

**TRENDS AND DETERMINANTS OF INTRAPARTUM STILLBIRTH IN THE PUBLIC
HEALTH FACILITIES OF ADDIS ABABA, ETHIOPIA**

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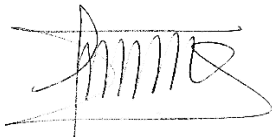
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DECLARATION

I declare that **TRENDS AND DETERMINANTS OF INTRAPARTUM STILLBIRTH IN THE PUBLIC HEALTH FACILITIES OF ADDIS ABABA, ETHIOPIA** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.



18 November 2017

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TRENDS AND DETERMINANTS OF INTRAPARTUM STILLBIRTH IN THE PUBLIC HEALTH FACILITIES OF ADDIS ABABA, ETHIOPIA I

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ABSTRACT

This study aimed to assess the magnitude, trends and determinants of intrapartum stillbirths in the public health facilities in Addis Ababa. A case-control study design was used along with quantitative data collection methods. Obstetric care data on key variables were collected from medical records of 728 cases and 1551 controls in the public health facilities during July 1, 2010 and June 30, 2015. Data were analysed using SPSS version 24 to determine associations and risk factors against intrapartum stillbirth. HMIS data from different sources were further analysed for the same period to determine trends of stillbirth in the public health facilities of Addis Ababa.

Findings from this study showed a staggering high prevalence of stillbirth at an average rate of 28 per 1000 births during the period 2010-2015. This figure was comparable with the population level prevalence of prenatal death in Addis Ababa which was 30 per 1000 birth (Central Statistical Agency 2011:115).

No statistically significant associations were revealed against the effects of maternal medical conditions including diabetes, hypertension, cardiac and renal diseases and key socio-demographic variables including age, parity and marital status, and intrapartum stillbirth. On the contrary, HIV and syphilis infections, foetal presentations, multiple pregnancy and the frequency of ANC visits during the index pregnancy had statistically significant associations with intrapartum stillbirth.

Furthermore, low FHR, non-vertex foetal presentations and ruptured cervical membrane on admission to labour were among risk factors for intrapartum stillbirth. Similarly, women in the stillbirth group received substandard care regarding the timely assessment of foetal decent, cervical dilatation, labour induction, and episiotomy care compared to women in the livebirth group. Obstetrical complications including obstructed labour, eclampsia and preeclampsia were more common among women in the intrapartum stillbirth group indicating that the above variables were key determinant of intrapartum stillbirth. These

findings suggest that poor quality of obstetric care during labour and childbirth were the underlying risk factors for intrapartum stillbirth.

In conclusion, strategies to overhaul the obstetric care practices in the public health facilities through skills building, accurate use of labour monitoring tools, close supervisions, accurate classification of stillbirth, proper documentation, and ongoing research efforts.

Key words:

Addis Ababa; antenatal care (ANC); Classification; FHR; foetus; health facilities; intrapartum stillbirth; labour monitoring; livebirth, maternal health; partograph, pregnancy; public.

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Dedication

This thesis is dedicated to my late mother, Kebebusi Kinfemichael, and all the great women of Africa who endured trauma, grief, and neglect from skilled and unskilled helpers while graciously fulfilling the most noble call of humanity; giving birth to ensure continuity of human race on the planet earth.

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LIST OF ABBREVIATIONS

AARHB	Addis Ababa Regional Health Bureau
ACOG	American College of Obstetricians and Gynaecologists
ANC	Antenatal Care
aOR	Adjusted Odds Ratio
BEmONC	Basic Emergency Obstetric and Neonatal Care
BOLD	Better Outcomes in Labour Difficulty
BP	Blood Pressure
CEmONC	Comprehensive Emergency Obstetric Neonatal Care
CI	Confidence Interval
CODAC	Cause of Death and Associated Condition
CPD	Cephalo-Pelvic Disproportion
DHS	Demographic and Health Survey
ENC	Essential Newborn Care
FHR	Foetal Heart Rate
FHRM	Foetal Heart Rate Monitoring
FMOH	Federal Ministry of Health
GBD	Global Burden of Disease
HDN	Haemolytic Disease of the Newborn
HIV	Human Immuno-Deficiency Virus
HMIS	Health management Information System
ICD	International Classification of Disease
ICFD	Initial Cause of Foetal Death
ICT	Information Communication Technology
IUGR	Intra Uterine Growth Restriction
LMIC	Low-Middle Income Countries
MDG	Millennium Development Goals
OR	Odds Ratio
PROM	Premature Rapture of Membrane
PSANZ-PDC	Perinatal Society of Australia and New Zealand Perinatal Death Classification
RCT	Randomised Controlled Trial
ReCoDe	Relevant Conditions at Death
SDG	Sustainable Development Goals
SELMA	Simplified, Effective, Labour Monitoring-to-Action
SOP	Standard Operating Procedures
SPSS	Statistical Package for Social Science

UK	United Kingdom
UNFPA	United Nation Fund for Population
UNICEF	United Nation Children Fund
USA	United States of America
USAID	United States Agency for International Development
VE	Vaginal Examination
WHO	World Health Organization

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

Stillbirth is defined as a baby born after the 24th week of pregnancy who did not at any time breathe or show any other sign of life after being completely removed from the mother (Fraser & Cooper, 2009:102). This definition varies across different countries and regions of the world depending on the level of expertise and capabilities of the health systems to accurately account for stillbirth incidents. According to the World Health Organization (WHO), stillbirth is the birth of a baby with a birthweight of 500 g or more, 22 or more completed weeks of gestation, or a body length of 25 cm or more, who died before or during labour and birth. For international comparisons, WHO recommends reporting of stillbirths with birthweight of 1000 g or more, 28 weeks' gestation or more, or a body length of 35 cm or more, commonly reported as third-trimester stillbirths (Frøen, Cacciatore, McClure, Kuti, Jokhio, Islam & Shiffman, 2011:1353-1366).

Stillbirth is one of the adverse outcomes of pregnancy that is less accounted for and gets relatively lower attentions at both policy and implementation levels. For instance, stillbirths are not accounted for in the Global Burden of Disease, disability-adjusted life-years lost and in the UN Millennium Development Goals (MDGs). Even the recently established Sustainable Development Goals (SDGs) and targets that have been declared in 2015 are not explicit about any focused commitment to reduce the global burden of stillbirth either (United Nations, 2015:14).

In many developed countries, the cut-off point for stillbirth definition is set at a much lower gestational age. For instance, in the United States of America (USA), stillbirth is defined as a baby born dead at the gestational age of 20 weeks or birthweight of 350 g. Accurate timing of gestational age is less reliable in many developing countries because of the low health literacy level. That is why birthweight based cut-off point for stillbirth definition is more common. Furthermore, because even live-born infants weighing <1000 g frequently do not survive owing to underdeveloped health care and limited technological facilities, many developing countries use 1000 g as the lower weight limit for defining a stillbirth.

Lowering the cut-off points in gestational age or birthweight for stillbirth definition would obviously increase the magnitude in developing countries thereby presenting a true picture of the global burden of stillbirth (McClure, Saleem, Pasha & Goldenberg, 2009:183).

Globally, nearly 2.6 million third trimester stillbirths occur each year. Notwithstanding the gestational age cut-off, stillbirth can occur either during antepartum or intrapartum period. Evidence shows that most of these stillbirths can be prevented through the correct application of clinical skills and public health tools making the current high prevalence unacceptable, particularly in developing countries. There is a high variation in stillbirth rates with low-income sub-Saharan African and South East Asian countries reporting the highest rates, ranging from 20 to 40 per 1000 births, nearly 10-fold higher than those documented in high-resource settings. Approximately 98% of all stillbirths occur in low and middle-income countries (LMIC). Studies confirm that the huge variation that ranges from 2 per 1000 total births in Finland to 40 per 1000 birth in Nigeria and Pakistan; a condition that might depict disparities in the level of quality of maternal and perinatal care services (Lawn, Blencowe, Pattinson, Cousens, Kumar, Ibiebele, Gardosi, Day & Stanton, 2011:1448).

Moreover, stillbirth has enormous social, economic and health significance in societies. The complex socio-cultural phenomena including grief, stigma, blame, marginalisation, and absence of recognition or rituals are believed to bear considerable emotional and mental health effects on people experiencing stillbirth (Frøen et al. 2011:1353). A book titled "They were Still Born", by De Costa (2011:1308) describes the event as dual silence. "First, the silence of the birth itself. There were no cries of joy and no wailing baby. No oohs and aahs from the nurses. Just silence. Then there is the much longer silence that surrounds the parents as they go home and try to live again. Silence from relatives, friends, and colleagues who don't know what to say, or feel that the loss of a baby before birth doesn't quite equate to the loss of a living child" (De Costa, 2011:1308).

Despite achieving remarkable results in relation to many health indicators including reducing maternal and child mortality over the last decade, Ethiopia remains one of the 10 high-burden countries accounting for two-third of global third-trimester stillbirth with estimated rate of more than 25 per 1000 births (Lawn et al. 2011:1448). The Ethiopian Demographic and Health Survey (DHS) (2011) further indicates that the country had

experienced 46 perinatal deaths per 1000 total birth annually in the 5-year period preceding the survey. Despite relatively better access to skilled birth services in Addis Ababa, the city showed relatively higher perinatal mortality, which was estimated at approximately 30 per 1000 births for the same period (Central Statistics Agency, 2012:115). Neither the Health Management Information System (HMIS) nor national surveys like DHS provide specific descriptions on the magnitude and trends of stillbirth in Ethiopia. Compounding stillbirth with early neonatal death further obscures the required specificity in addressing the underlying causes or associated factors. Furthermore, very limited attempts have been made in Ethiopia to analyse clinical records of women who experienced stillbirth to determine the associations between intrapartum-related factors including labour monitoring, maternal and foetal medical conditions against the outcome. Therefore, this study addressed such knowledge gaps by establishing trends and magnitude as well as by assessing determinants and factors associated with intrapartum stillbirth in public health facilities in Addis Ababa, Ethiopia.

1.2 BACKGROUND INFORMATION ABOUT THE RESEARCH PROBLEM

It is important to note that the definition of stillbirth varies between countries and across regions. The choice of a definition would determine the number of deaths counted as stillbirths. As some studies show, upper middle-income countries more often use a lower gestational age cut-off point and so 'count' more babies who are not born with signs of life, while low-income and lower middle-income countries tend to use a higher gestational age cut-off point, mostly ≥ 28 completed weeks of gestation as recommended by WHO. This may be attributed to the technological advancement and ability to provide care for babies born at a certain gestational age to increase the chance of survival. Adopting a common definition of stillbirth among countries will allow for more uniform reporting with comparability across countries and would provide a clearer understanding of the extent of the problem nationally and internationally (Aminu, Unkels, Mdegela, Utz, Adaji & Van den Broek, 2014:141).

Unnecessary to say, the first day of life is the most unpredictable and delicate period of life. Mortality declines from the point of birth throughout the first days of life and generally continues to decline until late adolescence (Romola, Jeremy & Leonard, 2010:1). Furthermore, labour and birth are the time of highest risk, with an estimated 1.19 million intrapartum stillbirths globally each year. This figure accounts for approximately 50% of

the total third trimester stillbirth. Most babies who die during labour are term babies who should survive if born alive and their deaths are often associated with obstetric emergencies and suboptimal care (Lawn et al., 2011:1448).

Classifying death around time of birth is crucial to inform programmatic investment in public health. To this end, greater attention needs to be given to differentiating stillbirth from early neonatal death. The two together constitute perinatal mortality. Using a recognised classification system to categorise stillbirth events might serve two principal purposes. First, it will create improved understanding of the causes and the events that have led to the death including the identification of pathophysiological entities initiating the chain of events that irreversibly led to death, based on pathologic, clinical, and diagnostic data. Secondly, from a more pragmatic perspective, it can help describe the situations around stillbirth in terms of what happened, highlighting relevant issues that could be useful to clinicians and planners in seeking and designing tools and guides to make improvements based on the information available (Gardosi, MKady, McGeown, Francis & Tonks, 2005:1115).

Moreover, a clear understanding of the causes of stillbirth is vital to the success of programmes aimed at reducing the burden of stillbirth. This will require a more intensive programme of capacity building of healthcare providers as well as policy makers to understand and recognise the causes of stillbirth and to evaluate cases of stillbirth using audit to identify where change in practice can be and need to be made. The use of terms such as 'fresh' or 'macerated' stillbirth is now relatively common and probably the only categorisation used in many settings, particularly in the developing countries. If used correctly ('no shame no blame'), this simple classification may help in defining an approximate time of death but may not be helpful when trying to establish a more precise cause of death or other associated factors (Aminu et al., 2014:141).

Worldwide, the stillbirth rate has declined by 14%, from 22.1 stillbirths per 1000 births in 1995 to 18.9 stillbirths per 1000 births in 2009 (about 1.1% per year). The estimated trend lags behind the progress in under 5% mortality rate (2.3% per year) (Cousens, Blencowe, Stanton, Chou, Ahmed, Steinhardt, Creanga, Tunçalp, Balsara, Gupta, Say & Lawn, 2011:1319). A more recent study indicated that moderate progress had occurred in reducing the world's burden of stillbirths. Globally, total stillbirths decreased by 47% since 1990, from 4 million in 1990 to 2.1 million in 2015, and stillbirth rates dropped from 28.1

per 1000 to 14.9 per 1000 during this period. The stillbirth rates varied greatly across geographies which ranged from 1.2 per 1000 in Iceland to 56.3 per 1000 in South Sudan (Murray, Wang & Fullman, 2016:1725). Furthermore, data from recent analysis showed expansive disparity across geographies, which ranged from 1.2 per 1000 in Iceland to 56.3 per 1000 birth in South Sudan. Western and central sub-Saharan Africa recorded among the highest stillbirth rates, with eight countries experiencing rates exceeding 25 per 1000 in 2015 (Lawn, Blencowe, Waiswa, Amouzou, Mathers, Hogan, Flenady, Frøen, Qureshi, Calderwood, Shiekh, Jassir, You, McClure, Mathai & Cousens, 2016:587).

Most stillbirths are avoidable as evidenced by the low stillbirth rate for developed countries of approximately 3 per 1000 births in contrast to the stillbirth rate of 28 per 1000 births in sub-Saharan Africa (Cousens et al., 2011:1319). For instance, increased coverage and quality of preconception, antenatal, intrapartum, and postnatal interventions could avert 33% of stillbirths per year. Furthermore, skilled birth attendance would avert intrapartum related neonatal mortality by 25% while Basic Emergency Obstetric and Neonatal Care (BEmONC) and Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) can avert 40% of intrapartum-related deaths. Approximately 82% of these interventions are attributable to facility-based care which, although more expensive than community-based strategies, improves the likelihood of newborn survival (Bhutta, Salam, Lassi, Austin & Langer, 2014:8-22).

Many structural and programmatic factors are believed to have contributed to the slow progress regarding key positive outcomes related to facility level childbirth. According to the "three delay" model, the third delay is a supply side constraint mostly accounting for poor service quality in the facilities during childbirth. A systematic review study revealed that the health facility level constraints including infrastructure, logistics, human resource, policy and referral systems bear negative impacts on delivery of adequate and appropriate services during childbirth which in turn impacts the rates of stillbirth (Knight, Self & Kennedy, 2013:e63846).

Ethiopia has made tremendous progress towards improving maternal and child health conditions. For instance, a recent systematic review published in the Lancet indicates that Ethiopia decreased MMR from 708 to 497/100,000 LB between 1990 and 2013 (Kassebaum, Bertozzi-Villa, Coggeshall, Shackelford, Steiner & Heuton, 2014:2). Trends in neonatal mortality also shows slight decline between 2000 and 2011 (McKinnon,

Harper, Kaufman & Bergevin, 2014:e165-e173). Investments in infrastructure, human resource, supplies and logistics have made positive contributions on health outcomes. For instance, the expansion of Basic Emergency Obstetric and Neonatal Care (BEmONC) facilities in Addis Ababa has reduced the average distance to obstetric care from 5 K to 2K, which bears favourable effect on place of child birth (Mwaliko, Downing, O'Meara, Chelagat, Obala, Downing, Simiyu, Odhiambo, Ayuo, Menya & Khwa-Otsyula, 2014:212).

The Health System and Overview of Stillbirth in Ethiopia

The FMOH document indicated that Ethiopian health service is restructured into a three-tier system; primary, secondary and tertiary level of care. In the urban context such as Addis Ababa, the primary level of care includes mainly public health centres that are designed to serve up to 40,000 population in a defined catchment area. At secondary tier level, a general hospital provides in-patient and ambulatory services to an average of 1,000,000 people with staffing capacity of approximately 234 professionals. Public health facility at this level serves as a referral centre for health centres and primary hospitals, a training centre for health professionals including health officers, nurses and emergency surgeons. Relevant public documents stipulate that the country had achieved many MDG goals. These include a 67% drop in under-five mortality, increased life expectancy from 45 to 64, a 69% decrease in maternal mortality and remarkable improvement in contraceptive prevalence rate from 3% to 42% that led to a drop in total fertility rate from 7.7 in the 1990s to 4.1 in 2014 (FMOH, 2015a:12).

The health system in Ethiopia has launched several initiatives to address some of the structural barriers in improving the quality of facility level health care services. For instance, the health care financing reform that was introduced in 2011 has enabled public health facilities to retain revenues generated from service fees, which can be utilised to improve infrastructures and supplies. The provision further grants exemptions of fees for critical services related to childbirth in the public facilities, which partly addresses financial barrier to quality intrapartum care (USAID, 2011:15). The government has also taken positive steps to train and deploy skilled birth attendants across the country. For instance, the proportions of skilled birth attendant to 100 deliveries in Addis Ababa is twice higher than the WHO recommended standard (FMOH, 2014:15).

Despite these positive interventions, considerable gaps in competency and motivation of skilled personnel in providing midwifery services particularly in the public health facilities persisted. Evidence shows that gaps exist at the level of curriculum for certain health workers including nurses, whereas for the others such as midwives the problem might be related to the transfer of skills during training and subsequent attachments to ensure that the desired level of competencies pertinent to emergency obstetric care are acquired before deployment (Fullerton, Johnson, Thompson & Vivio, 2011:308).

