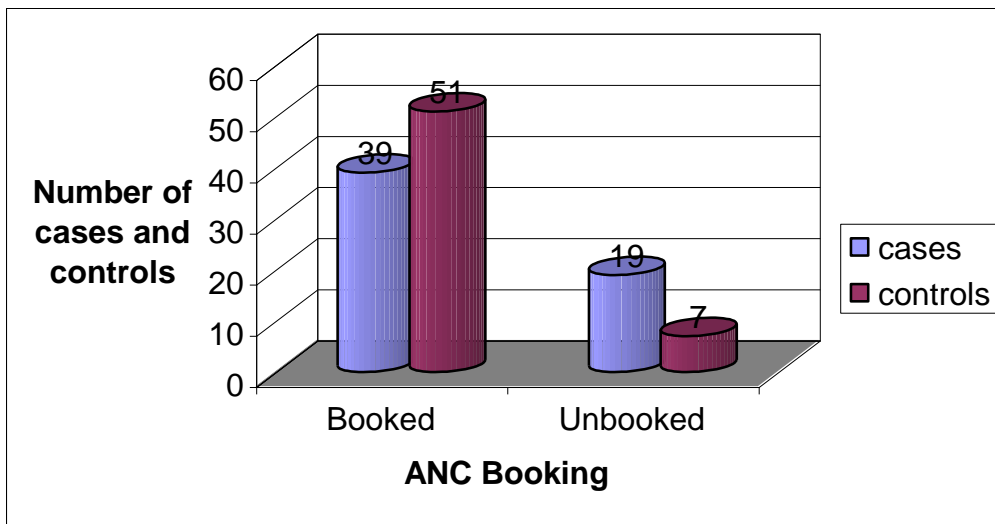
The results provided a statistically significant difference between the case group and the control

group. It is thus concluded that in this study " no antenatal clinic attendance" was a factor that

could be associated with increased neonatal deaths (x^2 =14.838, p<0.001)

4.2.1.4 Mother's complications (Cases: N=58. Controls: N=58)

A complication is regarded as any obstetric problem arising in a pregnant woman that has an

adverse effect on the mother and the unborn baby (fetus). Examples of complications that were observed were malaria, anaemia, antepartum hemorrhage, eclampsia/preeclampsia and HIV/AIDS.

An illustration of the results is seen in figure 4.3. Twenty-seven (46,6%) of the women in the case group experienced complications, while nine (15,5%) of the women in the control group experienced complications.

Figure 4.3 Mother's complications (Cases: N=58. Controls: N= 58)
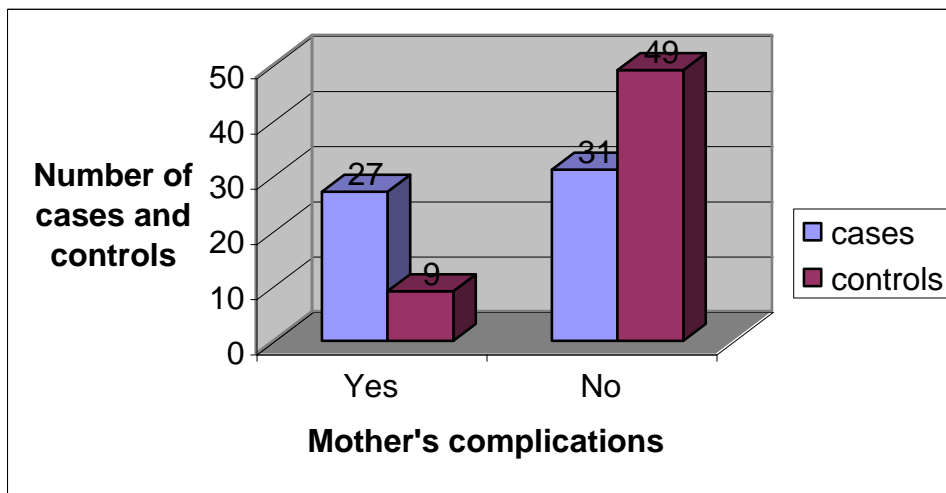
The identified complications were malaria 6 (10,3%) and pre-eclampsia 7 (12,1%). This is in line with a study that was done by Bergstrom et al. (1997: 38). They stated that complications like malaria, anaemia, antepartum haemorrhage and pre-eclampsia contributed to neonatal deaths.

Gyarfas (1997:9) in his guidelines for preventing cardiovascular diseases in Geneva also stated that during the advanced stage of pregnancy, where pregnancy induced hypertension occurs, the

woman may develop physiological derangements due to poor uteroplacental perfusion. This is a serious condition, which cannot be treated in any way except the speedy delivery of the baby; otherwise the woman is exposed to convulsions and cerebral haemorrhage that could further lead to fetal deaths.

Duley & Henderson-Smart (2000:2) revealed that, high blood pressure in pregnancy (pregnancy induced hypertension) causes vasoconstriction that reduces the blood supply across the placenta, leading to fetal distress.

In this study a statistically significant difference was found between the case and the control group. Therefore, complications encountered by the mothers could be regarded as factors associated with neonatal deaths (x^2=11.469,p<0.001).

4.2.1.5 Mode of delivery (Cases: N=58. Controls: N=58)

In this item the mode of delivery was analysed. The "mode" was either regarded as "normal" or "abnormal". In this study an abnormal mode of delivery was regarded as any mode other than a normal vertex delivery, which could have been either an LOA[1] or ROA[2].