Given that intrapartum care is time-sensitive and requires diligent and competent interventions, any slightest neglect could claim lives. For instance, a Caesarean section is recommended to take place within 30 minutes of diagnosis of foetal distress to avoid any adverse outcomes (FMOH, UNICEF, UNFPA, WHO & AMMD, 2010:30). To this effect, lack of prompt attention in the public health facilities poses greater challenge to the efforts of reducing intrapartum stillbirths in Ethiopia, particularly in Addis Ababa. A study reported that women could wait on average 1.7 hours to receive care after reaching health facility in Addis (Mirkuzie, Hinderaker, Sisay, Moland & Mørkve, 2011:275).

Studies further indicate that the absence of effective referral system between the different levels of health facilities providing obstetric care could contribute to the delays in receiving adequate and appropriate care (Afari, Hirschhorn, Michaelis, Barker & Sodzi-Tettey 2014:e005052). More importantly, obstetric care has been decentralised in Ethiopia. For instance, in Addis Ababa, the BEmONC facilities are the first contact points for the continuum of maternal and perinatal care and supposedly providing most antenatal, intrapartum and postpartum services while hospitals provide more specialised and comprehensive obstetric services mostly based on referrals.

Another study also reported that the proportion of intrapartum referrals in the BEmONC facilities in Addis Ababa was 42% (Mirkuzie et al., 2011:275). This evidence shows that over diagnosing obstetric complications are commonplace in the BEmONC facilities potentially signalling the competence and confidence gaps among providers. In a maternal audit in Malawi, negative obstetric outcomes were observed when the assigned skilled attendants are lacking the competences and motivation to monitor women in labour, to make correct diagnosis, to give prompt attention and when they delay to refer women who require critical care (Viva Combs, Tarek, Johanne & Address, 2014:16).

In general, it is assumed that multiple factors including service providers' skills and motivation, maternal and foetal conditions, facility level infrastructures, and supplies have contributed to the relatively high prevalence of stillbirth in Ethiopia. However, very limited evidence exists as to why women who commenced labour in public health facilities with indications of live foetus on admission to labour end up losing their babies during the childbirth process. This study reviewed medical records of women who experienced stillbirth in the public health centres and hospitals in Addis Ababa over the five-year period, June 2010–July 2015. Moreover, key determinants of pregnancy outcome including previous obstetric history, maternal medical conditions during antenatal period and types and timing of intrapartum care interventions for cases of stillbirth were assessed and analysed against similar variables of women who experienced livebirth in the same facilities over the same period.

1.3 RESEARCH PROBLEM

There is a gap in establishing the trends, magnitude, determinants, and factors associated with intrapartum stillbirth in Ethiopia. In particular, very little scientific studies have been undertaken to establish evidence on factors associated to the disproportionately higher magnitude of intrapartum stillbirth occurring in the health facilities in Ethiopia. Furthermore, there is a great deal of confusion in differentiating an intrapartum stillbirth from early neonatal death in the public health facilities in Ethiopia (FMOH, 2008:20). In general, the following points constitute the main problems that prevail in Ethiopia regarding the study topic:

- Relatively high burden of stillbirth; however, facility level trends are not well documented and data not disaggregated into stillbirth and early neonatal death.
- Limited evidence on factors associated with intrapartum stillbirth occurring in health facility settings.
- Absence of clear tools and guidance to classify intrapartum stillbirth based on timing and underlying causes to enable undertaking of appropriate remedial actions against intrapartum stillbirth.

1.4 AIM OF THE STUDY

1.4.1 Research purpose

The primary purpose of this study was to explore and describe the trends, magnitude, determinants, and factors associated with intrapartum stillbirth in Addis Ababa, Ethiopia. Against this background, the study sought to contribute towards the existing body of scientific knowledge related to stillbirth in human population. The relationship between substandard uptake of prenatal services, maternal and foetal health conditions during pregnancy and at the onset of labour, suboptimal intrapartum care during labour and child birth on the one hand and intrapartum stillbirth on the other are rarely investigated in a systematic way particularly in the public health facilities in Ethiopia. Therefore, findings from this study would contribute towards addressing the knowledge gaps on the key determinants of intrapartum stillbirth. Secondly, this research will contribute to the improvement of classification and accurate documentation of stillbirth to correctly differentiate foetal deaths around the time of childbirth based on the timing and other

relevant conditions. The recommendations and framework of actions from this research are deemed to improve the responsiveness of the intrapartum care practice in the public health facility by recommending appropriate tools and actions to improve the obstetric care interventions during labour and childbirth.

1.4.2 Research objectives

The objectives of this research were as follows:

- To assess the magnitude of intrapartum stillbirth in the public health facilities in Addis Ababa, Ethiopia.
- To explore and describe trends in intrapartum stillbirth in the public health facilities in Addis Ababa, Ethiopia.
- To establish determinants and factors associated with intrapartum stillbirth for deliveries taking place in the public health facilities in Addis Ababa.
- To describe tools and standards that are necessary to improve the quality of intrapartum care and to correctly classify stillbirth in the public health facilities of Addis Ababa, Ethiopia.

1.4.3 Research questions/hypothesis

Null Hypothesis – Intrapartum stillbirth is not associated with maternal or foetal health conditions during antenatal period or labour and the type and timing of obstetric interventions during labour and delivery women giving birth in the public health facilities in Addis Ababa, Ethiopia. The following research questions have driven the process of inquiry in relation to the study topic:

- What is the magnitude of intrapartum stillbirth in the public facilities in Addis Ababa, Ethiopia?
- What is the trend of intrapartum stillbirth in public health facilities in Addis Ababa, Ethiopia?
- What are the determinants and factors associated with intrapartum stillbirth in public health facilities of Addis Ababa, Ethiopia?
- What are the feasible systems of classification for stillbirth that can be applied by the public health facilities of Addis Ababa, Ethiopia?

- What tool can remind the correct and timely application of obstetric interventions by health professionals during monitoring labour and managing delivery in public health facilities in Ethiopia?

1.5 SIGNIFICANCE

Despite the staggering high prevalence of stillbirth in Ethiopia, very little evidence exists in characterising the key factors associated with its occurrence, particularly in the public health facilities. Most importantly, evidence shows that obstetric care providers do not dispose optimum competence to apply appropriate labour monitoring tools, distinguish intrapartum stillbirth from early neonatal death which might create challenges in correctly diagnosing the underlying causes and in implementing appropriate interventions during labour or immediately after childbirth (FMOH, 2008:20; Yisma, Dessalegn, Astatkie & Fesseha, 2013:1). Although national surveys like DHS indicate population level pictures of stillbirth in Ethiopia, specific facility-based trends and magnitude are not well documented to inform the process of evidence-based clinical or public health practices. Against this background, this study of this nature has more significance.

To this effect, this study sought to generate additional information on the trends, magnitude, determinants, and factors associated with intrapartum stillbirth in the public health facilities setting in Addis Ababa, Ethiopia. Based on the findings from this study, important frameworks of actions will be proposed to improve stillbirth classification and to remind the obstetric care providers on the appropriate intervals of midwifery interventions during labour and childbirth in the health facilities. These frameworks of actions will be suggested based on the existing gaps in the recording tools and standards of obstetric practices during labour management to prevent intrapartum stillbirth and to promote correct categorisation of stillbirth based on the timing or associated clinical conditions when they occur. Accordingly, appropriate and affordable short-term and long-term action points will be proposed to classify stillbirth in the public health facilities based on the findings related to labour admission indicators and how the intrapartum monitoring interventions are being implemented in the public health facilities.

1.6 DEFINITION OF TERMS

1.6.1 Conceptual definitions

Antenatal care

The care given to a pregnant woman from the time conception is confirmed until the beginning of labour to monitor the progress of pregnancy to optimise maternal and foetal health. The obstetric care providers are expected to facilitate woman-centred care by providing her with accessible and relevant information to help her make informed choices throughout pregnancy (Marshall & Raynor, 2014:4).

Labour

In a purely physical sense, labour may be described as the process by which the foetus, placenta and membranes are expelled through the birth canal. Furthermore, normal labour can be defined as a low risk throughout, spontaneous in onset with the foetus presenting by the vertex, culminating in the mother and infant in good condition following birth (Fraser & Coope, 2009:458).

Partograph

It is a chart on which the salient features of labour are entered in a graphic form and therefore provides the opportunity for early identification of deviations from normal. The charts are usually designed to allow for recordings at 15 minutes intervals and include: foetal heart rate; maternal temperature; pulse; blood pressure; details of vaginal examinations; strength of contractions; frequency of contractions in terms of the number in 10 min; fluid balance; urine analysis and drugs administered (Diane & Margaret, 2009:472).

Midwife

A midwife is a person who has successfully completed a midwifery education programme that is duly recognised in the country where it is located and that is based on the ICM Essential Competencies for Basic Midwifery Practice and the framework of the ICM Global Standards for Midwifery Education; who has acquired the requisite qualifications to be registered and/ or legally licensed to practice midwifery and use the title 'midwife'; and who demonstrates competency in the practice of midwifery (Marshall & Raynor, 2014:4).

Midwifery

This occupation is an art and science of caring for women undergoing normal pregnancies, labours and puerperia (Tindall, 2012:16). Midwifery entails skilled, knowledgeable, and compassionate care for childbearing women, new born infants, and families across the continuum throughout pre-pregnancy, pregnancy, birth, postpartum, and the early weeks of life (Renfrew, McFadden, Bastos, Campbell, Channon, Cheung, Silva, Downe, Kennedy, Malata, McCormick, Wick & Declercq, 2014:1129).

Stillbirth

A baby delivered after 28th week of pregnancy who has not, at any time after being completely expelled from mother, breathed or shown any sign of life (Tindall, 2012:16)

1.6.2 Operational definitions

Macerated stillbirths

Macerated stillbirths are those with signs of maceration at delivery including skin and soft-tissue changes such as skin discoloration, redness, sloughing of skin, and overriding of cranial sutures (McClure, Saleem, Goudar, Moore, Garces, Esamai, Patel, Chomba, Althabe, Pasha, Kodkany, Bose, Berreuta, Liechty, Hambidge, Krebs, Derman, Hibberd, Buekens, Manasyan, Carlo, Wallace, Koso-Thomas & Goldenberg, 2015:7).

Intrapartum stillbirth

Intrapartum stillbirth is defined as the delivery of any foetus after 28 weeks of gestation, or with a birth weight more than 1000 g, who had detectable foetal heart sounds upon admission, but died during the intrapartum period and therefore had an Apgar score of 0 at 1 and 5 min, without signs of maceration (Ashish, Johan, Uwe, Robert, Jageshwar, Gehanath, Kedar & Mats, 2016:2).

Basic Emergency Obstetric and Newborn Care (BEmONC)

A care provided to pregnant mothers and newborn babies at primary health facility level by improving the availability, accessibility, quality and use of services for the treatment of complications that arise during pregnancy and childbirth. These services might include antibiotics, oxytocic drugs, anti-convulsant, manual removal of placenta, removal of retained products of conception, assisted vaginal delivery and newborn care (Federal Ministry of Health, 2013:16).

Comprehensive Emergency Obstetric and Newborn Care (CEmONC)

A care provided to pregnant mothers and newborn babies at higher health facility level by improving the availability, accessibility, quality, and use of services for the treatment of complications that arise during pregnancy and childbirth. These include all services provided at BEmONC facilities plus emergency surgery (Caesarean Section) and blood transfusion (Federal Ministry of Health, 2013:16).

1.7 THEORETICAL FOUNDATION OF THE STUDY

1.7.1 Theoretical framework

This study presupposes that as an adverse outcome of pregnancies, intrapartum stillbirth has series underlying causal mechanisms. Understanding the pluralistic concepts of causality from both philosophical and scientific perspectives as well employing the positivist paradigm that cause-effect relationship can be observed through the application of scientific methods are considered as guiding frameworks to explain phenomena underpinning the occurrence of intrapartum stillbirth in health facilities.

1.7.1.1 Causality

In his book entitled, “The Theory of Causality: from Antiquity to Present”, John Losee (2011:35-36) presents three critical questions on the essence and definitions of causality: What types of entities qualify as “causes” and “effects”?; What is the relationship between cause and effect?; and How are causal claims to be assessed? (Losee, 2011:101). These questions are applicable to both philosophical and scientific disciplines in the pursuit of establishing knowledge as to why things occur the way they exist. In the context of studying the determinates of intrapartum stillbirth in the health facilities in Ethiopia, these questions would be equally relevant in seeking to understand why a pregnant woman who arrived in a health facility with live foetus lost her baby during the process of childbirth.

- What are the physiological, biological, socio-economic, demographic, cultural, medical, or environmental factors attributable to a stillbirth outcome and how these could have been averted?
- Did any of the underlying factors played separately or in combination to cause the stillbirth and how did they interact to bring the outcome?
- Would it be possible to detect any of these potential causal associations to intrapartum stillbirth in the documented maternity care records?
- What methodological approach should be used in pursuit of identifying the underlying factors that might have been responsible for the occurrence of stillbirth?

Several epidemiological studies have successfully developed illustrative models to show the underlying factors associated with morbidity and mortality in human population. For instance, the three-delay model that is presented below is one of the important perspectives that helped in the analysis of establishing the underlying causes of maternal mortality. Despite the fact that this model was developed long ago, the concepts behind still have strong relevance to the context of stillbirth (Thaddeus & Maine, 1994:1091).

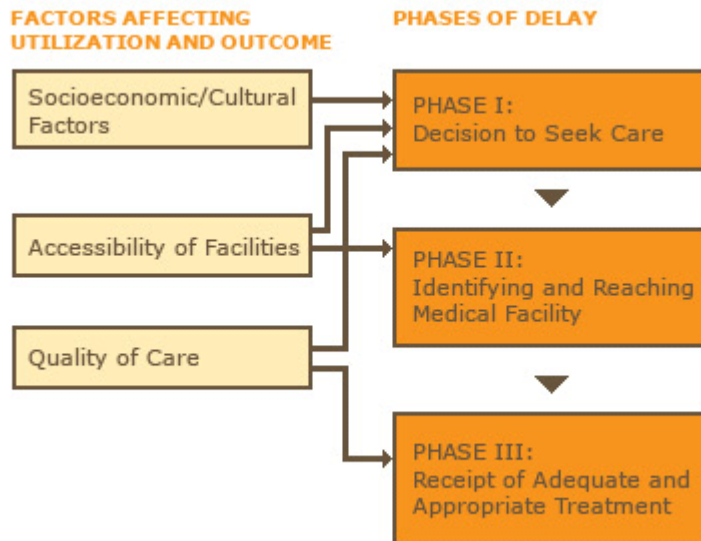


Figure 2.1 The Three Delay Model in the context of maternal mortality
(UNFPA, 2014)

According to the above model, stillbirth, as an outcome of a pregnancy, can result from delays in seeking maternity care by women in labour or due to poor quality intrapartum services at health facilities which in turn might occur owing to low competence and/or lack of motivation by health care workers or shortage of supplies and equipment.

However, establishing causal links between exposures and outcomes in the context of human health is not an easy and straightforward process. For instance, diagnosing the exact cause of intrapartum stillbirth would take a combination of advanced technological, clinical and biomedical capabilities which are hardly available particularly in developing countries like Ethiopia. As one of its important goals, epidemiologic studies offer alternative possibilities in detecting the underlying causes or factors associated with morbidity and mortality. This approach has immense practical significance in public health as understanding the causes of morbidity and mortality would lead to a more effective prevention, treatment, and control measures and consequently to the reduction in disease incidence, prevalence, or severity (Oleckno, 2008:55).

The distinction between association and causal factors underlying any morbidity and mortality is of paramount importance in improving health outcomes. In the context of epidemiological studies, exposure can be referred as any potential risk factor including environmental, pathological, behavioural, genetic, physiological, or health service quality that have the capability to cause disease or health-related occurrences called outcomes.

Oleckno (2008:180) argues that a statistical association between a given exposure and outcome is the starting point for consideration of a causal relationship in epidemiology. A statistical association implies that the exposure is related to a change in the probability of the outcome. However, it does not automatically mean that the exposure causes the outcome, rather it only implies that those with the exposure are likely to develop the outcome (Oleckno, 2008:55).

Furthermore, the strength of an epidemiological study is often measured by its ability to determine a causal link between exposures and outcomes. Experimental design is believed to be a superior framework in establishing causal relationships. However, a few other observational study designs including Cohort and Case-Control also add critical value in determining strong associations between exposures and outcomes (Katz, Elmore, Wild & Lucan, 2014:408).

Therefore, perspectives related to associations and causal links to health outcomes in the context of epidemiological studies have guided the design and conduct of this current study. By using a case-control study design, which is one of the observational designs, this study sought to describe and analyse factors associated with the occurrence of intrapartum stillbirths in the public health facilities of Addis Ababa. Medical records of women who experienced intrapartum stillbirth in the public health facilities will be reviewed to determine if any of the clinical, medical, demographic, or maternal care interventions during intrapartum period had association with the stillbirth outcome. These variables were analysed in comparison with data from women who experienced livebirth in the same facilities and during the same period.

1.7.1.2 Post-positivist paradigm

Creswell (2014:3) asserts that the overall decision in research undertaking involves which approach should be considered for a given study topic. This decision should be informed by the philosophical assumptions the researcher brings to the study; procedures of inquiry called research designs; and specific research methods of data collection, analysis, and interpretation. Accordingly, four distinct philosophical perspectives or worldviews are relevant to research undertakings. These include post-positivist, constructivists, transformative and pragmatic. These perspectives shape the type of research designs and data collection methods chosen to undertake a study. For instance, post-positivist

paradigm involves a deterministic philosophical outlook that assumes causes determine effects or outcomes. Therefore, the problems studied by post-positivists reflect the need to identify and assess the causes that influence outcomes (Creswell, 2014:3).

The second guiding framework for this study comes from the post-positivist paradigm that underpins the process of empirical observations mostly using quantitative methods. Grounded on post-positivist theoretical perspective, therefore, this research assumed that there are multiple variables contributing towards the occurrence of intrapartum stillbirth in the public health facilities in Ethiopia. This perspective is chosen because it is more appropriate to undertake quantitative analysis that helps to establish the causal relationships or associations between different variables using statistical tools and principles. To this effect, this study used quantitative data to determine if some of the key variables including maternal risk factors, foetal risk factors and intrapartum interventions have any association with the occurrence of intrapartum stillbirth. This theoretical perspective would guide the behaviour of the overall study orientation including literature review, data collection instruments, presentation of data, discussion of the findings and the formulation of recommendations. More detailed description of the theoretical framework informing this study is presented in Chapter 2.