Figure 4.4 Mode of delivery (Cases: N=58. Controls: N=58).
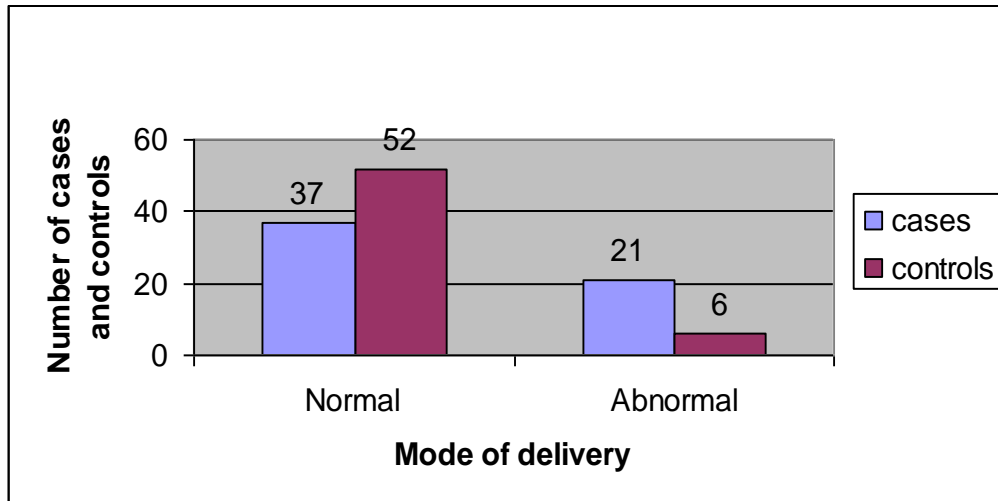
The results are depicted in figure 4.4. As can be seen, 37(63,8%) of the case group and

52 (89,7%) of the control group delivered their babies normally. This represents a statistically

significant difference between the case group and the control group. In this study any mode other

than a normal vertex delivery was found to be a factor that could be associated with increased

neonatal deaths (x^2 =50.721,p<0.001).

4.2.1.6 Gender (Cases: N=58. Controls: N=58)

With this item the gender of the neonate is determined to establish an influence on the incidence of

neonatal death. The results indicate that 32 (55,2%) of the neonates from the case group and 27

(46,6%) of the neonates from the control group were male infants.

Based on these results, no statistically significant difference was found between the case group and

the control group with regard to neonatal gender as a factor that could be associated with neonatal

deaths ($x^2 = 5.064$, p= 0.167). It is therefore concluded that in this study gender was found not to be a factor associated with neonatal deaths.

This is in contrast with a quotation from Sami & Balock (2002:1) where they indicate that in the Bolan medical complex the gender mostly affected with regard to neonatal deaths are males.

It is however concluded that in this study gender was found not to be a factor associated with neonatal deaths.

4.2.1.7 Birth weight of the neonates (Cases: N= 58. Controls N= 58)

This item was analysed to determine the influence of birth weight on neonatal deaths. The results as illustrated in figure 4.5 indicate that 29 (50%) of the neonates in the case group weighed less than 2500 grams, while 8 (13,8%) of neonates in the control group weighed less than 2500 grams.

A statistically significant difference was found between neonates of the case group and the neonates of the control group. In this study a birth weight below 2500 grams was found to be a factor that could be associated with increased neonatal deaths ($X^2 = 17.914$, p < 0.001).

Figure 4.5 Birth weight of the neonate (Cases: N=58. Controls: N=58)
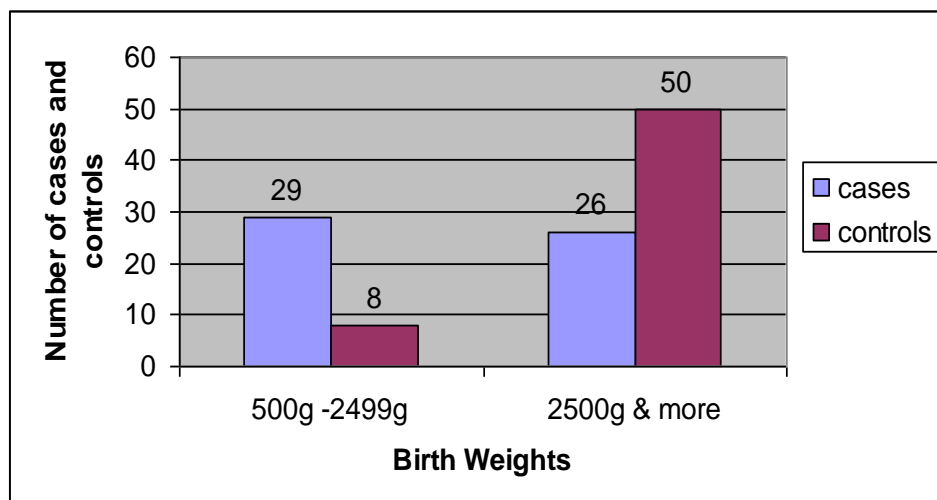
Low birth weight as a contributing or associative factor is well researched and documented. In a report from "USAID", it is reported that in developing countries like Namibia 60% of neonatal deaths are linked to low birth weights (Birth weight < 2500 grammes). Furthermore, the report indicated that these low birth weights were due to prematurity, a known leading factor associated with neonatal deaths (USAID, 2002:4)

The above is in line with the findings of this study.

4.2.1.8 Complications experienced by the neonates (Cases: N= 58. Controls N= 58)

In this study two complications were focused on, namely asphyxia during delivery and prematurity. These findings, as depicted in figure 4.6, indicate that 19 (32, 8%) of the neonates in the case group developed asphyxia while none in the control group had asphyxia as a complication during delivery. In addition 17 (29,3%) of the neonates in the case group were born prematurely, while 9(15,5%) of the neonates in the control group were born prematurely.

Figure 4.6 Complications experienced by the neonates (Cases: N= 58. Controls N= 58)
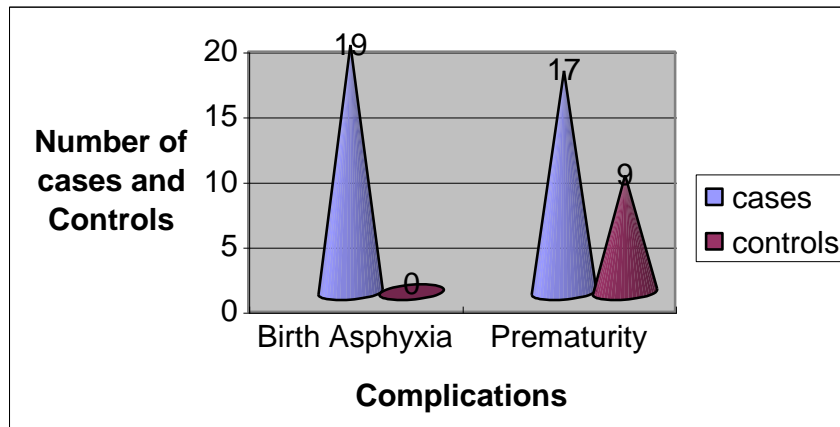
In comparing the results related to complications between the two groups, a statistically significant difference was found. In this study asphyxia during birth and prematurity were found to be factors that could be associated with increased neonatal deaths ($X^2 = 93.481$, $p < 0.001$).

4.2.2 Environment Related Factors

Aspects to be discussed under this heading are:

- Residential area

- Place of delivery

- Personnel assisting the delivery

4.2.2.1 Residential area (Cases: N=58. Controls: N=58)

In this item the residential area refers to urban, rural or peri-urban locations. The peri- urban location in this study means squatter camps (Informal settlements). This item was included in the study because both the rural and the squatter areas have poor access to communication and poor access to clean water and sanitation, which are known health hazards, and could lead to increased

neonatal deaths.

The results indicate that of the cases 11(19%) who were from the urban setting were lower than that of the controls 17 (29%). There is no great difference between the case group and the control group from the rural and the peri urban settlements. This could be due to the fact that they share similar consequences in terms of health infrastructures (see Table 4.1 for an outline of these results).

In this study no statistically significant difference was found between the case group and the control group. It is therefore concluded that residential area could not be regarded as a factor associated with neonatal deaths (x^2=1.217, p = 0.544).

Table 4.1 Residential area (Cases: N=58. Controls: N=58)

	Urban	Rural	Peri-Urban	Total
Case group	11(19%	24(34,5%)	23(39,7%)	58(100%)
Control group	17(29,3%)	21(36,2%)	20(34,5%)	58(100%)

4.2.2.2 Place of delivery (Cases: N=58. Controls: N=58)

In this item the place where the diseased neonate was delivered was determined to establish the influence it has on the neonate. Forty nine 49 (84,5%) of the cases and 57(98,3%) of the controls delivered in the hospital, while only 9 (15,5%)cases and 1(1,7%) controls delivered their babies elsewhere than a hospital.

In this study no statistically significant differences were found between the case group and control

group. It can be concluded that in this study place of delivery was found not to be a factor associated with neonatal deaths ($x^2 = 108.513$, $p < 0.001$).

4.2.2.3 Personnel assisting with the delivery (Cases: N=58. Controls: N=58)

In this item the category of personnel that assisted during the delivery process was determined to establish their influence on the incidence of neonatal deaths. The categories used were nurses, doctors, TBA's and relatives. The results as illustrated in Table 4.2 below show that the majority 40 (69%) of `women who delivered from the case group and 56(86%) of women who delivered from the control group were assisted by nurses in health facilities. The remaining deliveries were by doctors and relatives (Table 4.2 illustrates these results).

Table 4.2 Personnel assisting the delivery (Cases: N=58. Controls: N=58)

Personnel	Cases	Percentage	Controls	Percentage
Doctors	9	15.5%	1	1.7%
Nurses	40	69%	56	96,6%
Relatives	9	15.5%	1	1.7%
Total	58	100%	58	100%

Unfortunately, no correlation statistics have been employed for this item. What is noticeable from the data is the high number of assistance by medical doctors and relatives in the case group. An explanation might be that these patients in the case group might be already considered a high risk, and therefore a medical practitioner was involved from the onset. The high involvement of relatives in the deliveries of the case group appears to be significant, but this is a subjective

observation.

4.2.3 Time Related Factors

In this category the main factors to be discussed are the gestational age at the time of booking, the duration of labour, the gestational age at time of delivery, the baby's apgar score in one minute and the baby's Apgar score in five minutes.

4.2.3.1 Duration of labour (Cases: N=58. Controls: N= 58)

The duration of labour in hours was also analysed. The duration of labour was regarded as either less than 12 hours, which is considered normal, 12 hours and more, which is considered to be abnormal. In this study it is also assumed that the longer women stays in labour, the higher the incidence of neonatal deaths. The results as depicted in figure 4.7 show that 26 (44,8%) women in the case group and 39 (67,2%) women in the control group delivered within 12 hours of labour, while 32 (55.2%) women in the case group and 19 (32,8%) women in the control group delivered after being in labour for more than 12 hours (see figure 4.7).