1.8 ASPECTS RELATED TO THE RESEARCH DESIGN

1.8.1 Research design

According to Creswell (2014:3), research approaches are plans and procedures for a research undertaking that maps out the steps from broad assumptions to detailed methods of data collection, analysis and interpretation. The overall decision involves which approach should be used to study a topic. Informing this decision should be the philosophical assumptions the researcher brings to the study; procedures of inquiry (called research designs); and specific research methods of data collection, analysis and interpretation (Creswell, 2014:3).

According to Perri and Bellamy (2011:10), a research design means the specification of the way in which data would be created, collected, constructed, coded, analysed, and interpreted to enable the researcher to draw descriptive, explanatory or interpretive results from the process (Perri & Christine, 2012:10). Therefore, research design serves

as a blueprint dictating the process of collecting, analysing and interpreting data in a research undertaking.

As indicated in the theoretical framework section above, a research design can be influenced by the underlying philosophical assumptions. For instance, analytical research designs including cohort or case-control and experimental design are more suitable to positivist theoretical worldviews that prefer the collection, analysis and interpretation of quantitative data to explain causal or associational relationship between different variables. The following figure presents the bi-directional interlinks between research design, methods and theoretical frameworks.

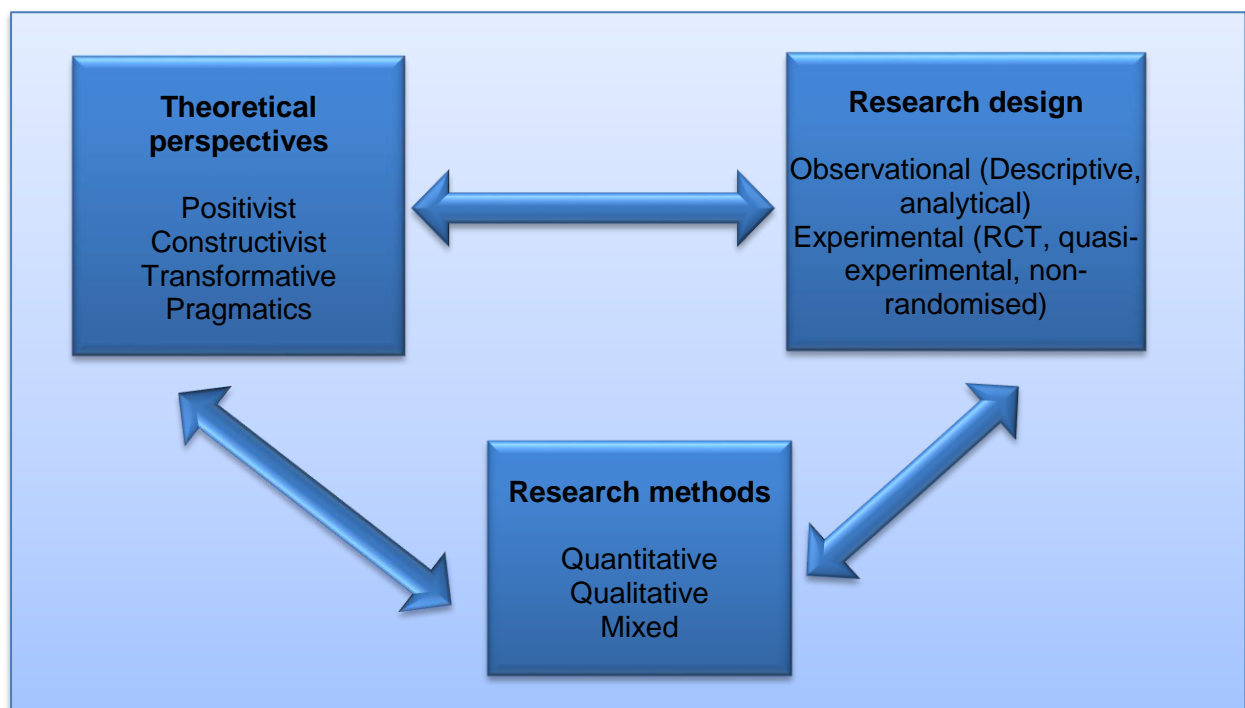


Figure 1.2 The interaction between theoretical perspectives, research design and research methods

(Creswell, 2014:3)

Epidemiologic studies mostly focus on the quantitative methods, leaning towards the positivist theoretical framework. They can be broadly classified as observational or experimental. In observational studies, the investigators simply observe the subjects as they naturally divide themselves by potentially significant variables or exposures. There is no direct intervention. These studies include both descriptive and analytic designs. Cohort (prospective or retrospective), Case-control, cross-sectional and ecological study

designs are among the observational categories of the epidemiologic studies. Conversely, in experimental studies, the investigators control the conditions of the experiment, including the subjects' exposure, by selecting and employing one or more interventions. Randomised Controlled Trial (RTC), quasi-experimental and non-randomised experimental studies fall under the experimental epidemiologic design (Oleckno, 2008:55).

This current study used a case-control design, which is the non-experimental quantitative approach that is commonly employed for epidemiologic inquiries. The study aimed at exploring the determinant underlying the intrapartum stillbirth for mothers who attended childbirth in public health facilities in Addis Ababa. The case-control design is most appropriate for this study owing to its relevance in studying multiple underlying factors simultaneously that might have causal association with a disease or health outcome. This study method is also well suited to investigations of risk factors for rare diseases, where, otherwise, there may well be problems in generating a sufficient number of diseased people to produce accurate results (Woodward, 2014:23).

1.8.2 Research method

This study uses a quantitative research method. Accordingly, quantitative data on key variables were collected from facility records of mothers who had given birth in the public health centres and hospitals of Addis Ababa from Jul 1, 2010–June 30, 2015. Key variables including foetal hear rate and condition of uterus during admission for labour in the health facilities; time of admission; intrapartum care interventions including monitoring foetal heart rate, cervical dilatation, maternal vital signs, time of delivery and status of the baby at birth will be reviewed from the intrapartum care charts and appropriately transferred to the data collection instrument. A structured questionnaire that contained all the variables indicated in the maternity care services, including during antenatal and intrapartum period were developed to capture relevant date from the records retrospectively.

One advantage of selecting cases and controls retrospectively in a case-control study is that the investigator can go back as far as needed to get sufficient number of cases, which is why this study collects data over the five-year period. Using medical records to collect

data further reduces the burden of tracing cases or controls in their residences to undertake data collection.

The chart review in this study covered cases of intrapartum stillbirth that took place in the target facilities over the five years' period ranging from 2010 to 2015. In 2010, 26 public health centres offered Basic Emergency Obstetric and Neonatal Care (BEmONC) in Addis Ababa (FMOH 2010:68) out of which 20 were selected for this study. Similarly, chart reviews were conducted in three out of the five public hospitals in the city where Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) have been provided since 2010.

The number of public health facilities particularly health centres that provide BEMOC or CEMOC have increased since 2010. However, this study focused only on those facilities that were active since the base reference time (2010) to ensure consistency in data capturing. In this regard, public health centres without any annual cases of stillbirth will be omitted whereas public hospitals under the Addis Ababa City Health Bureau that did not provide maternity care since 2010 were also excluded from this study.

The case-control study design requires that comparison should be made between data obtained from subjects with the outcome of interest and those experienced similar exposures however did not develop the outcome. The later groups are referred to as controls. Therefore, this study selected appropriate control groups of women who had given livebirth in the public health facilities during the period in reference. Both cases and controls for this study were selected based on the definition described in the next section.

1.8.2.1 Definitions of case and control

In a case-control study design, it is imperative that both cases and control groups are clearly defined. The definition of cases needs to be consistent with the core problems that prompted the study itself (Oleckno 2008:55). The accurate definition of cases and controls further determines the criteria for inclusion and exclusion of study subjects. Accordingly, cases and controls for this study have been defined in the following manner.

- **Case:** All mothers who were admitted to maternity units for childbirth in the 20 public health centres and three public hospitals in Addis Ababa during the period

July 1, 2010–June 30, 2015; who were assisted by skilled health workers during intrapartum period; who were admitted for a childbirth with a live foetus and who experienced documented incidence of stillbirth as an outcome.

- **Control:** All mothers who were admitted to maternity units for childbirth in the 20 public health centres and three public hospitals in Addis Ababa during the period July 1, 2010–June 30, 2015; who were assisted by skilled health workers during intrapartum activities, who sought intrapartum care services in the same health facilities as cases and who did not experience any documented incidence of stillbirth as an outcome of the childbirth event.

1.8.2.2 Population and sample selection

1.8.2.2.1 Study population

In this research undertaking, the study referred to two different categories of populations. The first category is referred as target population, a population about which we want to make inferences based on samples. The entire group of individual or objects that an investigator wants to generalise the results from a study constitute a target population. Conversely, a specific group of people or objects from which data would be collected for a given research undertaking is referred as a study population (Woodward, 2014:23).

The study population for this research consists of all mothers who experienced intrapartum stillbirth while giving birth in public health facilities in urban Ethiopia. Mothers who had given birth in the public health centres and hospitals in Addis Ababa during the period July 1, 2010–June 30, 2015 were sampled and data were collected from their respective charts pertaining what was documented on their clinical record during the time of providing the intrapartum care.

1.8.2.2.2 Sampling

Once the study population is defined, the next logical step in a research process would be to determine the actual sources of data and how these would be collected. There are fundamentally two options in deciding who should be targeted for data collection. The process could either include all eligible members of the study population or taking a representative sample based on clear criteria. Several factors including cost, time and

quality of data would influence whether a complete enumeration or a portion of the study population should be considered for data collection. The determination of a study population and subsequent sampling technique in a case-control design are very much affected by who had the outcome of interest at the time of data collection. Furthermore, the study setting, whether it is a population based or facility setting also determines how sampling should be approached in a case-control study design. Details of the sampling approaches for this study will be discussed in greater depth in Chapter 3 of this thesis(Creswell, 2014:3-160).

This current study was conducted in a health-facility setting with intrapartum stillbirth as an outcome of interest. Therefore, all cases of intrapartum stillbirth that occurred in the public health facilities in Addis Ababa constituted the sampling frame for this study. This study opted to conduct a complete enumeration of all cases of intrapartum stillbirth in 20 public health centres and hospitals that taken place during the period July1, 2010–June 30, 2015. Therefore, this study included all cases of intrapartum stillbirths that were registered in the maternity care registers of targeted facilities as described under “method” section above and meeting the sample selection criteria described in the next section. As a result, all clinical charts of women who experienced stillbirth in the defined period and that qualified the selection criteria for cases were chosen as sources of data for this study.

Being a comparison design, this study focuses on sampling controls that had similar experiences in terms of the maternity care characteristics except for the stillbirth outcome. To increase its statistical power, the study selected control groups that had given birth in the same facilities and over the same period in two to one (2:1) ratio. Therefore, in each facility, two medical charts of women with livebirths were selected for each case of intrapartum stillbirth. Accordingly, the charts of control groups were selected from the registers in a random manner using lottery method. On every page where cases of intrapartum stillbirth were detected, record numbers of women with livebirth were listed and rolled on pieces of paper of which an individual other than the data collector randomly selected the required number of controls. Containing both cases and controls to the same page of the register would reduce any bias in comparison that might occur owing to difference in time or changes in the quality of service in the public health facilities over time.

1.8.2.2.3 *Sample selection*

As indicated in the sampling section above, the maternity registers in the public health facilities were taken as entry points to identify cases of intrapartum stillbirth. Once record numbers of intrapartum stillbirth cases were obtained from the maternity registers, data collector traced the actual clinical chart in the facilities' archives through the help of relevant staff. The intrapartum care charts in the public health facilities contain comprehensive information on pregnancy-related follow-ups and detailed intrapartum care interventions for each woman. Normally, the intrapartum care interventions are presented either on a Partograph or on labour monitoring sheets that can be attached to the chart where detailed descriptions of services including types and timing are written by the midwife or obstetrician in charge of each delivery. Once each chart was retrieved from the respective archives, the data collector will screen them to see their eligibility to be considered for the study based on the inclusion/exclusion criteria.

Selection of medical records of the control groups for this study was conducted concurrently with that of cases. Based on the sampling procedures described in the section above, the data collector traced the record numbers to find the actual medical charts of women in the control groups in the respective archives. The inclusion/exclusion criteria was applied to all charts to screen for eligibility. Two charts of women with livebirth that meet the selection criteria were reviewed for each case of intrapartum stillbirth.

1.8.2.2.4 *Inclusion and exclusion criteria*

Linked to the definition of cases and controls in a case-control study, it is imperative that clear criteria are set as how and why study subjects in both case and control groups would be enrolled into a study. The inclusion/exclusion criteria of cases and controls are similar except for the differentials in the outcomes (Keoghand & Cox 2014:12). The following set of criteria was used for this study to ensure only eligible charts of both cases and controls become enrolled and reviewed accordingly.

Inclusion criteria

- Birth undertaken in public health centres and hospitals in Addis Ababa.
- Age of the mother who given birth between July 1, 2010–June 30, 2015 is between

15–49 (this was referred as a standard reproductive age category and given the study relies only on chart review, ethical concerns are limited).

- Birth assisted by skilled health workers in a health facility setting.
- Complete documentation of intrapartum care intervention available.
- Foetus was alive during admission for intrapartum care.
- Mother received at least one round of ANC prior to admission for intrapartum care.

Exclusion criteria

- Mother who did not give birth in public health facilities in Addis Ababa.
- Mother who given birth between July 1, 2010–June 30, 2015 but outside of the age group 15–49.
- Mothers who were not assisted by skilled health workers during childbirth in the public health centres in Addis Ababa.
- Mother given birth in public health centres or hospitals in Addis Ababa who did not have complete documentation on intrapartum care intervention.
- Women who given birth in the public health facilities however admitted for labour with death foetus.
- Documented cases of immediate neonatal death.

1.8.2.3 Data collection

When variables are measured in a research setting, the resulting values are referred as data. There are different types of data, namely, nominal, ordinal, interval or ratio depending on the scales of measurements. Nominal scales are presented in categories or classes whereas ordinal scales present data using ranks or orders. On the contrary, interval and ratio scales take values that can be either continuous or discrete numbers (Bruce et al., 2008:6).

The data for this study were collected at all scales of measurements. For instance, the marital status of subjects were referred to in the antenatal charts to obtain a nominal scale measurement, whereas number of previous pregnancies or births were measured at an ordinal level. Many other questions in the questionnaire including age of the woman, foetal heart rate, status of cervical dilatation will generate data at interval or ratio scales.

Accordingly, data for this study were collected from medical records related to maternity care in the public health facilities in Addis Ababa. A structured questionnaire that is consistent with the detailed standard antenatal and intrapartum services recording forms in the public health facilities in Ethiopia were developed to capture data from individual medical records of women in the case and control groups. In addition, an experienced nurse with a midwife training background was employed as a fulltime data collector for a period of four months. A weeklong training that includes theoretical explanations on the data collection instruments and practical sessions on chart review at health facilities were provided to the data collector. The researcher made initial introductory visits to all selected public health facilities to introduce the data collector, secure authorisation from the facility leadership and to explain the purpose and process of data collection. Furthermore, the researcher conducted regular onsite visits to monitor the data collection process and to check the completed forms for consistence, completeness and accuracy on daily basis.

Chart reviews of all cases of intrapartum stillbirth taken place in the 20 public health centres and three hospitals in Addis Ababa from July1, 2010–June 30, 2015 were conducted until all relevant data were collected. In each target health facility, the data collector commenced data collection by reviewing the maternity register to identify cases of intrapartum stillbirth in the birth outcome column. Using the registration number, the data collector looked for the maternity medical chart of each case in the health facility archives. Each chart then reviewed using the inclusion criteria to be considered for the data collection or to be rejected if not meeting the criteria. Further intensive reviews were conducted on medical records that meet the inclusion criteria to collect data related to antenatal follow ups as well as intrapartum are interventions that were provided to women from the time of admission to the labour unit all the way to end of childbirth process.

Selection of medical charts of women in the control groups followed similar procedures in each health facility. Accordingly, for each case of intrapartum stillbirth, two records were selected randomly from the maternity registers as controls to meet the one to two (2:1) case to control ratio. Based on the registration numbers, the data collector consulted relevant health facility staff to retrieve the medical records, which were reviewed using the controls inclusion criteria. Those charts that did not meet the criteria were replaced

by another chart by randomly selecting alternatives from the same page on the maternity registers.

Based on the above procedures of identifying medical charts for cases and controls, the data collector reviewed all eligible charts for cases of intrapartum and collected data from those meeting the inclusion criteria. Similarly, charts were reviewed for control groups and data were collected from those meeting the inclusion criteria until the 2:1 control-care ratio is fulfilled.

Upon completion of collecting data from the public health facilities, the researcher further consulted with the AARHB to collect and compile annual data on stillbirth and livebirth from all public health facilities under the jurisdictions of the bureau. Furthermore, a secondary data sources were referred from the Federal Ministry of Health (FMoH) annual reports and HMIS data to complement missing elements and to get a complete picture on the trends and magnitude of stillbirth in the public health facilities of Addis Ababa during the period between 2010 and 2015.

1.8.2.4 Data processing and analysis

Data analysis is a planned process of inspecting, cleansing, transforming, and modelling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making. In addition, data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names in different disciplines including business, science, and social science domains (Wikipedia, 2017). In a research undertaking, data processing and analysis is usually performed as part of the data collection process and immediately after the completion of data collection. The analysis of data broadly consists of two phases: (1) an exploratory phase, in which measures of central tendency (e.g., means, medians), variability, and shape of distributions should be calculated and graphed; and (2) an inferential phase, in which population parameters are estimated and hypotheses about them are tested (Jerome, Arnold & Robert, 2010:454).

This study has a rigorous plan for data processing and analysis, which will be observed strictly throughout the data collection and shortly afterwards. Accordingly, data validity, consistency, and completeness checks were conducted rigorously throughout the data

collection processes. Consistent spot checks visits were undertaken in the public health facilities by the researcher to determine whether the data collector operates up to the required level of standards and as per the instructions during the data collection process. A comprehensive data entry template was created using SPSS statistical package version 24 and all data from the structured questionnaire were entered into the software by an experienced data clerk.