Figure 4.7 Duration of labour in hours (Cases: N=58.Controls: N=58)
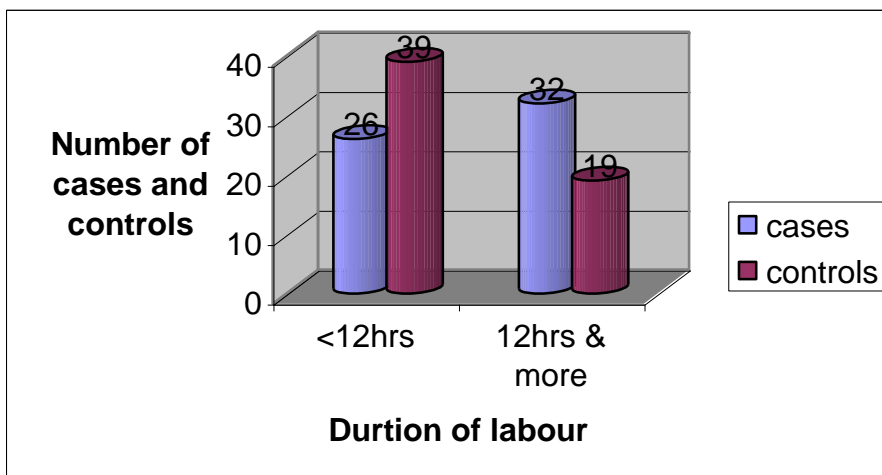
Based on these results a statistically significant difference was found between the case group and the control group with regard to the duration of labour in hours and neonatal deaths. In this study it is therefore concluded that any labour exceeding 12 hours was found to be a factor that could be associated with increased neonatal deaths (x^2 41.213, p< 0.001)

4.2.3.2 Baby's Apgar score in one minute (Cases: N=58. Controls: N=58)

In this item the Apgar score of the baby at one minute after delivery has been assessed to determine its association with neonatal deaths.

In this study the majority of neonatal deaths in the case group had an Apgar score below 7 at one minute after birth, i.e., 39 (67,2%) of the case group, while 4 (6,9%) of the control group had an Apgar score below 7. These results are illustrated in figure 4.8.

Figure 4.8 Baby's Apgar score in one minute (Cases: N=58. Controls: N=58)
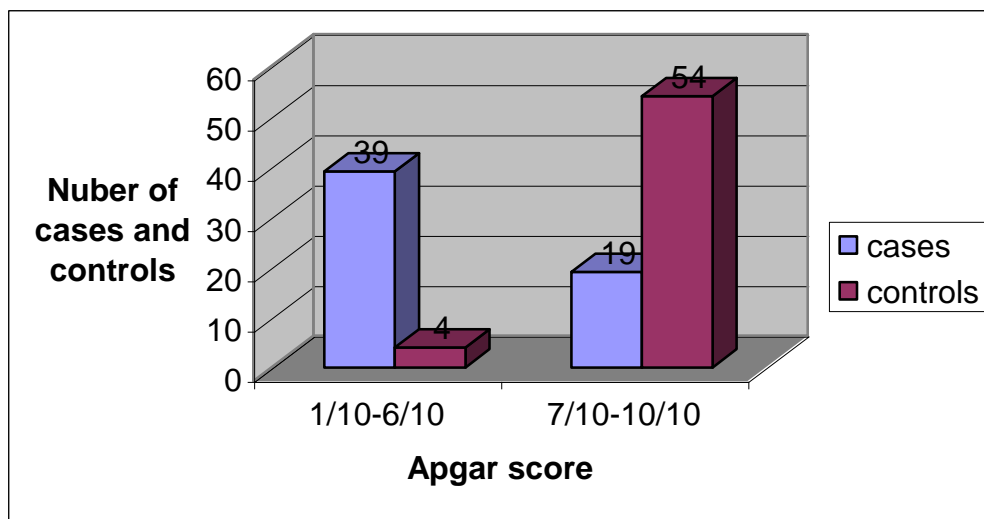
A statistically significant difference was found between the case group and the control group with regard to the neonate's Apgar score in one minute and neonatal deaths. In this study a score of less

than 7 at one minute was found to be a factor that could be associated with neonatal deaths (x^2 =15.088,p<0.001).

4.2.3.3 Baby's Apgar score in five minutes (Cases: N=58. Controls: 58)

In this item the Apgar score of the baby at five minutes after delivery is determined to find its association with neonatal deaths. The results as seen in figure 4.9 indicating a high number of 31(41,4%) for the case group and only 1(1,7%) of the control group that had an Apgar score below 7 in five minutes after birth.

Figure 4.9 Baby's Apgar score in five minutes (Cases: N=58. Controls: N=58)

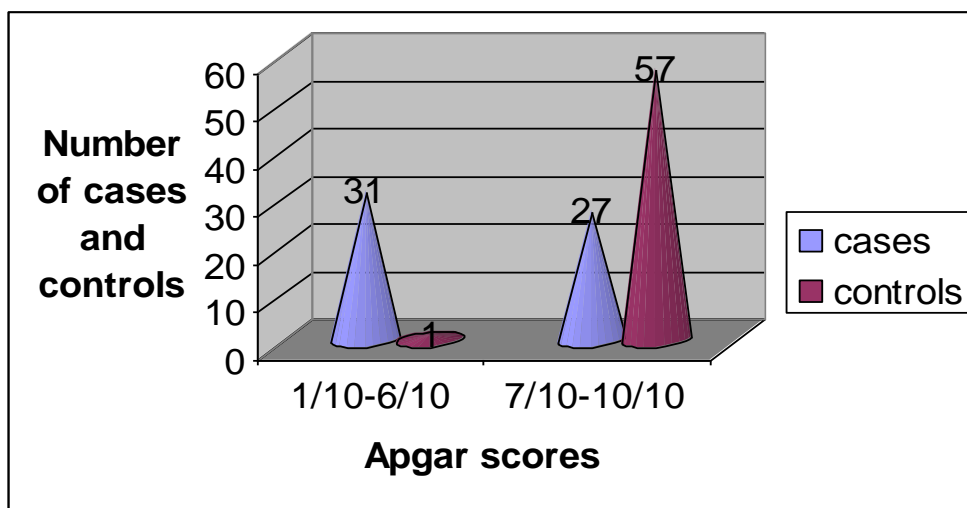The results provided a statistically significant difference between the case group and the control group with regard to the neonate's Apgar score in five minutes and neonatal deaths. In this study a score of less than 7 at five minutes was found to be a factor that could be associated with neonatal deaths (x^2 =36 723,p<0.001).

4.2.3.4 Gestational age at first time of booking (Cases: N=58. Controls: N=58)

Antenatal care is aimed at monitoring the health of the mother as well as the well being of the baby during pregnancy until delivery. During this period the risk factors present or that might occur, which might have an effect on the neonate, are assessed. The gestational age at which the pregnant women first visit the ANC is important in that complications or bad obstetric history would be detected and corrected early.

In this study 36 (62%) women from the case group and 48 (82.8%) women from the control group attended their first ANC in the first and the second trimester, compared to 3 (5,2%) of the cases and 3 (5,2%) of the controls that attended their first ANC in the third trimester. The remaining 19 (32.8%) of the case group and 7(12.1%) of the control group did not attend ANC as specified in figure 4.3.

Table: 4.3 Gestational ages at first time of ANC booking (Cases: N=58.Controls: N=58)

Weeks	Cases	Percentage	Controls	Percentage
O-15	10	17,2%	14	24,1%
16-28	26	44,8%	34	58,6%
29 and more	3	5.2%	3	5.2%
None	19	32.8%	7	12,1%
Total	58	100%	58	100%

No statistically significant differences could be found between the case group and control group with regard to gestational age at first time of ANC booking. It is therefore concluded that in this study the gestational age at first time of booking cannot be regarded as a factor that is associated with neonatal deaths (x^2= 6.452, p= 0.001).

4.2.3.5 Gestational age at the time of delivery (Cases: N-58. Controls: N=58)

The gestational age was considered in relation to whether the pregnancy was at term (40 weeks gestation) or below term (preterm) up to 39 weeks gestation. The results indicate that the majority 39 (62,2%) women from the case group and 32 (55,2%) women from the control group delivered their babies within 28-36 weeks, showing that they were born prematurely, which is a known major risk factor to neonatal death.

No statistically significant differences were discovered between the case group and control group. Therefore in this study gestational age at time of delivery was found not to be a factor associated with neonatal deaths (x^2= 2.482, p= 0.115).

The results are in contrast with what was documented in the literature. The WHO (2001:2) reports that 61% of neonatal deaths are due to preterm and low birth weight. The results of this study should be interpreted from the perspective of its being a contextual study, as well as a study with a relatively small population.

Summary

In this chapter the case and control groups were compared by means of correlation statistics, more specifically the Pearson Chi – Square. The items for which statistically significant differences were found were analysed and presented as having a possible association with neonatal deaths. The researcher did however from the outset indicate that these findings do not prove a *cause- effect* result.

These findings will be concluded in Chapter 5, and final recommendations regarding the associations found will be presented.

CHAPTER 5

Summary of the research findings, conclusions, recommendations, limitations and further research

5.1 Introduction

In this chapter the research findings are summarised and conclusions are drawn. Based on these conclusions, recommendations are formulated and presented within the limitations recognised to exist within this study. These limitations will be presented and placed within context.

The discussion of this chapter will be based on the order and focus of the macro arguments, namely the aim (or purpose) and objectives of the study.

5.2 Aim of the study

The aim of this research project was to explore and describe the factors associated with neonatal deaths in Katima Mulilo Hospital.

It has been revealed in the literature that neonatal deaths are caused by a variety of factors. These factors were presented in the literature according to an epidemiology related framework, and discussed as person, environment and time related factors, for which applicable objectives were compiled.

These objectives will be presented again for clarity in order to maintain the focus of the chapter.

5.3 Objectives

- To explore and describe the person related factors associated with neonatal deaths

- To explore and describe the environment related factors associated with neonatal death

- To explore and describe the time related factors associated with neonatal deaths

- To make recommendations for striving to reduce or minimise neonatal deaths

Each objective will thus be discussed individually, conclusions will be drawn and recommendations submitted.

5.3.1 Objective 1

The first objective reads as follows:

To explore and describe the person related factors associated with neonatal deaths

This objective incorporated eight (8) items, namely: age, gravida/parity, marital status, gender, neonatal complications, maternal complications, ANC bookings, and mode of delivery, to be regarded as factors that the researcher was interested in (See annexure C).