Following the completion of data entry, the researcher worked closely with a statistician that was hired to undertake the statistical analysis for this study. To this end, data cleaning, descriptive and inferential statistical analysis were conducted together with the statistician. Accordingly, descriptive observations on key variables were presented in tables and graphs to show distributions of different characteristics of the study population. Simple tests were conducted using the p-value to see any differentials between the stillbirth and control groups against major risk factors. Multivariate models that included all variables with $p < 0.2$ in the univariate analysis were run first followed by a stepwise multiple logistic regression analysis to determine the level of significance of risk factors including socio-demographic, maternal history, status on admission, and key intrapartum interventions.

1.8.2.5 Data and design quality: Validity and reliability

Validity in quantitative research refers to the extent to which a study accurately reflects or assesses the specific concept that the researcher is attempting to measure. Conversely, reliability refers to the extent to which any measuring procedure yields the same result on repeated trials (Hernon & Schwartz, 2009:73) . Furthermore, there are two types of validity, namely, internal and external. According to Oleckno (2008:197), the internal validity represents the degree to which the results of a study, apart from random error, are true for the source population. Conversely, external validity represents the degree to which the results of a study are relevant for populations other than the study population.

This study was conducted with outmost attention and adherence to the principles of validity and reliability. Rigorous efforts were made to ensure that the research design, sampling approaches and data collection instruments fulfil scientific standards to ensure

that the results depict the true values of the study population as well as could be modestly generalised to other relevant population in similar settings.

To this effect, all necessary measures including the development of appropriate instruments, protocols for questionnaire administration, close supervision during data collection, data entry and analysis were conducted appropriately during the design and implementation of this research to ensure data integrity. Owing to the relative strength of the case-control study design and because the study was conducted in health facility settings, which made case and control selection easier, the findings from this study could be fairly generalised to women who experienced intrapartum stillbirth in urban health facility settings in Ethiopia.

1.9 ETHICAL CONSIDERATIONS

The data collector was trained and strictly monitored on the principles of confidentiality of clients' information on the records during the process of data collection. The charts review were conducted within the respective facilities through consented authorisation of relevant leaders at each location. Individual data sources remained anonymous during data analysis and reporting. This approach helped to ensure that the research addressed ethical concerns related to research participants.

Individual institution (public health centres and hospitals) remained anonymous throughout the data analysis and reporting of the study results. However, prior written permission was obtained from the Addis Ababa Regional Health Bureau as part of the administrative approval followed by written authorisations from leaders of respective facilities which constitutes an official institutional consent for any analysis that would be conducted at individual units. The consenting process involved detailed explanations regarding the purposes of the study to the relevant officials at all public health facilities where the data were collected to address concerns related to ethicalities.

In general, ethical concerns under this study can be seen along the four basic ethical principles, namely, autonomy, justice, beneficence, and non-maleficence to the participants, researcher, institutions as well as the domain of this research. Although data were not collected directly from the participants owing to the design nature of this study, appropriate consents were obtained from the respective health facilities to respect

autonomy of the study subjects. The sample selection criteria including age of the mother, completeness of medical record, signs of life of the foetus at admission for labour and skilled birth attendance were strictly applied to treat all charts equitably during data collection process. This study has beneficence effect to women delivering in public facilities in Ethiopia because of the tools that were recommended to improve the follow-up of labour and provision of intrapartum care.

Similarly, the rights of public health facilities where from the data for this study were collected had been protected as per the authorisations obtained from the Addis Ababa Regional Health Bureau and respective sub-city health offices. Furthermore, utmost precautions were taken during data collection, analysis and reporting not to cause any harm to the reputation and practice of public health facilities because of this research.

There was no recognised ethical concern in relation to the autonomy, justice and non-maleficence of the researcher and the domain because of this study. However, the additional knowledge and recommendation from this research had beneficial effect in promoting the causes of stillbirth in Ethiopia. Moreover, the researcher fulfilled the academic requirements for the degree of Doctor of Literature and Philosophy from the University of South Africa when this study is carried out successfully.

1.10 SCOPE OF THE STUDY

As literature indicates, a case-control study design has greater advantages in studying rare events such as stillbirth, which can be considered as one of the strengths of this study. Furthermore, both cases and controls for this study were selected from the same source population in the public health facilities and based on clearly defined criteria, which was extremely important in reducing selection bias that is often inherent to a case-control design. Data were collected from medical records that were taken at the time of the actual events hence limiting the chances of recall bias (Keoghand & Cox, 2014:12).

One of the potential limitations of this study might be related to the issue of undifferentiated documentation of intrapartum stillbirth from early neonatal death in the public health facilities. The public health facilities records do not always indicate whether there is any fatality of the newborn immediately after birth and many such cases might have been wrongly classified as stillbirth (FMOH et al. 2010:30). The chart inclusion

criteria were applied strictly to ensure that medical records of women who experienced neonatal death immediately after childbirth is excluded during data collection.

Moreover, this study relied on medical chart review method to collect data thereby facing another potential disadvantage in terms of not being able to control for the challenges related to data completeness, correctness, and relevance. To this effect, quality of data from the medical records in the public health facilities might not meet the expected high standards, which can be referred as one of the limitations of this study. However, stringent exclusion criteria indicated in this document were applied strictly to remove charts with incomplete records on the subject to reduce the limitations. Service providers' skills and motivations during provision of intrapartum care might create bias in terms of establishing associations between recommended interventions and outcome variable. Simple screening checklist were used to ensure that chart review of cases and controls are performed only if the minimum qualification requirements of intrapartum care providers in the public health facilities were met.

1.11 STRUCTURE OF THE THESIS

This thesis is structured around seven chapters. The first chapter gives highlights on all subsequent chapters thereby giving a general orientation to the research undertaking. The first chapter also contains subsections including introduction, description of study problem, study aim and objectives, summary of research methodology, and scope of the study. The second chapter deals with the conceptual framework of the study where detailed philosophical and practical concepts underpinning the current research are outlined. This chapter contains different sub-sections including introduction, philosophical perspectives on causality theory, epidemiological perspectives on causality, indicators of causality in health, and the application of the causality theory to this study. The third chapter was dedicated to literature review where synthesis of information obtained from different materials including published articles, textbooks, and unpublished manuscripts on topics relevant to this research will be discussed.

Chapter 4 presents descriptions on research design and methods. Materials related to the sampling, data collection and analysis processes and issues of ethicality in the context of this research will be described in this chapter. Chapter 5 remains a central and important piece of this thesis where all key findings from the study will be presented using

different format including texts, graphs and tables. Chapter 6 contains conclusions and recommendations of the study that present distilled information from the research findings tallying them to relevant actions to contribute to the improvement of the intrapartum practice in the public health facilities based on the findings from the study. Finally, Chapter 7 will respond to two objectives of this study thereby presenting important and focused framework of actions to address the issues related to stillbirth classification and to improve the timeliness and quality of intrapartum care in the public health facilities of Ethiopia.

1.12 CONCLUSION

This study employed a case-control design to establish the trends and determinants associated with the intrapartum stillbirth in public health facilities in Addis Ababa. Primary data were collected through chart review of selected cases and controls from public health facilities in Addis Ababa. In addition, the data were analysed using SPSS V.24 statistical package and both descriptive and inferential statistics were run to present findings.

It is envisaged that findings and recommendations from this study will inform strategic discussions around improving the quality of intrapartum care in public facilities in Ethiopia. More importantly, the research work will help the researcher fulfil the academic requirements for the D Litt et Phil at the University of South Africa.

CHAPTER 2

CONCEPTUAL FRAMEWORK

THE THEORY OF CAUSALITY AND ITS APPLICATIONS TO PUBLIC HEALTH

2.1 INTRODUCTION

Science makes constant efforts to understand and reveal the underlying triggers that bring things into being. The central tenet of these quests includes finding answers to questions related to metaphysical, epistemological or molecular concepts using different disciplines and methods. Some of these reasoning processes produce discoveries and others help solve simple day-to-day problems in life. At the heart of this quest to reveal the underlying triggers lies the problem of causality. According to Illari and Russo (2014:3), these underlying triggers are called 'causes' and sometimes less loaded names such as 'risk factors', 'determinants', 'associations', and so on are used (Illari & Russo, 2014:4).

There are a few interrelated concepts associated to causality that need to be differentiated for the sake of establishing a better understanding. The concept "causality" refers to causal relations, i.e. the relations between causes and effects. This generic term has various, more specific meanings. It may refer to "causation", which is deterministic causality; or "volition", which is (roughly put) in-deterministic causality; or "influence", which concerns the interactions between causation and volition or between different volitions (Sion, 2010:101) .

Illari and Russo (2014:4) identify five different scientific problems related to the concept of causality. The first problem is related to the issue of inference, which questions if there are causal relationships between any given two variables. For instance, in the context of this study, is there a causal relationship between pregnancy-related maternal hypertension and intrapartum stillbirth? How much of the maternal hypertensions would cause intrapartum stillbirth? More importantly, establishing such links would help make inference about the phenomena.

Predicting causality is the second scientific challenge that concerns knowing accurately as to what will happen in the presence of a causal factor. For instance, what will happen if pregnant women had high blood pressure and what would be the timing of any of the outcomes? The third important challenge of causality is related to making explanations about the causes. After establishing the existence of a causal link and determining its predictability, the logical next question would be “how did it happen and why?” For instance, studies show that HIV infection can cause stillbirth and hence it can be predicated that women who were tested HIV+ during pregnancy might experience stillbirth as outcome of their pregnancy. However, making explanation as how exactly the HIV infection causes stillbirth and why this phenomenon happens is another interesting debate in the realm of explaining causality (Illari & Russo, 2014:4).

According to Illari and Russo (2014:4), the fourth important challenge of causality is related to whether the variables known to cause an outcome can be controlled in a real situation. If maternal hypertension is known to cause stillbirth, could we manipulate this variable to see if the effect could be changed by withdrawing or reducing its presence? Or would it also be possible to control for any other variables that might confound the relationship between maternal hypertension and intrapartum stillbirth? The accurate knowledge of mechanisms to control variables from causing an outcome would be critical in interfering with causal pathway and in stopping the underlying triggers from driving the outcome.

Illari and Russo (2014:5) further argue that reasoning is the fifth and broadest challenge facing any scientific argument around causality. This challenge connects science and philosophy, thereby shaping the way people think about causality regardless of the context where the causal links are being analysed. The argument further challenges other causal problems discussed above including the intent of making inference, predictions, explanation and control by raising some critical dimensions in checking whether reasoning was exercised appropriately in addressing those elements. For instance, the following questions can be asked to explore the relevance of reasoning in shaping the phenomena around causality (Illari & Russo, 2014:4):

- What reasoning underlies the construction and evaluation of scientific models?
- What conceptualisation of causation underpins causal methods?

- How do we reason about all aspects of causality?
- How can we sharpen up that reasoning, making it more precise and so more effective?

These arguments around causality are relevant to many contemporary scientific disciplines including psychology, social science, natural science, and public health. In each of these domains, methodological approaches to determine causality between variables of concerns might vary. However, the questions of causality remain the predominate area of concern for all. There have been many important developments in quantitative models for assessing causality in the last two decades as well as important related developments in epidemiology, statistics and computer science. Writers have conceptualised causality using deterministic models, quasi-deterministic models, and probabilistic models. In epidemiology, the probabilistic model of causation dominates where it is being argued that a cause increases the probability that a disease or other adverse health conditions will occur (Coughlin, 2010:129).

Furthermore, in epidemiology, the certainty with which a causal inference could be made depends on the methodological rigour including the study design employed. For instance, a well-implemented experimental design has greater power over observational designs, the latter being superior over descriptive design, in unleashing causal connections between variables of interest. This current study used a case-control design, which does not necessarily guarantee any casual attributions among variables. However, the design has the capacity to indicate associations between variables in terms of the exposure and outcome status thereby demonstrating the level of relative risks. This chapter lays a theoretical foundation for the study by focusing on the theory of causality from different perspectives and later narrowing down its significance in public health and epidemiology.

A conceptual model presenting key risk factors that might have direct association with stillbirth along the continuum of a woman's reproductive life including preconception, during pregnancy and delivery has also been included in this chapter. These risk factors are discussed in greater depth in Chapter 3. However, highlights of these factors together with a few recommended interventions at different stages of women's reproductive life are described towards the end of this chapter.

2.2 PHILOSOPHICAL PERSPECTIVES ON CAUSALITY THEORY

“Men are never satisfied until they know the “why” of a thing” — Aristotle

The causality discourse and debates are as old as human history and yet as present as the time this thesis was being written or being read by someone. Analysis of causations can be complex requiring a disciplined thinking and intricate methods, tools and technology. However, the “why” questions we ask ourselves or other fellow human beings when we are puzzled about a situation or wanted to have better understanding and make more meaning out of a circumstance at the heart of our intellectual drive to understand causality.

Accordingly, the type of questions prompting causal analysis might be of metaphysical origin as why and how the universe came to being or as practical as why the outcome of a pregnancy becomes a stillbirth. For instance, in his book entitled, “The why of things: Causality in Science, Medicine, and Life”, Peter (2013:8) postulates that the identification of an initiating cause for the existence of the universe has been a persistent preoccupation of many theological, philosophical or scientific scholars. Consequently, this resulted in the creation of different hypotheses including the famous “Big Bang” theory or the dogmatic ascription of such phenomena to supernatural formations. More dynamic and consuming questions that sought explanations in different walks of human life have also been asked across time to which many concrete or presumptive responses were given. Some of these questions of causality or their corresponding responses might have been changed as the result of advancement in science and technology making earlier assertions obsolete. To this end, the role of intellectual debates and scientific research to produce concrete evidences remain of paramount relevance to addressing the issues of causality in many disciplines including public health. For instance, what is today labelled a supernatural origin of events can be found in many, if not all cultures. However, such beliefs can be proven wrong through methodological inquiries by establishing more concrete evidences about alternative causality of the same events through time (Peter, 2013:6).

As indicated above, the fundamental concepts of causation have been the subject of philosophical inquiry since antiquity. Early thinkers were predominantly rationalists in that they sought scientific knowledge through reasons and intuition rather than empirical

observations. Aristotle, for example, emphasised syllogisms, a form of deductive logical argument consisting of a major premise, a minor premise, and a conclusion as an important approach to comprehend causality. Major figures in philosophy in the medieval period were also rationalists in their approaches to causality. In contrast to rationalist philosophers, empiricists such as Francis Bacon, John Locke, and David Hume believed that knowledge is gained through observations of natural phenomena (Coughlin, 2010:129).

In his book entitled, “Theories of Causality: From Antiquity to the Present”, Losee (2011:101) discussed the following three important questions pertaining to systematic arguments on the issues of causality in a historical context:

- What types of entities qualify as “causes” and “effects”?
- What is the relationship between cause and effect?
- How are causal claims to be assessed?

Responses to these questions can reflect the different pillars of worldview ranging from seeing causation as predetermined phenomena to ascribing certain inherent or external factors as causal agent that are subject to critical assessments using theories or procedures in science. According to Losee (2011:101), Aristotle used both scientific and philosophical paradigms to discuss causation as a process that drives transition from a state of potential to another state of actual. Therefore, four aspects of causation include the forms of the process (formal cause), the matter being transformed (material cause), the interaction between the transforming agent and that being transformed (efficient cause), as well as the purpose of the process (final cause-*telos*) are involved. However, although the inductive nature of Aristotle’s causal analysis was acceptable to Bacon, the latter rejected Aristotelian claims of the presence of ultimate purposes for all causes. Bacon postulates that more rigorous methods should be employed in causal analysis to reduce biases including distortions introduced upon acceptance of philosophical dogmas. The argument around causality continued in the subsequent era through the works of other thinkers including Descartes, Hume and Kant, each building complementary or contradicting positions on the discourse (Losee, 2011:101).

Furthermore, the work of most philosophers who lived before the 18th century relied mainly on thoughts, feelings and the human actions to synthesise theories and to interpret

phenomena around human life. Their works were based on subjectivist epistemological viewpoints that assume knowledge is obtained through the imposition of meaning on the object by the researcher, or subject (Coughlin, 2010:129).

Positivism is a philosophy that developed in the 18th century in a period known as the Enlightenment. The latter was a time when scientists stopped relying on religion, conjecture and faith to explain phenomena, and instead began to use reasons and rational thoughts. This period saw the emergence of the view that it is only by using scientific thinking and practices that we can reveal the truth about the world. Positivism assumes a stable observable reality that can be measured and observed. Therefore, for positivists, scientific knowledge is proven knowledge, and theories are therefore derived in a systematic, rigorous way from observation and experiment. This approach to studying human life is the same approach that scientists take to study the natural world. Human beings are believed by positivists to exist in causal relationships that can be empirically observed, tested and measured and to behave in accordance with various laws. As this reality exists whether we look for it or not, it is the role of scientists to reveal its existence, but not to attempt to understand the inner meanings of these laws or express personal opinions about these laws. Furthermore, the positivist approach requires the researcher to take an objective distance from the phenomena so that the description of the investigation can be detached and undistorted by emotion or personal bias (Bruce et al., 2008:6).

Most of these philosophers and scientists of the earlier days attempted to determine the presence or absence of causality, their origins and the direction of causal relationships. Recognising causality takes thorough and methodical analysis of events around an outcome. Peter (2013:28) further argues that five critical assumptions should be considered in making causal analysis:

- The concept of causality is valid and describes a process by which one event brings about or increases the likelihood of the occurrence of another event.
- Causes are discoverable, but absolute certainty about causal relationships is not possible.
- Time is experienced as unidirectional, moving from the past to the future.

- There are several models of causality. These complement rather than contradict or supersede one another. No single model of causality can claim that it is irrefutable, universal, or irreplaceable.
- The choice of which model of causality to use is not random but depends upon the type of question being asked and the elements of the specific causal chain being considered (Peter, 2013:6).

Considering causality as a process that encompasses chains of micro and macro level events that can be measured or observed would make the arguments on this subject more tangible compared to the hypothetical and philosophical discussions consumed the medieval era in history. One important concept that would strengthen the relevance of causal chain is related to the description of the mechanisms that connect the causal agents with the ultimate outcomes or each process. A causal mechanism is a particular configuration of conditions and processes that always or normally leads from one set of conditions to an outcome through the properties and powers of the events and entities in the domain of concern (Illari, Russo & Williamson, 2011:277).