A statistical analysis showed that a significant difference between the case group and the control group was found in the following factors:

- Mode of delivery
- Mother's complications

- Birth weight

- Neonatal complications

These four (4) items were regarded as being statistically significant, meaning that they could be regarded as factors that are associated with neonatal deaths. They are depicted in Table 5.1

Table 5.1 Person related factors considered to be associated with neonatal deaths

Item (factor)	Chi – square	Comments
Mode of delivery	$X^2 = 50.721$ $P < 0.001$	Any other method, other than a vertex delivery is associated with an increase in neonatal deaths
Mother's complications	$X^2 = 11.469$ $P < 0.001$	Malaria and pregnancy induced hypertension during pregnancy and at birth is associated with an increase in the incidence of neonatal deaths
Birth weight of neonates	$X^2 = 17.914$ $P < 0.001$	A neonatal birth weight of less than 2500 grams is associated with an increase in neonatal deaths
Neonatal complications	$X^2 = 52.200$ $P < 0.001$	Asphyxia during birth or prematurity is associated with an increase in neonatal deaths

5.3.1.1 Conclusion

These findings, as indicated in Table 5.1 are similar to other quoted studies in the literature review, and the conclusion of the researcher is that they are associated in this study with an increase in neonatal deaths.

With regard to the mode of delivery several authors have cited that any other mode other than a vertex delivery increases the possibility of neonatal complications (Levitt 1999:101 and Kennedy 1995:4) (See also Chapter 2, point 2.3.1.2.5 p: 30).

With regard to the birth weight of neonates, studies by WHO (2001:3), NDHS (2000: 124) and Bergstrom & Goodburn (2001:4) were cited, and they confirmed the association that was found in this study. (See Chapter 2, point 2.3.2.1 p: 34).

Similarly, ample evidence has been found in the literature that asphyxia during the birth process or as an "*incident*" during prematurity, and prematurity per se, are the most common factors associated with neonatal deaths. These aspects were also well documented and researched in studies by WHO/AFRO (2004:2), Malik (2001:1), Woods (1996:1), Kibel Wagstaff 1997:61) and Bergstrom, et al. (1997:78). These authors focused mainly on asphyxia. Prematurity was also addressed in the findings of Odendaal, et al. (1997:3), Gormally (2002:5), Von Der Pool (1998:19) and Scolls (1996:1) (See Chapter 2, point 2.3.2.3.3 p: 41).

The complications experienced by the mother addressed malaria and pregnancy-induced hypertension. Malaria infection in pregnant women is well documented as adding to the mortality

of neonates (WHO, 1998:5& 2003:8).

Several authors also cited pregnancy-induced hypertension, and it can be concluded that any obstetric related condition like pregnancy-induced hypertension contributes to a high number of neonatal deaths (Duley& Henderson-Smart, 2000:2, Gyarfas, 1997:9 & Liu et al. 1996:22) (See also Chapter 2, point 2.3.1.1.3 p: 16).

5.3.1.2 Recommendations with regard to Objective 1

These recommendations are based on the conclusion that was drawn above. The conclusion is that the factors indicated in Table 5.1 are regarded to be associated with an increase in neonatal deaths.

The researcher is sensitive to the prospect that other items (factors) might also be relevant, and the literature has confirmed this, but this study is contextual in nature, and within this context the recommendations are made

- **Mode of delivery**

The impetus here is that, as far as possible, normal delivery modes should be encouraged. This aspect is however influenced by a variety of variables like complications of the fetus and the pregnant mother. To eliminate some of these complications and prevent any other mode other than a normal vertex delivery, optimal antenatal services should be available and be used by pregnant women.

This entails:

  - Emphasis on health education messages to the community, which should include the

importance of early utilisation of health facilities (ANC) for early detection of unnecessary complications such as an abnormal position, multiple pregnancies and pre-eclampsia that may lead to any other mode other than a normal vertex delivery.

▪ Nursing personnel and TBA's who are practicing should be given more in-service training in the correct identification of patients with risk factors and correct referrals to a health facility.

▪ More in service training sessions are required including programmes that can equip nursing personnel with knowledge and skills on the correct identification of malpresentation and prolonged labour.

- **Mother's complications**

The intention/idea is to minimise any complication that may arise and further lead to the incidence of neonatal death. To achieve this nursing personnel should be competent enough in detecting these complications at an early stage and managing them. As has already been mentioned, the utilisation of health facilities (ANC) needs to be emphasised. In addition:

▪ Regular auditing and care for all obstetric records is important, as it will strengthen strategies to reduce neonatal deaths.

▪ The results of the audits need to be discussed at in-service education sessions or during the perinatal mortality meetings, which should be held on a monthly basis.

▪ During these sessions the following have to be addressed in order to develop methods to reduce malaria cases in pregnancy: in maternal anaemia, pre-eclampsia and eclampsia during pregnancy. These are illustrated in Table 5.2 p 95

Table 5.2 Recommendations on complications experienced by the mother

Complication	Recommendation
Malaria	-Emphasise the use of chemoprophylaxis or intermittent preventive treatment for malaria for all pregnant women -Encourage all pregnant women to sleep under insecticide treated nets that can also guard the life of

	the newborn baby
	- All pregnant women with hyperpyrexia should be tested, and if necessary treated, for malaria in the Caprivi Region
Pregnancy-induced hypertension	-Nurses and midwives should receive the required in-service education on the safe and effective use of the essential midwifery drugs, according to the treatment protocol
	- The nursing personnel should know the dangers of high blood pressure in pregnant women and early detection of signs and symptoms of pre-eclampsia/eclampsia
	-The dangers of the drugs on the treatment protocol should be emphasised

- **Birth weight of neonates**

The aim is to deliver a child (neonate) with a birth weight of at least 2500 grams. The incidences of low birth weight are recognised indicators of the well being of the neonate, because weight at birth is an important determinant of the survival chances of the newborn (NDHS, 2000: 123). Health personnel, specifically nurses, should be competent to:

- Provide health education with regard to proper nutrition for the mother to gain enough weight (eat a balanced diet with enough calories/kilojoules with the use of

locally available and acceptable food supplements containing iron) (Cobra & Semba, 1997) and to adhere to the regular recommended antenatal visits.