For instance, evidence shows that birth asphyxia, a condition related to the deficiency of oxygen in blood and increase in carbon dioxide in blood and tissues (Tindall 2012:16), causes intrapartum stillbirth or immediate neonatal death. In this situation, asphyxia is a phenomenon resulted from other underlying causal agents. However, its forward action that leads to the occurrence of a stillbirth can be further analysed using the causal mechanism framework. This might take pathological examination at cellular and tissue levels to see what exactly happened when the foetus run short of oxygen or which organ was most affected by the high concentration of carbon dioxide to terminate the unborn life. The causal mechanism analysis would also provide a framework to determine the chain of events, agent/s and their interactions along the slippery slope that resulted in the fatal outcome of stillbirth. These types of analyses would require sophisticated skills and complex technological facilities such that the possibility of making routine pathological level causal analysis would be limited in developing countries like Ethiopia. However, applying the concept and principles of causal mechanism would be helpful in examining any causal interactions at various levels including clinical, social or physical world.

Causal analyses entertain the various important dimensions including knowing the causal models, levels of causal analysis and the logics used to determine the causes. According

to Peter (2013:31), there are three models of causes including the categorical (absolute or binary), the probabilistic (dimensional or continuous) and the emergent (nonlinear). The categorical model identifies causes that directly bring about an event whereas the probabilistic model is reflected in the phrase “more/less likely.” These models can be analysed at four levels including predisposing factors, precipitating factors, programmatic (the interactions among multiple elements that contribute more than any one of the constituent elements in bringing about the event) and purposive factors (the “why” an event occurred).

Moreover, three distinct logics can be used to determine cause. They include the following:

- The empiric, which requires that a question can be subjected to experimental study that can repeat, replicate, or in some manner validate the hypothesis or the data.
- The empathic, in which events are linked in a coherent, comprehensive, and convincing manner and in which the causal connections are understood depending upon the perceptions of the person or group making the connections.
- The ecclesiastic, in which causal knowledge derives from a group-shared position of pre-existing absolute knowledge (Peter, 2013:6).

2.3 EPIDEMIOLOGICAL PERSPECTIVE ON CAUSALITY THEORY

Rooted in the empiricist tradition, epidemiology is concerned with the distribution and determinates of diseases and health conditions within and between populations. Being greatly influenced by the positivist paradigm, epidemiologic methods use both inductive and deductive arguments to achieve empirical observations (Creswell 2014:3). Before moving deep into the epidemiological approaches to determination causality, it is worthwhile to differentiate the two concepts indicated above, namely, induction and deduction.

2.3.1 Inductive and deductive reasoning

Both have been important in the development of scientific knowledge, and it is useful to appreciate the difference between the two to understand the approach taken in epidemiology. Coughlin (2010:148) argues that induction is a perspective founded on

collection, comparison, and exclusion of factual qualities in things and their interior structure. With inductive reasoning, researchers make repeated observations and use this evidence to generate theories to explain what they have observed. For example, if a researcher made several observations in different settings of twin pregnancies resulting in stillbirth, they might then inductively derive a general theory as: All twin pregnancies cause stillbirth.

Deduction works in the opposite way to induction, starting with a theory (known as a hypothesis) and then testing it by observation. Therefore, a very important part of deductive reasoning is the formulation of the hypothesis – that is, the provisional assumption researchers make about the population or phenomena they wish to study before starting with observations. A good hypothesis must enable the researcher to test it through a series of empirical observations. Using the above example, in deductive reasoning, the hypothesis would be: All multiple pregnancies will cause stillbirth. Observations would then be made to test the validity of this statement. This would allow researchers to check the consistency of the hypothesis against their observations, and if necessary, the hypothesis can be discarded or refined to accommodate the observed data (Bruce et al., 2008:6).

Although inductive research paradigm is more favoured in epidemiology, there is an ongoing heated debate among epidemiologist over their preference between inductive and deductive approach. As indicated earlier, in inductive approach, the researchers formulate hypotheses based upon their insights and the insights of others. In order to test hypotheses, empirical data is collected and analysed according to a written protocol. The observations are then used to determine whether or not the hypotheses should be rejected. Results are examined across studies to draw causal inferences. Existing scientific theories may be modified and new hypotheses can be generated for further testing. The adequacy of a scientific theory may be evaluated based upon its accuracy, consistency, simplicity, fruitfulness, and scope or reach (Coughlin, 2010:129).

2.3.2 The influence of other scientific disciplines on epidemiology

The assumptions of contemporary epidemiological investigations are associated with a view of science and knowledge known as positivism. The disease causations and associations can be studied at various levels including molecular, tissue or organ,

individual and at population levels. Different scientific disciplines pay attention to studying factors that cause or contribute to a disease occurrence. For instance, cell biology or biochemistry deals with factors at molecular level whereas pathology puts emphasis to study organ or tissue level causalities. On the other hand, the patient or individual level factors are addressed by clinical medicine whereas epidemiology focuses on the population level factors (Katz et al., 2014:408).

The birth of epidemiological inquiries can be traced back to Hippocrates description of certain diseases and his speculative assertions that diseases might had been associated with natural environmental elements like the wind, water and the weather. This early thinking on causal relationships evolved further with the advent of methods for scientific observations and measurement based on empirical data. The pioneering systematic observations of social and natural phenomena by the intellectual giants of the sixteenth to early nineteenth centuries including John Graunt, John Snow, Pierre Charles Louis, Rudolf Virchow, and Joseph Goldberger laid solid foundations to disciplined reasoning on underlying causalities to morbidities and mortalities in human population. More importantly, the works of many of these disciplined thinkers championed the importance of fundamental principles in collecting data and using numerical methods to produce evidence and to postulate that diseases or health conditions are the results of avoidable causes (Saracci, 2010:3).

2.3.3 The scope and strengths of epidemiological methods

The major preoccupation of epidemiology is identifying risk factors for disease. This is a step towards understanding disease causation. A risk factor may be defined as a behaviour, environmental exposure, or inherent human characteristic that increases the probability of the occurrence of a given disease. Risk factors may play direct or indirect causal roles in the diseases occurrence (Oleckno, 2008:55).

As its primary objective, epidemiology seeks to identify the aetiology or cause of a disease and the relevant risk factors increase a person's risk for a disease. Person, place and time are of paramount essence to epidemiologic analysis in characterising causalities and associations of risk factors. Determining the extent, natural history and prognosis of diseases; evaluating both the existing and newly developed preventive and therapeutic measures; and developing public policy related to environmental problems, genetic

issues, and other considerations regarding disease prevention and health promotion are among other key objectives of epidemiology (Leon 2014:468). Furthermore, Oleckno (2008:180) argue that the understanding of the causes of morbidity and mortality often leads to more effective prevention, treatment, and control measures and consequently to a reduction in disease incidence, prevalence or severity.

The scope of epidemiology can be classified as either of classical or clinical focus. Classical epidemiology is population-oriented and studies the community origins of health problems, particularly those related to infectious agents; nutrition; the environment; human behaviour; and the psychological, social, economic, and spiritual state of a population. Classical epidemiologists are interested in discovering risk factors that might be altered in a population to prevent or delay disease, injury and death. Conversely, clinical epidemiology is interested in studying patients in health care settings rather than in the community at large. Its scope is to improve the prevention, early detection, diagnosis, treatment, prognosis, and care of illness in individual patients who are at risk for, or already affected by specific diseases (Katz et al., 2014:408).

Empiricism, a method that deals with the study of observable phenomena by scientific approaches, detailed observation and accurate measurement is central to epidemiological study. These approaches presuppose certain important criteria including being systematic, rigorous, reproducible and repeatable so that causal and risk factors could be determined consistently by many researcher or the same researcher at different times (Bruce et al., 2008:6).

Epidemiology offers a broad range of methods and study designs with varying strength of measuring the causal relationships between exposures and occurrence of diseases or health conditions, which can be referred as outcomes. Major study designs in epidemiology can be divided into two categories, namely, observational and experimental studies. Identification of causal factors in observational (non-experimental) research include: what can we say about the nature of causality that is likely to be of interest to epidemiologists and how should causal claims based upon the results of epidemiologic research be warranted (Coughlin, 2010:129).

Observational studies are epidemiologic studies where the researchers collect, record, and analyse data on subjects without controlling exposure status or the conditions of the

study. The investigators simply observe the subjects as they naturally divide themselves by potentially significant variables or exposures. Furthermore, observational studies can be descriptive or analytical. Descriptive approach focused on characterising health-related occurrences by place, person or time without attempting to test any hypothesis. The analytical designs focus on testing a priori hypothesis about specified associations between exposure and outcomes without introducing any experimentation in the process. By contrast to the observational design, in experimental studies the researchers control the conditions of the experiment, including the subjects' exposure status. On the contrary, experimental studies can be recognised by a planned intervention, which involves the introduction of an investigational treatment, procedure, programme or service so as to determine its efficacy or effectiveness with regard to a given outcome (Oleckno, 2008:55).

2.4 INDICATORS OF CAUSALITY IN HEALTH RESEARCH

Application of the concept of causality in the health sciences should furnish with concrete indications of the link between a causal agent, the outcome and the direction of such links in a temporal sense. Pursuing in the lines of argument related to causal pluralism, it seems plausible that both probabilistic and deterministic models of causation have something to offer to the debate on the nature of causality. The deterministic model is more certain about a disease or a health condition being attributed to a specific cause. Accordingly, if a causal agent is present at a certain period, then it is guaranteed that a related outcome will happen. On the contrary, probabilistic causation theories make it a requisite that a cause raises the probability of the effect. In epidemiology, a probabilistic model of causation holds that a cause increases the probability that a disease or other adverse health condition might occur (Coughlin, 2010:129).

Both probabilistic and deterministic model of causation can be used in understanding complex causations where multiple factors become responsible for an outcome. Peter (2010:28) argues that association and causation can be suspected when a factor "A" is repeatedly associated with "B" and if "B" occurs regularly when "A" is introduced or if the removal of "A" leads to a resolution of "B" (Peter, 2013:6).

Regardless of the different model of causation and the levels at which causal analysis might be conducted, there are certain important parameters to look for in exploring causal relationship between variable in a research context. As discussed earlier in this chapter, finding a final proof of causation particularly through an epidemiologic research approach would be less realistic. Therefore, establishing causal links is merely an inference based on an observed conjunction between two variables (exposure and health status) in time and space. Epidemiologic investigations often rely on data-driven approach to the notion of causation, comfortably embracing Bradford Hill's criteria of causality. These criteria seem more applicable to non-experimental, bias-prone, confounding-rich nature of epidemiological research. Bradford Hill's criteria put particular emphasis upon the temporality of the relationship, its strength, the presence of a plausible dose–response relationship, the consistency of findings in diverse studies, and coherence with other disciplinary findings and biomedical theory (Robyn & Anthony, 2005:792).

The Bradford Hill criteria for causal inference or their subsets are still widely used as a heuristic aid for assessing whether associations observed in epidemiologic research are causal (Coughlin 2010:129). These criteria are taken as aspects of the association between an exposure and an outcome that should be considered before deciding that the most likely interpretation of it is causation. None of the Bradford Hill's criteria alone is sufficient to establish causality as for each criterion there are situations in which both lack of satisfaction of the criterion may be causal and satisfaction of the criterion may be non-causal. Temporality, the requirement that the exposure must precede the effect, is the only necessary criterion for a causal relationship (Robyn & Anthony, 2005:792). Oleckno (2008:187) discusses the process of judging whether a given association between an exposure and outcome was spurious, non-causal or causal in the following diagram.

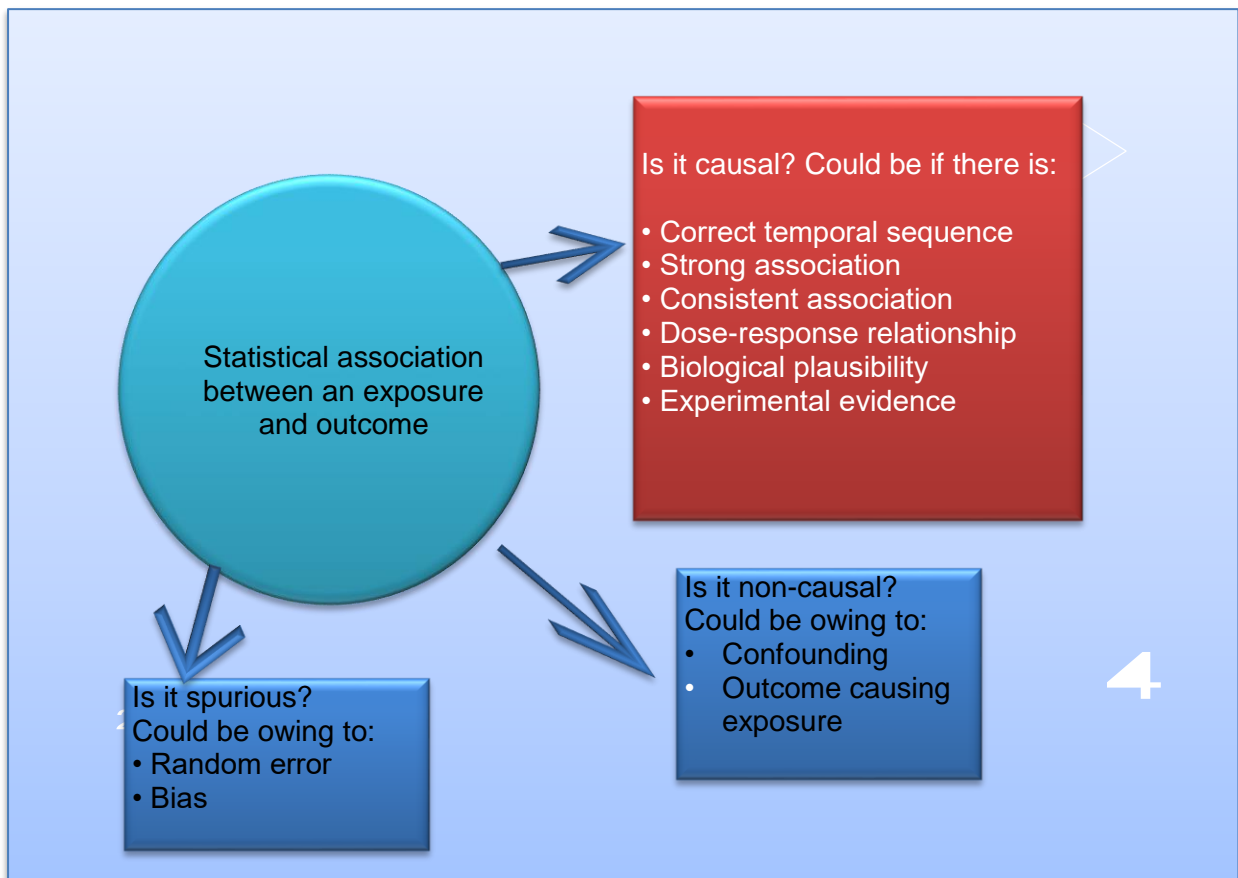


Figure 2.1 Statistical associations between exposure and outcome
(Oleckno, 2008:55-390)

Overview of each of the causal criteria that were postulated by Bradford Hill is discussed in the sections below.

2.4.1 Correct temporal sequence

Temporal sequence of associations addresses the confusion in differentiating which of the observed variables in a research situation were the causes and which were the effects. Particularly, in probabilistic causal claims, two or more variables assumed to be linked in causal relation might co-exist without giving any clue as which occurred first (Illari & Russo, 2014:4).

Therefore, for an exposure to be considered a cause of an outcome, it must precede the outcome. Exposures that occur concurrently with an outcome or subsequent to an outcome cannot be considered causal because they do not alter the frequency of the outcome. Certain study designs including cross-sectional and case-control where

exposure and outcome are assessed concurrently can be problematic in determining if an exposure precedes an outcome. For example, in a cross-sectional study designed to determine if there is a relationship between the prevalence of malnutrition and diarrheal disease, it may not be clear which factor came first. Therefore, the correct temporal sequence cannot be established reliably (Oleckno, 2008:55). Another example can be cited from the current case-control study design to show challenges in determining the temporal sequence between the occurrence of stillbirth and any of the presumed underlying factors including maternal hypertension or lack of the intrapartum care interventions. For instance, only a highly sophisticated pathological or molecular level analysis could determine what exactly caused the occurrence of intrapartum stillbirth, a scenario that could unlikely be integrated in a case-control study design.

2.4.2 Strength of the association

It is easier to find categorical responses to an exposure; either the subject was exposed to a causal factor or not. For instance, in a causal analysis where attendance of antenatal care has a relationship with the stillbirth outcome, it is either a woman received the care or not. In a case-control study with a binary exposure, the simplest analysis involves calculating the prevalence of exposure in the case group and in the control group and then examining whether the exposure prevalence differs by case and control status (Keoghand & Cox, 2014:12).

In general, the stronger an association between a given exposure and outcome, the more likely the association is causal. When the risk ratio is very high, for example, it is more difficult to explain away the association owing to unrecognised or subtle sources of bias or confounding. In the example above, if there is a statistically significant difference between women who attended the recommended dose of antenatal care and those who did not, statistical analysis would show associations which might indicate that not receiving antenatal care might increase the chance of stillbirth occurrence. Depending on the strength of associations and controlling for other potentially confounding variables, it can be safely argued that not receiving the recommended dose of antenatal care is a risk factor for stillbirth. Although it will be difficult to conclude that smaller association would not account for causality, the stronger an association becomes in an exposure-outcome link, the higher it is chance of being considered as causal factor (Illari & Russo, 2014:4).

2.4.3 Consistency of the association

Consistency of the association is another important criterion that will consolidate that an exposure has causal link with an outcome. One way of determining if an apparent association is likely to be owing to random error is to replicate the study. If the findings are consistent, it strengthens the case for a causal association, assuming there are no significant sources of bias or confounding in the studies. For instance, studies on different population groups, at different time, in different contexts and using similar methodological approaches identify specific association between maternal hypertension and stillbirth. As a result, it will increase the probability of the association being causal.

2.4.4 Dose-response relationship

In an exposure-outcome conjunction, a pattern of dose-response relationship might indicate the probability of causal associations. If increased levels of exposure lead to greater frequencies of the outcome, then this is suggestive of a causal relationship. For instance, in a closely monitored situation where maternal hypertensive disorder was analysed for probable causation of stillbirth, a comparison between cases of stillbirth and control groups might indicated the presence of strong association between the two variables. However, if a further analysis showed that proportionally more women with consistent higher degree of blood pressure had stillbirth compared to women with lower degree blood pressure, this might be suggestive of hypertension and stillbirth to be in a dose-response order of causality.

On the contrary, the absence of a dose-response relationship does not necessarily mean that an association is non-causal. However, it might mean a function of whether the dose surpasses a threshold level. A threshold is a level of exposure (dose) that must be reached before effects become apparent. Below the threshold, there are no observed effects (Illari & Russo, 2014:4). For instance, in the maternal hypertension example above, a threshold blood pressure level can be determined beyond which many women likely experience stillbirth. This might lead to a recommendation that women's blood pressure should be controlled at a certain level during pregnancy to avoid a fatal outcome. However, it should be noted that a dose-response relationship could be owing to a strong confounding factor that closely follows an exposure. Therefore, it is vital that any variables

that could co-cause an outcome should be controlled through strong methodological rigours including study design and data analysis.

2.4.5 Biological plausibility

Biologic plausibility refers to coherence with the current body of biologic knowledge (Leon, 2014:4681). The basic question here is: Does the association make biological sense? Is the association credible based on our understanding of the natural history of the disease or possible pathogenic mechanisms? Recognising biological plausibility takes deeper understanding of the properties of both the exposure and outcome and mechanisms that lead to an outcome of interest to determine if the causal claim was consistent with the established theories of disease causation including pathophysiological, biochemical and microbiological knowledge. However, failure to make biological sense does not necessarily negate the possibility of a causal association. In some cases, our understanding of the biological mechanisms may be incomplete, and what does not make sense today may make sense sometime in the future (Illari & Russo, 2014:4).

2.4.6 Experimental evidence

Evidences from experimental designs of epidemiologic studies have stronger power to convince that association between a given exposure and outcome can be of causal nature. For instance, a well implemented randomised controlled trial (RCT) study design would avoid the possibility of selection biases. As a result, the effects of treatments can be reasonably compared between the groups that were exposed to the intervention and controls (without the exposure). All other things being constant, the outcome from an RTC study can be attributed to the exposure thereby making causal claims plausible beyond a reasonable doubt. Despite the ethical concerns associated with the application of RTC study design particularly among human population, its utility in harnessing causal connections between variables is proven advantageous. For instance, let us say in a hypothetical clinical trial of vaccine efficacy against HIV infection, the researcher randomly selects people who are infected with the virus and have similar socio-demographic characteristics. The researcher then administers the vaccine to randomly selected half of the group and provides placebo to the remaining half without disclosing the content of what they received to both groups. Given the current biologically plausible fact that HIV does not have a cure, causal association will be more convincing if some

people in the group who received vaccine were cured from the virus compared to none in the placebo group (Illari et al., 2011:277).

2.5 RELEVANCE OF THE CAUSALITY THEORY TO INTRAPARTUM STILLBIRTH

The theory of causality is highly relevant to many health outcomes including intrapartum stillbirth. The latter involves a termination of life, which is almost always induced by triggers ranging from physiological, biological, physical, or environmental factors. Notwithstanding the challenges associated with revealing specific agents or exposures related to stillbirth which often is owing to the limitation of human skills and technology, all the criteria indicated above including temporal sequence, strength of association, and biological plausibility can be proven to demonstrate that certain factors are responsible for the occurrence of stillbirth in human population.

Etiologic determinants of stillbirth have been detected through various clinical and epidemiologic studies across time and in different geographic contexts. For instance, clinical researchers explored the chain of events using pathophysiological analysis including post-mortem examination of the foetus and placenta to unravel causal determinants that end the unborn life during the intrapartum period. Accordingly, many factors of maternal and foetal origin have been documented as causal agents. Factors including placenta abruption, maternal infection, maternal hypertension, cord prolapse and asphyxia were listed among these determinants (Bukowski, Carpenter, Conway, Coustan, Dudley, Goldenberg, Rowland, Koch, Parker, Pinar, Reddy, Saade, Silver, Stoll, Varner & Willinger, 2011:2459). These types of studies clearly indicate that intrapartum stillbirth fully fits to the causality theory presented in this chapter and as such systematic and ongoing investigations are warranted to reveal complete pictures of underlying causal factors and mechanisms resulting in the events.

The efforts required to detect causal relationship in the process of intrapartum stillbirth can be complex. For instance, many of the presumed causal factors seen in the above paragraph might have occurred concurrently or in series of events, one leading into another until the outcome took place. Let us say, placental abruption was the cause of an incidence of intrapartum stillbirth. In a woman who was diagnosed with hypertension during the same pregnancy, it will be problematic to detect whether hypertension and placental abruption co-caused the foetal death or if the hypertension first caused placental

abruption which in turn lead to the final outcome of stillbirth (Marshall & Raynor, 2014:4). Therefore, resolving these challenges will take commitment from health practitioners and advancement in clinical science and technology. However, the unwavering truth of this argument is the fact that intrapartum stillbirth happens owing to causal relationship of physiological or clinical origins.

2.6 THE PATHWAYS TO REDUCE INTRAPARTUM STILLBIRTH

This current research considers intrapartum stillbirth as a sub-set of broader stillbirth phenomena. Intrapartum stillbirth is also being seen as an outcome occurring because of a continuum of underlying factors that are interconnected in causal chain of biological, physiological and clinical phenomena. A conceptual framework adapted from a publication in The Lancet stillbirth series was utilised to present the key risk factors along the reproductive life cycle women. Although a case-control study design is not the strongest in establishing causal relationship between exposures and outcomes, this study puts previously recognised determinants in perspective to analyse if there were any associations between these key factors and intrapartum stillbirth in the context of public health facilities in Ethiopia.

According to this conceptual framework, intrapartum stillbirth is a function of causal determinants that might have crept into a woman's reproductive life at various stages. These might include before pregnancy, during pregnancy, during labour or the childbirth process. Because of its case-control design nature and data availability, the study puts major emphasis on looking at the associations between potential exposures during the pregnancy, labour and childbirth. However, many of the factors presumed to occur before pregnancy and immediately after the childbirth were also covered in Chapter 2 of this research as part of a comprehensive literature review.

Pathway to Reduce Stillbirth

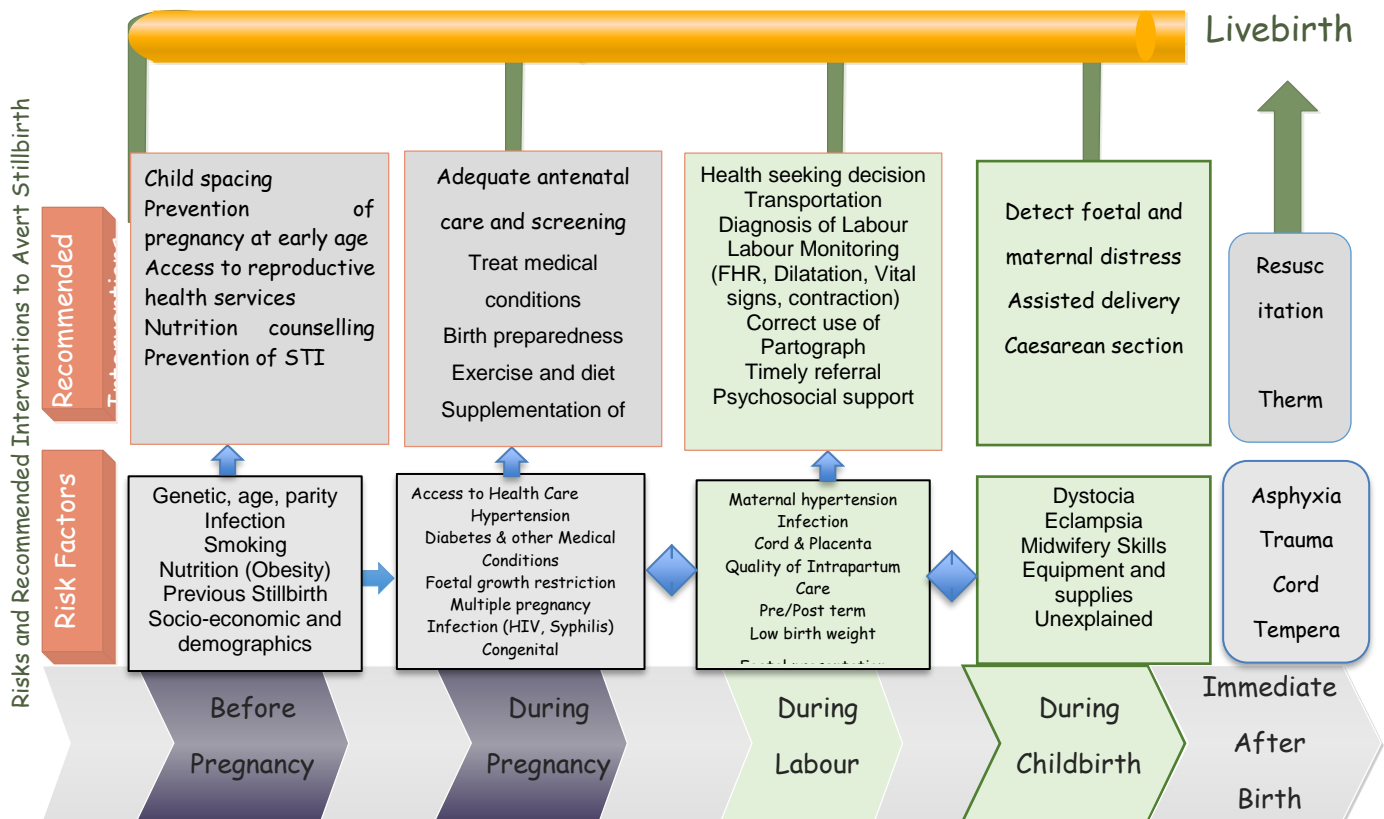


Figure 2.2 Conceptual framework for the study

(Adapted from Pattinson, Kerber, Buchmann, Friberg, Belizan, Lansky, Weissman, Mathai, Rudan, Walker & Lawn, 2011:1610-1623)

The Conceptual Framework above is adapted from the Lancet publication where researchers demonstrated the links between stillbirth and health and obstetric interventions among women in the reproductive age group (Pattinson, Kerber, Buchmann, Friberg, Belizan, Lansky, Weissman, Mathai, Rudan, Walker & Lawn, 2011:1610-1623). A prior written permission had been obtained to adapt the framework, which will help as a guiding prism through which the different components and chapters of this research can be observed. Grounded in the causality theory model discussed in this chapter, the framework gives an overall orientation to the research by outlining the recognised risk factors along with the recommended interventions at different stages of a woman's reproductive life. Accordingly, the study design, data collection and analysis

methods are all aligned to the causality theoretical perspectives where intrapartum stillbirth can be seen as an outcome resulting from underlying causal factors related to maternal, foetal, environmental or quality of obstetric care during pregnancy and around the time of childbirth.

This conceptual model might appear too simplistic in presenting the “why?” of stillbirth. However, it adds tremendous value in summarising the causal chain of complex phenomena underlying the outcome, along with proven interventions at different stages of reproductive age of a woman. Notwithstanding variations in the gestational cut-off point for defining stillbirth, the latter takes place either antepartum or intrapartum period of a pregnancy. However, evidence shows that factors associated with stillbirth might creep into the equation even way before conception.

For instance, literature indicates that socio-demographic, lifestyle and infection-related factors including the age of a woman during pregnancy, nutritional status, smoking experience, and presence of syphilis or HIV infections could predispose a pregnancy to the risk of stillbirth. Similarly, risk factors including access to antenatal care, pregnancy induced medical conditions like hypertension and diabetes, infection and foetal growth restriction need to be screened and acted upon during pregnancy to reduce the occurrence of stillbirth. The highest concentration of stillbirth related risk factors existed around the time of labour and childbirth. Some of these risk factors are cumulative and continued effects of causal factors introduced during the earlier phases. However, only time-sensitive and highly skilled interventions could avert the occurrence of stillbirth once causal factors are identified at the stage of labour and childbirth (Pattinson et al., 2011:1610).

The Lancet stillbirth series extensively documented the global burden of stillbirth and key factors causing such a high adverse outcome along with effective interventions that could contribute to its reduction (Bhutta, Yakoob, Lawn, Rizvi, Friberg, Weissman, Buchmann & Goldenberg, 2011:1523-1538).

Out of the approximately 35 potential interventions available to reduce stillbirth at various stages of a woman’s reproductive life, the authors recommend 10 for implementation:

- Peri-conceptual folic acid fortification.

- Insecticide-treated bed nets or intermittent preventive treatment for malaria prevention.
- Syphilis detection and treatment.
- Detection and management of hypertensive disease of pregnancy.
- Detection and management of diabetes of pregnancy.
- Detection and management of foetal growth restriction.
- Routine induction to prevent post-term pregnancies.
- Skilled care at birth.
- Basic emergency obstetric care.
- Comprehensive emergency obstetric care (Bhutta, Yakoob, Lawn, Rizvi, Friberg, Weissman, Buchmann & Goldenberg, 2011:1523-1538).

This current study draws relevant clinical and public health knowledge from The Lancet stillbirth series and other published and unpublished sources on stillbirth topics. Most of the literature confirm that intrapartum stillbirth is an outcome occurring as a result of complex causal mechanisms originating from underlying factors including medical conditions, quality of intrapartum care and obstetric complications. Therefore, the focus of this study was to investigate whether some of these underlying casual factors were associated with the occurrence of intrapartum stillbirth in the public health facilities of Addis Ababa, Ethiopia.

Despite its high prevalence, stillbirth calcification and determining the underlying causal factors is rudimentary in the public health facilities in Ethiopia. Although outdated, the emergency obstetric care audit conducted in the country in 2008 indicated that it was not possible to distinguish between the fresh and macerated stillbirths in the health facility records and as a results data had to be aggregated for stillbirth and very early neonatal death (FMOH, 2008:20).

2.7 CONCLUSION

This chapter presented the theory of causality as a guiding framework to organise the research design, data collection methods and analysis of the current research. Causality was reviewed from different perspectives including its philosophical and epidemiological

relevance thereby drawing concrete definitions and underlying criteria to identify causal links.

The discussion in this chapter related to the causality theory further assisted in the development of the conceptual framework which illustrates the underlying causal factors of stillbirth that are mostly related to maternal, foetal, environmental or quality of obstetric care during pregnancy and around the time of childbirth. Many of these risk factors and stillbirth-related causal concerns will be further discussed in Chapter 3 as part of a comprehensive literature review. This study assessed if any of the evidences and interventions recognized in the conceptual framework were being implemented in the public health facilities of Addis Ababa and if absence of their application have significance to the intrapartum stillbirth.

CHAPTER 3

LITERATURE REVIEW

3.1 INTRODUCTION

Stillbirth can be referred to as death prior to the complete expulsion or extraction from its mother of a product of conception regardless of the duration of pregnancy (Joy, Michael, Toni, Craig & Cynthia, 2010:1471). Developing countries represent 98% of the approximately 3 million stillbirths that occur annually. While many developed countries have stillbirth rates as low as 3–5 per 1000 births, most developing countries have rates that are approximately ten-fold higher. For instance, in South Africa, the stillbirth rate is 15-24 per 1000 total births, and intrapartum stillbirth accounts for 39% of stillbirths (Walker, Cohen, Walker, Allen, Baines & Thornton, 2014:714).

Reductions in stillbirth rates in developed countries are primarily attributed to the reductions that occurred in intrapartum stillbirth rates. Increased access to obstetric services including Caesarean section when indicated can prevent intrapartum stillbirth (McClure et al., 2015:7). The greatest risk to life for the mother and baby is noted during childbirth. Intrapartum foetal death is a subset of perinatal mortality, an event that occurs during the process of childbirth. It is a health indicator that measures the quality of obstetric care on the one hand, and the association between maternal and neonatal health on the other; as such it is a determinant of the quality of intrapartum care. Timely and appropriate obstetric care rendered by skilled attendants in an atmosphere that is conducive will prevent or at least reduce the occurrence of intrapartum stillbirth. Intrapartum-related neonatal death deserves prominence in global health programming and policy because it has a significant contribution to the under-five child mortality rate (Adekanbi, Olayemi, Fawole & Afolabi, 2015:635).

Worldwide, the stillbirth rate has declined by 14%, from 22.1 stillbirths per 1000 births in 1995 to 18.9 stillbirths per 1000 births in 2009 (about 1.1% per year). The estimated trend lags behind the progress in under-five mortality rate (2.3% per year). Most stillbirths are avoidable, as evidenced by the low stillbirth rate for developed countries of approximately three per 1000 births in contrast to the stillbirth rate of 28 per 1000 births in sub-Saharan

Africa (Cousens et al., 2011:1319). For instance, increased coverage and quality of preconception, antenatal, intrapartum, and postnatal interventions could avert 33% of stillbirths per year. Furthermore, skilled birth attendance would avert intrapartum-related neonatal mortality by 25% while basic Emergency Obstetric and Neonatal Care (BEmONC) and Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) can avert 40% intrapartum-related deaths. Approximately 82% of these interventions are attributable to facility-based care (Bhutta et al., 2011:1523).

Stillbirth poses significant public health concerns in Ethiopia. Owing to the absence of fine classification system of stillbirth, the Ethiopian DHS 2011 aggregated data on stillbirth and early neonatal death, which had been referred to as perinatal mortality. Accordingly, the perinatal mortality rate was 46 per 1,000 pregnancies of seven or more months of gestation. As a result, the perinatal mortality rate was higher among births to young mothers (less than 20 years of age) as well as among births that occurred less than 15 months after the previous birth. The report also indicated that perinatal mortality generally decreases with an increase in the levels of education and of household wealth. Despite relative advantages of residents of Addis Ababa in regard to the educational and wealth status, the report revealed that the City experienced equally high perinatal mortality, which was at 30 per 1000 births (Central Statistical Agency, 2011:115).

The purpose of this literature review is to capture the different perspectives around stillbirth in general and intrapartum stillbirth in particular to establish a better understanding and to facilitate intellectual arguments on its definition, underlying factors and causes, calcifications and feasible interventions to address the issue. In particular, this literature review serves as a cornerstone in informing the conduct of the study on “Trends and Determinants of Intrapartum Stillbirth in the Public Health Facilities of Addis Ababa, Ethiopia”.