- Detect inadequate fetal development and growth. This means that nursing personnel should be able to perform scientifically correct palpations, and if possible, also refer a patient for sonar. Since there is a scarcity of doctors, there is a need to train registered nurses to perform examinations of pregnant women by ultrasound machines.

- More attention should be given to accurate record keeping in the antenatal period and interpretation of information such as height, weight and arm circumference of the mother.

- The nursing personnel should be skilled in neonatal resuscitation as it is probable that low birth weight neonates might experience organ malfunctions such as an underdeveloped pulmonary system.

- **Neonatal complications**

The aim is to deliver a healthy neonate without any form of complication that may cause death to the neonate. The same recommendation that was stated earlier, namely competence in neonatal resuscitation, applies here. In addition:

- All midwives should be trained in perinatal education programmes, which are aimed at improving the care of pregnant women and their newborn infants in Namibia.

- Staff training should be conducted in proper management and care of premature and low birth weight babies. Skin-to-skin Kangaroo Mother Care (KMC) to be introduced in all regions. Follow ups of all premature babies to be made after discharge from the

hospital.

- Establishment of hospital facilities to improve the care of premature babies e.g. a neonatal unit with necessary equipment.

- Risk identification and education regarding the signs symptoms of preterm labour should be a routine part of prenatal care.

- The registered nurse, and in this case the sub-professional nurses as well, should be able to detect early indicators of jaundice. Neonates born prematurely might also have an inadequately functioning liver. This may cause the incomplete biotransformation of bilirubin, leading therefore to kernicterus (bilirubin encephalopathy) (Woods, 1996:7). Stemming from this recommendation, more specific recommendations are submitted:

  - ❑ Registered nurses and the sub- professional nurses should be competent to initiate and care for a neonate on phototherapy.

  - ❑ Registered nurses and the sub-professional nurses should be aware that exposure to sunlight could also be implemented for jaundice should phototherapy not be available.

  - ❑ Registered nurses and the sub-professional nurses should be familiar with laboratory results like direct and indirect total serum (blood) bilirubin.

  - ❑ Registered nurses and the sub-professional nurses should note that where the phototherapy fails to lower the total serum bilirubin a blood exchange should be done.

5.3.2 Objective 2

The second objective reads as follows:

To explore and describe the environment related factors associated with neonatal death.

With the second objective three (3) variables were assessed namely:

- Residential area

- Place of delivery

- Personnel assisting during delivery

5.3.2.1 Conclusion

From the environment related factors that were assessed, no variable was found to be associated with neonatal deaths.

5.3.2.2 Recommendations with regard to Objective 2

Although the research findings of this retrospective study could not reveal some of the issues such as residential area (urban and rural), place of delivery (home delivery and hospital delivery) and the characteristics of the place of delivery (personnel, equipment and philosophy) as associated with the incidence of neonatal deaths, these possibilities need to be addressed and accommodated in future policies, such as;

- Health facilities need to be at reasonable walking distances throughout the region.

- Outreach services of obstetric care need to be extended to the community to improve access and reduce neonatal deaths.

- All pregnant mothers need to be encouraged to deliver their babies at health facilities where trained health workers can attend them to, in order to minimise complications.

- Efforts should be made to ensure that every health facility has functional obstetrical

equipment including laboratory equipment.

5.3.3 Objective 3

The third objective reads as follows:

To explore and describe the time related factors associated with neonatal deaths

In this item three (3) variables were presented and conclusion drawn. These are duration of labour, gestational age and Apgar score. A significant difference was found between the sample and the control group with regard to all the variables mentioned as associated with neonatal deaths. They are depicted in Table 5.3

Table 5.3 The time related factors considered to be associated with neonatal deaths

Factor	Chi- squire	Comments
Duration of labour	X^2 41.213,p<0.001	Any labour that exceeds twelve (12) hours increases the incidence of neonatal deaths
Apgar score at one minute	X^2=15.088,p<0.001	A neonate's Apgar score of less than seven (7) at one minute is associated with an increase in neonatal deaths
Apgar score at five minutes	X^2=36 723,p<0.001	A neonate's Apgar score of less than seven (7) at five minutes is associated with an increase in neonatal deaths

5.3.3.1 Conclusion

These findings, as indicated in Table 5.3 and concluded in some other studies quoted in the literature, are considered to be associated with an increase in neonatal deaths.

With regard to duration of labour the studies of Hughey (2001:4) and Sellers (2003:1357) were cited and concluded that any labour that exceeds 12 hours increases the incidence of neonatal deaths (See Chapter 2, point 2.5.1.2 p: 54).

Similarly the Apgar score was addressed in the studies of Woods (1996:1) and Osmond & Murphy (1998:2)(see Chapter 2, point 2.5.2.p: 57). These authors cited that any Apgar score of less than 7 at one or seven minutes is strongly correlated with the possibility of neonatal deaths.

Therefore for this study it was concluded that the time related factors were found to be associated with neonatal deaths.

5.3.3.2 Recommendations with regard to Objective 3

These recommendations will be based on the conclusions that were made. These conclusions were reached due to the degree of statistical significance that these factors obtained.

- Encourage and improve the use of a patogragh for every woman who delivers in the health facility.

- Programmes are needed to re-educate health workers in the improvement of identifying and managing malpresentation and prolonged labour. In this regard every pregnant woman should know the signs and symptoms of true labour.

- Health education should be given to the community on the importance of early booking for ANC.