3.2 LITERATURE REVIEW ON THE STUDY TOPIC

3.2.1 Definition and magnitude of stillbirth

The definition of stillbirth varies between countries and even across studies conducted in a country. The commonest definition which is being recommended by the World Health Organization (WHO) for international comparison uses gestational age and weight of the

foetus (WHO, 2016a:19). Accordingly, stillbirth is a baby born dead at 28 weeks of gestation or more, with a birthweight of ≥ 1000 g, or a body length of ≥ 35 cm. The rationale for restricting international reporting to stillbirths of greater than 1000 g or after 28 weeks is to assure comparability, as the countries where most stillbirths occur mostly still do not capture even these larger, more mature deaths reliably and therefore, data remain uncertain. Furthermore, in countries lacking neonatal intensive care, few babies below the gestational age of 30 weeks survive (Aminu et al., 2014:141). A more technical definition of stillbirth refers as the birth of an infant with no signs of life (Apgar score 0/0 at 1st and 5th minute, respectively) at or beyond 28 weeks gestation (Robalo, Pedroso, Amaral & Soares, 2013:39). Intrapartum stillbirth is a subset of late foetal death that typically occurs during labour, which clinically presents as fresh stillbirth (Adekanbi et al., 2015:635).

The definition of stillbirth and other outcome of pregnancies should be seen along a spectrum of gestational age and birth processes. The following diagram presents such milestones together with corresponding definitions given to the adverse outcomes of pregnancies. Accordingly, the 40 weeks period of human pregnancy was conventionally divided into three segments which are referred as first, second and third trimesters. Any loss of the foetus during the first two trimesters particularly before the gestational age of 22 weeks is defined as miscarriage. An expulsion of a foetus before 37 completed weeks of gestation is defined as preterm and the survival of the baby depends on many factors. These include the quality of intrapartum care, availability of newborn supportive facilities, and the level of maturity for the baby including birthweight. Overlaying the definition of stillbirth along this continuum of gestational age has been the most commonly used approach by researchers and clinicians alike. Accordingly, the death of foetus that occurs between 28 weeks of gestation and the onset of labour has been referred as antepartum stillbirth whereas a situation where such death occurred after the onset of labour and before the complete expulsion of a baby from the uterus is referred as intrapartum stillbirth. The most challenging aspect of the stillbirth definition emerges from lack of clear differentiation between intrapartum stillbirth and immediate postnatal time, a condition referred “Grey nexus” in the diagram below (WHO, 2016a:19).

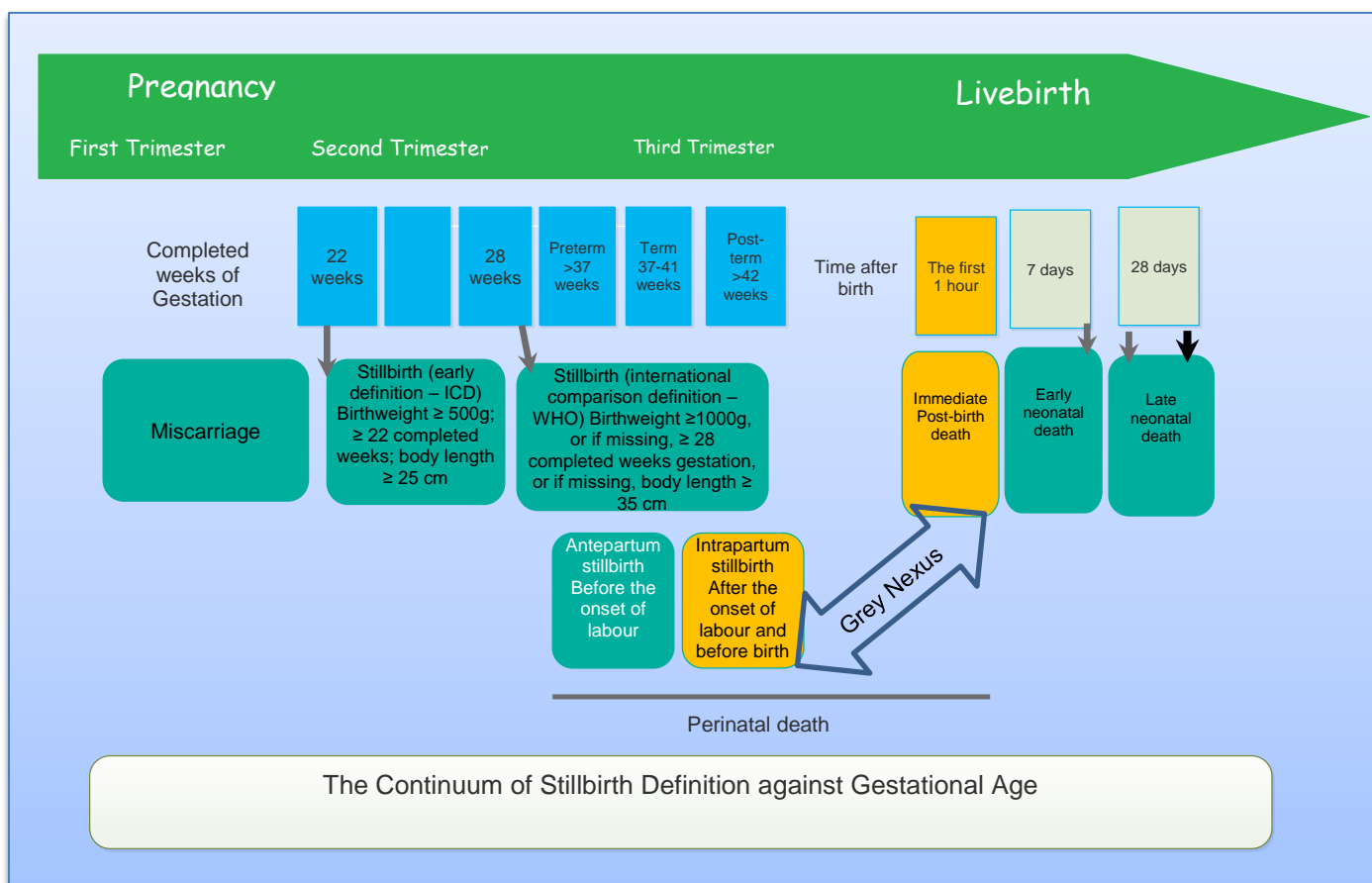


Figure 3.1 Spectrum of pregnancy outcomes

(WHO, 2016a:19)

Death itself is defined as having no sign of life, such as a heartbeat or spontaneous respiration after delivery. The terms ‘stillbirth’, ‘foetal demise’ and ‘intrauterine foetal death’ are often used interchangeably (Goldenberg, Kirby & Culhane, 2004:79). Furthermore, the International Classification of Diseases, 10th revision (ICD-10) defines a foetal death as follows:

“death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the foetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles” without specification of the duration of pregnancy (Joy et al., 2010:1471).

This latter definition is much broader and captures any termination of unborn life including miscarriages, antepartum and intrapartum stillbirths.

High-mortality settings require broad causal categories that can be distinguished through simple clinical observations or even through verbal autopsy and which are programmatically relevant in that they identify conditions associated with large numbers of deaths. One useful distinction for stillbirth prevention strategies is between macerated (antepartum) and fresh (intrapartum) stillbirths. Rates of fresh stillbirths are assumed to reflect the quality of intrapartum care while rates of macerated stillbirths are assumed to reflect the quality of foetal growth and of care during the antenatal period. The antepartum/intrapartum distinction can generally be explored in verbal autopsy studies with questions pertaining to the appearance of the infant's skin. Once these two major categories are well defined, a more detailed set of programmatically relevant causal groups can be distinguished further. This intermediate level of detail is possible with clinical data and achievable in most facility deaths in low and middle income countries (Joy et al., 2010:1471).

Moreover, the choice of a definition will determine the number of deaths counted as stillbirths. Upper middle-income countries more often use a lower gestational age cut-off point and so count more babies who are not born with signs of life, while low-income and lower middle-income countries tend to use a higher gestational age cut-off point. This may be related to technological advancement and the ability to provide care for babies born at a certain gestational age to increase the chance of survival *ibid*).

Hospital-based data on stillbirth show that the rates are high in developing country settings. However, it is difficult to provide meaningful population level rates. Data on cause of stillbirth are collected relatively infrequently at this level. Although at health facility level most maternity registers record information on condition at birth (alive, stillborn), stillbirth is currently not recognised in the Global Burden of Disease (GBD). The International Classification of Diseases neither counts it as missed lives in disability-adjusted life-years nor fully identified as an individual death. To make matters worse, stillbirths are hardly integrated to national Health Management Information Systems (HMIS) data and reports of approximately 90 countries worldwide. This lack of recognition and paucity of data on stillbirth has continued to make it difficult to assess the true rates of stillbirth in many developing countries (Aminu et al., 2014:141).

Despite the challenges with data availability, it is being estimated that every year approximately three million stillbirths occur worldwide. The majority (98%) of stillbirths occur in low- and middle-income countries and more than half (55%) of these happen in sub-Saharan Africa. Although some developed countries report a stillbirth rate (SBR) of 3 per 1000 births, a ten-fold increase is noted in some settings in sub-Saharan Africa and South East Asia with reported stillbirth rates up over 30 per 1000 births and over (Aminu et al., 2014:141). For instance, a systematic review report estimated that in 2015 there were one million stillbirth cases in sub-Saharan Africa accounting for 29 per 1000 births (Hannah, Simon, Fiorella, Lale, Doris, Colin, Dan, Suhail, Zeshan, Danzhen & Joy, 2016:98). Furthermore, approximately one million intrapartum stillbirths occur annually, representing one-third of stillbirths globally. Despite the caveats inherent in the interpretation of the intrapartum stillbirth estimates, these estimates clearly highlight the magnitude of loss of life just minutes and hours prior to birth (Joy et al., 2010:1471).

Being one of high stillbirth burden countries in sub-Saharan Africa, Ethiopia endures a heavy toll of stillbirth every year. The systematic review indicated above, which was conducted by Hanna et al (2016: e104), reported that Ethiopia ranked fifth among the high burden countries globally with absolute annual loss of over 6 000 babies owing to stillbirth during the period 2000 and 2015 (Hannah et al., 2016:98). The national data on stillbirth is scanty in the country. Despite issues related with its accuracy, the annual health management information system (HMIS) data have been inconsistent and fail to include stillbirth at times. However, one of such documents that was published by the Federal Ministry of Health (FMOH) in 2012 indicated that the country experienced over 15 000 stillbirths in the health facilities alone with alarming rate of 26 per 1000 births (FMOH, 2012:20). The recent DHS report as well as annual data from the HMIS in the subsequent period confirmed that the stillbirth rate was not showing any significant decline in Ethiopia in the recent years. More detailed analysis based on actual health system data from Addis Ababa will be described in Chapter 5 of this thesis to present the trends and magnitude of stillbirth in the country over the course of five years (2010–2015).

3.2.2 Causes and factors associated with stillbirth

There were conflicting views regarding what is considered a 'risk factor' for stillbirth and what is considered a "cause" and in fact most authors use the two terminologies interchangeably. However, many studies indicated the importance of making the distinctions between the two to identify what can be done to improve obstetric care at the health facility level. The most common factors associated with stillbirths in developing countries were the lack of adequate antenatal care, lack of a skilled birth attendance at delivery, low socio-economic status, poor nutrition, previous stillbirths, gestational age at birth, parity, birthweight, foetal sex, multiple gestation, and maternal morbidity. Furthermore, the most commonly recognised causes of stillbirth from developing countries are hypertensive disorders in pregnancy, asphyxia, trauma and infection that typically accompany prolonged labour (Aminu et al., 2014:141).

Determining specific cause of stillbirth will also require a sophisticated techniques and facilities including post-mortem examination equipment. In a study that made complete post-mortem analysis to determine the causes of stillbirth, the researchers attempted to establish causes of stillbirth by considering three important features:

- "When," with an analysis of the clinical condition of the pregnancies at the time of stillbirth.
- "What," with a detailed and systematic pathologic protocol for post-mortem examination and placental evaluation.
- "Why," or the reason for the foetal death taking into account all clinical and pathologic characteristics of the stillbirth.

These features were then evaluated using Initial Causes of Foetal Death (ICFD) to determine the cause of death in as many cases as possible using rigorous and standardised definitions. However, this type of rigorous approaches and facilities are not accessible to many settings particularly in developing counties which makes identification of causes of stillbirth more difficult (Dudley, Goldenberg, Conway, Silver, Saade, Varner, Pinar, Coustan, Bukowski, Stoll, Koch, Parker, Reddy & Stillbirth Research Collaborative, 2010:254).

Several ongoing epidemiologic and clinical researches paid attention to unravelling the casual elements underpinning stillbirth. For instance, it has been observed that some potential factors underlying unexplained stillbirth might have had their origins in the pathological and clinical interactions between several factors including maternal, foetal/placental factors and foetal stressors. Accordingly, death occurs only if all three factors intersect and only if the stressor and maternal factor match the specific vulnerability of the individual foetus. The latter explains why the same critical event and/or maternal factors are not always associated with stillbirth or even poor pregnancy outcome. In this regard, a study suggested that unexplained late stillbirth occurs when a foetus that is somehow vulnerable dies as a result of encountering a stressor because of maternal conditions in a combination which can be lethal for both (Michael, Shiliang, Zhongcheng, Hongbo, Robert & Joseph, 2002:493).

However, some researchers do argue that foetal deaths are associated with broader spectrum of factors than such narrow list of determinants. Proponents of the former perspective provide long list of potential determinants of stillbirth. These include the following:

- Placental conditions.
- Obstetric complications such as cervical insufficiency, placental abruption, preterm labour, and preterm premature rupture of membranes.
- Foetal major structural malformations and/or genetic abnormalities.
- Infections involving the foetus, placenta, or severe maternal systemic infection.
- Maternal medical conditions including diabetes.
- Hypertensive disorders (chronic hypertension and preeclampsia).
- Umbilical cord abnormalities such as prolapse, strictures, and thrombosis.
- Other conditions such as hydrops and early amnion rupture sequence.

Accordingly, obstetric complications were the most common category for cause of death including abruption, complications of multiple gestation, and the constellation of preterm labour, preterm premature rupture of membranes, and cervical insufficiency (Bukowski et al., 2011:2459).

Moreover, etiologic determinants differ widely according to whether the stillbirth occurs antepartum or intrapartum, that is, before or during labour. Antepartum stillbirths often occur with severe maternal, placental, or foetal abnormalities, including umbilical cord complications, preeclampsia, intrauterine growth restriction, abruption placentae, and infection. Maternal smoking, advanced maternal age, grand multiparty, and obesity are also widely recognised determinants of antepartum stillbirth, while one fourth can still occur without known cause. On the contrary, intrapartum foetal deaths are usually the result of foetal distress and/or obstructed labour and often reflect poor access to or quality of clinical care during delivery (Michael et al., 2002:493).

A research conducted by Adekanbi et al. (2015:636) presented a list of causal factors that are consistent with the ones indicated in the above paragraphs. Accordingly, many of the maternal, foetal and clinical care-related factors including obstructed labour, infections, asphyxia, maternal haemorrhage, severe pre-eclampsia and eclampsia, maternal/foetal malnutrition, congenital anomalies and umbilical cord complications, diabetes, and infections associated with preterm birth and post-term pregnancies were cited as causes of stillbirth. Many of these preventable causes of stillbirth have been virtually eliminated in high income countries. However, contributions from these important causes in the sub-Saharan Africa region are scarcely documented. For instance, birth asphyxia, a condition of newborns who had breathing abnormality at birth has been considered one of the most salient causes of stillbirth and early neonatal death. Controlling this factor alone through effective and high quality intrapartum care as well as immediate newborn interventions would avert significant numbers of stillbirth (Adekanbi et al., 2015:635). While there are not good data available about the number of stillbirths occurring secondary to asphyxia/hypoxia, approximately 25% of perinatal deaths are attributed to asphyxia. These incidents are mostly related to poor care quality during intrapartum period, a situation many developed countries successfully contained. Hence, it is likely that stillbirths could be reduced significantly with adequate care in developing countries as well (Goldenberg & McClure, 2009:1).

It is also well recognised that twin pregnancy is at increased risk of stillbirth especially when complicated by twin-to-twin transfusion. Current researches suggest that the foetus who is particularly vulnerable to late stillbirth is the foetus who fails to grow appropriately. Intrauterine Growth Restriction (IUGR) owing to placental insufficiency is identified in about 40-60% of stillbirths, also in otherwise unexplained stillbirths and highlights the

probable role of placental pathology in stillbirth. The foetus who slows or stops moving is also one who is vulnerable to stillbirth. Placental dysfunction and abnormalities also have a well-known association with poor pregnancy outcome. It has also been suggested that the foetus at risk may stop movement to conserve energy in the presence of placental dysfunction. It is understood that placental function diminishes as the pregnancy nears and goes over due delivery date. Such research studies indicate the pivotal role that the placenta has in pregnancy outcome and maybe an important factor impacting on foetal vulnerability in many stillbirths (Jane & Edwin, 2014:1471).

A related cause of stillbirth in developing countries is foetal malposition. In developed countries, these foetuses are generally delivered by Caesarean section to prevent the complications of prolonged labour, asphyxia, and birth trauma. However, when Caesarean sections are unavailable, mortality from these complications becomes high. In geographic areas where blood pressure and urine protein screening are not routine, and where induction of labour or Caesarean sections are not accessible, foetuses frequently die secondary to hypoxia associated with maternal preeclampsia or eclamptic seizures. Often some conditions existing before the pregnancy, such as poor nutritional status, malaria, or sickle cell disease are also attributable to stillbirth. The baby may have congenitally acquired infections such as syphilis, TB, and HIV, which are believed to have certain association with the occurrence of stillbirth. To this effect, particularly in developing countries, estimates suggest that infection contributes to nearly half of the stillbirths (Gardosi et al., 2005:1115).

For instance, in a study that looked at the impacts of infection on stillbirth outcome, approximately 52% of pregnancies in mothers with untreated or inadequately treated syphilis result in some adverse pregnancy outcome including stillbirth (Qin, Yang, Xiao, Tan, Feng & Fu 2014:e102203). The effect of HIV infection on the stillbirth outcome seems inconclusive. A study on this topic revealed that there was no significant difference in HIV positivity when postpartum women with a reported stillbirth and those without were compared (Turnbull, Lembalemba, Guffey, Bolton-Moore, Mubiana-Mbewe, Chintu, Giganti, Nalubamba-Phiri, Stringer, Stringer & Chi, 2011:894). However, a clinical trial among HIV-infected mothers in Tanzania found an increased risk of stillbirth among mothers with a higher plasma HIV viral load and who were symptomatic (Aminu et al., 2014:141).