5.4 Summary

In this chapter the items (factors) that were considered to be associated with the incidence of neonatal deaths were analysed, conclusions were drawn and recommendations made, item by item. The chapter ended with the recommendations regarding Apgar score at one and five minutes.

6. Limitations of the study

This study was contextual in nature and therefore cannot be generalised to the broader region or country.

The philosophy of the institution was not possible to assess with regard to its association with neonatal deaths. This includes to a certain degree the knowledge, skills and attitudes of health workers.

The researcher is also cognisant of the inherent socio-economic factors that are hidden, and that they might have varied and complicated effects on the findings. To a certain extent this aspect was taken into consideration by including the total population and executing a probability sampling for the control group.

7. Further research

A comparative descriptive design is also used to generate hypotheses. It would be possible to formulate hypotheses to test all the factors for which statistically significant associations have been found. In this manner a possible "cause-effect" relationship might be found that could lead to

more in-depth interventions.

It is also recommended that this study should be repeated, but in another region/hospital. This could only contribute to the possibility of generalisations

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ANNEXURE A: A LETTER TO THE MATRON

<div style="text-align: right">

P.O. Box 2578
Ngweze
Katima Mulilo
10 October 2005

</div>

The Matron
Katima Mulilo State Hospital
Nursing Services
Private Bag 1081
Ngweze

Dear Madam

SUBJECT: PERMISION TO CONDUCT RESEARCH IN MATERNITY WARD

I am a registered nurse in Katima Mulilo State Hospital doing a Masters Degree in Public Health (MPH) at the University of Namibia (UNAM).

The health information system in Katima Mulilo Hospital has always reflected a high number of neonatal deaths and showed a tremendous increase from 2001 to 2002. Despite all the reproductive health programmes which are being conducted in the region by both the Ministry of Health and Social Services (MOHSS) and other none governmental organizations (NGO'S), the neonatal deaths still accelerates.

This worrying situation has triggered me to carry out a study on factors associated with neonatal deaths in Katima Mulilo State Hospital. I am planning to use patients' files, meaning it will be a retrospective study.

The outcome of this study will be a benefit to the health facilities by improving the incidence of neonatal deaths but mostly to the community at large that is losing their precious babies.

Thank you

Yours sincerely
Christina Liomba (Registered Nurse)

ANNEXURE B: PERMISSION FROM THE MINISTRY

REPUBLIC OF NAMIBIA

Ministry of Health and Social Services

Private Bag 13198	**Ministerial Building**	**Tel:** (061) 2032125
Windhoek	**Harvey Street**	**Fax:** (061) 272286
Namibia	**Windhoek**	**E-mail: amuheua@mhss.gov.na**
Enquiries: Mr. A. Muheua	**Ref.:** 17/11	**Date:** 23 Sept. 2005

OFFICE OF THE PERMANENT SECRETARY

Ms. Christina Liomba
P.O. Box 2578
Katima Mulilo State Hospital

Re: Study; Factors associated with neonatal death in Katima Mulilo state hospital

1. Reference is made to your application to conduct the above-mentioned study.

2. The proposal has been evaluated and found to have merit.

3. Kindly be informed that approval has been granted under the following conditions:
3.1 The data collected is only to be used for academic purposes;
3.2. A quarterly progress report is to be submitted to the Ministry's Research Unit;
3.3. Preliminary findings are to be submitted to the Ministry before the final report;
3.4. Final report to be submitted upon completion of the study;
3.5. Separate permission to be sought from the Ministry for the publication of the findings.

Wishing you success with your project.

Yours sincerely,

DR. K. SHANGULA
PERMANENT SECRETARY

Directorate: Policy, Planning and HRD

ANNEXURE C: CHECKLIST OF FACTORS ASSOCIATED WITH NEONATAL DEATHS

1.PERSON RELATED FACTORS

1.1.MOTHER

1.1.1.AGE

	Cases	Controls
• 17 – 35 years		
• < 17/36 years and more		

1.1.2.GRAVIDA/PARITY

• 0-1		
• 2-4		
• 5 and above		

1.1.3 ANC BOOKINGS

• Booked		
• Unbooked		

1.1.4 MOTHER'S COMPLICATIONS

• Complications		
• Non complications		

1.1.5 MODE OF DELIVERY

• Normal vaginal delivery		
• Abnormal delivery		

1.2. THE NEONATE

1.2.1.GENDER

• Male		
• Female		

1.2.2.BIRTH WEIGHT

• 500g- 2499g		
• 2500g and more		

1.2.3.NEONATE'S COMPLICATIONS

• Birth Asphyxia		
• Prematurity		

2. ENVIRONMENT RELATED FACTORS

2.1.RESIDENTIAL AREA

Urban area		
Peri-urban area		
Rural area		

2.2. PLACE OF DELIVERY

• Home/Clinic		
• Hospital		

2.3.PERSONNEL ASSISTING DURING DELIVERY

• Doctors		
• Nurses/Midwives		
• Relative		
• TBA's		

3. TIME RELATED FACTORS

3.1. GESTATIONAL AGE AT FIRST TIME OF BOOKING

0 – 28 weeks		
29 - More		

3.2.DURATION OF LABOUR IN HOURS

• <12 Hours		
• 12 Hours and more		

3.3. GESTATIONAL AGE AT TIME OF DELIVERY

• 28-36 weeks		
• 37-40 weeks		

3.4.BABY'S APGAR SCORE IN ONE MINUTE

• 1-6		
• 7-10		

3.5.BABY'S APGAR SCORE IN FIVE MINUTES

• 1-6		
• 7-10		