In another study comparing aetiology of stillbirth across time, it was implied that infection including ascending and haematogenous infections, was the primary factor for cause of stillbirth (Wou, Ouellet, Chen & Brown, 2014:e004635). Data analysed from 7993 pregnancies in six developing countries by a researcher also confirm that infection and asphyxia account for about one third of stillbirth each. The same study also indicates that hypertensive disorders were the most important cause of perinatal death, followed by preterm delivery and intrapartum conditions (Nguyen-Ngoc, Merialdi, Abdel-Aleem, Carroli, Purwar, Zavaleta, Campódonico, Ali, Hofmey, Mathai, Lincetto & Villar, 2006:699).

Studies around the impacts of smoking on stillbirth risk show consistent results where dose-response relationships have generally been established. These findings lend support to the hypothesis that smoking during pregnancy may cause stillbirth (Hogberg & Cnattingius, 2007:699).

However, it is being estimated that between one third and one half of all late term stillbirths are unexplained, that is a specific cause cannot be identified. Even in high income countries where autopsy and/or placental pathological examinations are available, the unexplained rate can still be around 15%. Unexplained stillbirth is a difficult problem to study because of the paucity of clues. If improvements in prediction and prevention of stillbirth are to be made, specific risk factors that are modifiable should be targeted. Clinical practice and observational studies primarily target maternal risk factors such as maternal hypertension, smoking, obesity and other medical conditions (Jane & Edwin, 2014:1471). However, aspects of impacts associated to the quality of obstetric care needs to be well documented as well. For instance, a study in Bangladesh confirmed infants born in institutions had twice the odds of being stillborn after adjusting for parity, socio-economic status, maternal education, and reported delivery complications partly explaining the fact that suboptimal institutional care contributes to poorer outcomes of pregnancy (Ellis, Azad, Banerjee, Shaha, Prost, Rego, Barua, Costello & Barnett, 2011:e1182).

The relevance of such enumeration of potential causal factors is to establish a clear understanding of the mechanisms prompting stillbirth thereby to find practical solutions to reduce its burden. Evidence has been conclusive that many of the stillbirth incidences could be effectively prevented. However, for many cases of stillbirth the cause of death

is currently never established definitively. Cause of death is very often not recorded accurately or not recorded at all. Reduction in stillbirth will also require a more intensive programme of capacity building of healthcare providers as well as policy makers to understand and recognise the causes of stillbirth and to evaluate cases of stillbirth using audit to identify where change in practice can be and need to be made (Aminu et al., 2014:141).

In summary, causes and risk factors associated with stillbirth have diverse origins including maternal conditions, foetal conditions, access to obstetric services, socio-economic conditions and unknown factors. Maternal risk factors include age at birth, nutritional status, parity, substance use; medical conditions including hypertensive disorder and diabetes; uterine condition including placenta, infection and obstetric history including previous experience of stillbirth. Similarly, a range of foetal factors including prematurity, birthweight, congenital anomalies, sex, infection, intrapartum trauma, asphyxia, and cord accident are believed to have associations with stillbirth. Evidence also shows that lack of access to adequate and timely antenatal services, skilled and timely obstetric care, effective referral services for complications are factors that could lead to stillbirth. Low socio-economic status including wealth index and maternal education has been reported by several studies as contributing to stillbirth in developing countries.

3.2.3 Classification of stillbirth

Classification of stillbirths can be defined as the process of systematic assembling, storage and retrieval of the underlying cause of death and/or other relevant important information pertinent to the event (Flenady, Froen, Pinar, Torabi, Saastad, Guyon, Russell, Charles, Harrison, Chauke, Pattinson, Koshy, Bahrin, Gardener, Day, Petersson, Gordon & Gilshenan, 2009:1). The value of any death classification system is closely aligned with its ability to identify the underlying causes of death and the key factor which started the chain of events leading to the death (Goldenberg et al., 2004:79). The ultimate purpose of classification of stillbirth is to identify deficiencies in the provision of care, to focus attention where improvements are already possible and to indicate where new developments or knowledge may be expected to lead to further advancement. The overarching goal, common to all classification systems are related to the reduction in stillbirth incidence and to conserve the useful information about the death of the foetus.

The use of suboptimal classification systems may lead to a loss of important information and contributes to a high proportion of unexplained deaths (Flenady, et al., 2011:1331).

Furthermore, the usefulness of a classification system which results in most cases being “unexplained” or “unclassified” is questionable. While this categorisation might prompt for further research, in everyday sense such terms are often taken as being synonymous with “unavoidable,” which has connotations for all parties concerned:

- The parents who are seeking explanations and are trying to come to terms with the loss.
- The clinicians who are seeking to advise the mother on the implications and plans for future pregnancies.
- The health care institutions which need to review classification system of stillbirth to adjust the service they are providing.
- The planners and commissioners who are seeking to improve the service (Jason & Robert, 2010:114).

In general, there are intensified demands on medical, political and epidemiological grounds for proper determination and classification of cause of perinatal mortality. Such classification is complex owing to the complicated pathophysiological processes encountered in the mother, foetus and placenta, and because of their interactions. The multiplicity of contributing factors and the different background of the clinicians involved add to the complexity of classifying stillbirth (Korteweg, Gordijn, Timmer, Erwich, Bergman, Bouman, Ravisé, Heringa & Holm, 2006:393).

A well-structured and highly specified stillbirth classification would serve the following four main purposes:

- To enable regional and international comparisons.
- To undertake epidemiologic and health surveillance.
- To improve the quality of clinical practices.
- To conduct research in the domain.

These four categories represent very different requirements for a classification depending on the setting. Despite the differences in use, the original case information is the data source for all classifications. For some this will be an extensive protocol of clinical history, examinations and tests. For others, it will be based on only sparse clinical information that might be available from records of obstetric care. Regardless of the completeness of the original case information, the narrative of the case history is often a crucial part of the information that needs to be conserved. In addition to information capture, ease of use and interrater agreement are important requirements of any classification system. A uniform global approach to classification of stillbirths is the ideal. A universally accepted classification will help countries or districts to benchmark and compare their mortality rates and the associated factors or underlying causes. This in turn will help in the push for the appropriate resources to fill health gaps and to develop equitable services that can recognise and respond to local challenges (Jason & Robert, 2010:114). However, the current use of fragmented and possibly suboptimal classification systems for stillbirths limits the potential for advancements in the understanding of stillbirth and prohibits meaningful comparisons across regions and countries to assist in identifying priorities for prevention (Flenady et al., 2016:695).

Another related study indicated that there are two principal purposes for classification systems, and these are not mutually exclusive. The first is to improve our understanding of the causes, and the events which have led to the death. It was argued that a valuable classification system for research would identify the pathophysiological entity initiating the chain of events that irreversibly led to death, based on pathologic, clinical, and diagnostic data. Related to some of the causal mechanisms discussed under chapter 2 of this thesis, the criteria to be used to categorise a condition as a cause of stillbirth should consider the following principles:

- There is epidemiologic data demonstrating an excess of stillbirth associated with the condition.
- There is biologic plausibility that the condition causes stillbirth.
- The condition is either rarely seen in association with live-born or when seen in live-born results in a significant increase in neonatal death.
- A dose–response relationship exists so that the greater the “dose” of the condition, the greater the likelihood of foetal death.
- The condition is associated with evidence of foetal compromise.

- The stillbirth would likely not have occurred if that condition had not been present, that is, lethality.

The same study further underscores on a more pragmatic classifications suggesting that while often a cause cannot be found, the stillbirth can still be described in terms of what happened around the time of birth to help clinicians and planners to make improvements based on the information available (Jason & Robert, 2010:114).

Stillbirth classification also varies along geographic regions, causes and timing of stillbirth in relationship to labour. The older concept of macerated versus fresh stillbirth roughly corresponds to gross categorisation of antepartum and intrapartum categories, but with the advent of ultrasound and foetal heart rate monitoring, the timing of the stillbirth in developed countries is generally known, at least approximately (Goldenberg et al., 2004:79).

However, a systematic review study argued that the use of terms such as 'fresh' or 'macerated' stillbirth is still relatively common and in some contexts probably the only type of categorisation used. If used correctly and without shame or blame associated, this simple classification may help in defining an approximate time of death but may not be helpful when trying to establish a more precise cause of death or other factors including provision of sub-standard care during the antenatal period. However, the high proportion of fresh stillbirths observed in many studies does indicate that the quality of care during the time immediately preceding birth and at the time of birth at health facility level needs to be improved (Aminu et al., 2014:141).

On the contrary, many countries have developed more complex systems for classification of stillbirth. The same study in the above paragraph posits that currently there are over 35 classification systems for stillbirth and/or perinatal mortality, none of which has been clearly agreed and adopted globally. These classification systems use different approaches resulting in poor comparability between settings and they consistently report about two-thirds of stillbirths as unexplained. Some of the widely known classification systems, including the Extended Wigglesworth and Amended Aberdeen are considered unsuitable for classification of stillbirths. The high number of classification systems available, each focusing on one or more areas of foetal (e.g. Wigglesworth), maternal

(e.g. Aberdeen) or placental causes, makes it even more difficult for developing countries to adapt a system that will work in all or at least most health settings *ibid*).

One recurring obstacle to identify and address problems related to classification systems is the fact that many of these systems seek to establish a “cause” of death. However, very often, the causes have not been sufficiently investigated, or the capabilities to investigate them are not available. For example, post-mortem analysis varies substantially between countries and over time; in some health systems, they are not freely available, and in some communities, they are not accepted on cultural or religious grounds. Even full investigation using post-mortem evaluation may not affect the proportion of cases considered “unexplained” because of the rigidity of the classification system (Jason & Robert, 2010:114).

Researchers and practitioners have used many alternative approaches alike in different settings to describe “what” has happened, using a classification that focuses on clinical conditions, and results in messages that are clinically relevant. For instance, a stillbirth classification system called Relevant Conditions at Death (ReCoDe) was used to a cohort of stillbirths that occurred in the West Midlands, England from 1995 to 2005, and was found to reduce the size of the “unexplained” category to 16%. This method allowed conditions to be included which described “what” happened, without claiming any causal explanation. To take further the concept of distinguishing condition (what) and cause (why), a three-tier perinatal classification of “when,” “what,” and “why” has been proposed by some researchers. First, the “when” establishes the timing of the death: antepartum, intrapartum, and early neonatal as well as the gestational age of the foetus. “What” describes the relevant conditions as in ReCoDe, and the “why” seeks to establish in more detail the underlying causes (Jason & Robert, 2010:114).

A few other systems have been used in different health systems to classify stillbirth. One among these systems is CODAC (Cause of Death and Associated Conditions), which uses a hierarchical tree of potential causes to code the underlying actual cause of a stillbirth incidence. This classification seeks that the cause of perinatal death should be classified under categories including infection, neonatal, intrapartum, congenital anomaly, foetal, cord, placental, unknown, and termination (MBRRACE-UK, 2013:15). Perinatal Society of Australia and New Zealand Perinatal Death Classification (PSANZ-PDC) is another system being used to classify foetal and neonatal deaths beyond standard ICD

(International Classification of Diseases) coding, with a view to better assess the aetiology and to more accurately determine specific factors leading to perinatal death. Accordingly, potential causes of stillbirth include congenital abnormality, perinatal infection, hypertension, antepartum haemorrhage, maternal conditions, specific perinatal conditions, hypoxia, foetal growth restriction, spontaneous preterm and unexplained antepartum death are presented as categories (Perinatal Society of Newzealand and Australia, 2009).

- Furthermore, a system of classification that relies on pathophysiological conditions to determine the causes of perinatal death was developed by a panel of multidisciplinary experts at a teaching hospital in the Netherlands. This classification called Tulip and consists of six main causes with sub-classifications. These include the following:
 - Congenital anomaly (chromosomal, syndrome and single or multiple organ system).
 - Placenta (placental bed, placental pathology, umbilical cord complication and not otherwise specified [NOS]).
 - Prematurity (preterm pre-labour rupture of membranes, preterm labour, cervical dysfunction, iatrogenous and NOS).
 - Infection (trans-placental, ascending, neonatal and NOS).
 - Others (foetal hydrops of unknown origin, maternal disease, trauma and out of the ordinary).
 - Unknown (Korteweg et al., 2006:393).

Amended Aberdeen and Extended Wigglesworth Classification have interrelated approaches of stillbirth classification systems where both attempt to establish causes that lead to the death of the foetus. The Aberdeen system creates codes for both obstetric and foetal-related probable causes along with specific description of potential conditions that might have led to death. For instance, codes are assigned to likely obstetric mechanical causes that resulted in foetal death including cord prolapse, breech presentation, oblique or compound presentation, uterine rupture etc. Similarly, foetal causes of different categories were given 24 independent codes that service providers are expected to use for classification of foetal death. On the contrary, the Extended Wigglesworth system describes nine categories of causes including congenital,

unexplained antepartum foetal death, intrapartum asphyxia, immaturity, infection, and sudden infant death (Epicure, 1995).

However, when six of the popular classification systems (Amended Aberdeen, Extended Wigglesworth, PSANZ-PDC, ReCoDe, Tulip, and CODAC) were evaluated on their ability to classify stillbirths, ease of use, inter-observer agreement and ability to retain information, studies reported that CODAC performed best with PSANZ-PDC and ReCoDe performing well. ReCoDe has been reported as the only classification system specifically developed to categorise cause of stillbirth with relative ease of application in many settings. However, there is still a real need to develop and agree upon a simple classification system that can be used at health facility level in low and middle-income countries (Aminu et al., 2014:141).

Like many other countries in sub-Saharan Africa, the Ethiopian health systems do not promote any systematic and sophisticated system of classification that could indicate the underlying causal factors of stillbirth. Only two categories of stillbirth including “macerated” and Fresh” are presented in the intrapartum care record of particularly the public health facilities. Furthermore, stillbirth is being reported across the ladders of the health system in Ethiopia as a single variable without any differentiations or indication of sub-classifications (FMOH, 2008:20).

In a country that sees the death of approximately 30 unborn lives out of every 1 000 births (Central Statistical Agency, 2011:115), absence of classification of stillbirth based on underlying causes or conditions at the time of the incidence would further jeopardise the effort of addressing the burden. One of the important potential consequences of considering a stillbirth as a gross incidence of mortality would be the limitation it might bear on the ability of the health system to improve the quality of intrapartum care (Jason & Robert, 2010:114).

Moreover, stillbirth is an outcome that has many underlying causal factors that need to be explored and correctly categorised to mitigate the situation. The classification challenges in the Ethiopian health system seem even beyond making causal attributions to stillbirth. For instance, the only health facility based service audit that was conducted by the Federal Ministry of Health in 2008 revealed that the health facility records were not robust enough to differentiate intrapartum stillbirth from immediate postnatal death of the

newborns. The report highlighted that misclassification of stillbirths and very early neonatal deaths may occur because staff feels unjustifiably guilty about the death of a newborn and would therefore classify it as a stillbirth. And consequently may not want to tell a mother that her newborn was born alive and then died (FMOH, 2008:20).

3.2.4 Evidence on interventions that could reduce intrapartum stillbirth

Several clinical and health promotion interventions targeting mothers and foetus at different stages of pregnancies have proven effective in reducing the chances of stillbirth occurrence. For instance, hospital-based studies suggest that from 25-62% of intrapartum stillbirths are avoidable with improved obstetric care and more rapid responses to intrapartum complications, including reducing delays in seeking care from home (Joy et al., 2010:1471). Moreover, competency of obstetric care providers to determine the condition of foetus using critical clinical assessments including foetal heart rate would help prevent intrapartum stillbirth. To this effect, the rate of intrapartum stillbirth can be determined by taking foetus with detectable heart tones at admission as a denominator for infants at risk, and infants delivered and discharged alive as the numerator (Goldenberg, McClure, Kodkany, Wembodinga, Pasha, Esamai, Tshetu, Patel, Mabaye, Goudar, Saleem, Waikar, Langer, Bose, Rubens, Wright, Moore & Blanc, 2013:230). This indicates that accurate measurement of foetal heart rate on admission for labour and subsequent monitoring throughout the intrapartum period would reduce the chance of foetal deaths.

Furthermore, preventive measures aimed at reducing the incidence of intrapartum foetal death entail all measures aimed at improving the quality of antenatal care and preventing intrapartum asphyxia. Appropriate obstetric care in the prenatal and intrapartum periods is vital. In addition, close monitoring with readily available appropriate care during labour to enable obstetrical providers recognise conditions such as prolonged labour, placental abruption, placental praevia, foetal malposition, and foetal distress will allow for rapid intervention through Caesarean section to further reduce the rate of intrapartum foetal deaths. Intermittent auscultation for monitoring foetal heart rate in labour is preferred and should be promoted in the low and medium income countries, rather than continuous foetal heart rate monitoring devices. This recommendation is based on the outcome of a Dublin-based study, which concluded that there is no difference in intrapartum stillbirth

rates, as well as long-term outcome between the intermittent auscultation group and the continuous foetal heart rate monitored group (Adekanbi et al., 2015:635).

Monitoring the progress of labour using ultrasound technology has been considered to have clinical significance in reducing stillbirth. Although studies are not conclusive to show whether the results are statistically significant, the use of Partograph provides a continuous pictorial overview of the progress of labour and distinguishes between the latent and active phases of labour. Slower progress identified by the alert line on the Partograph can be used as a basis for transfer to a facility for higher level skilled intervention and delivery. For instance, a large, multicentre study from Southeast Asia reported a relatively lower stillbirth rate among women using the Partograph compared to a control group for whom it was not implemented. Planned Caesarean section for breech and transverse presentation of foetus, elective induction of labour for post-term pregnancies, and prophylactic corticosteroid or antibiotic therapy in preterm labour are among the recommended interventions to reduce the occurrence of stillbirth (Fernando, Zulfiqar & Gapps, 2010:S3).

Some studies also indicated that malnutrition including protein energy and micronutrient deficiencies are believed to have some associations with stillbirth. As a consequence, different nutritional interventions have been tried for women at high risk of nutritional deficiencies, including supplements of specific micronutrients, such as zinc, iron and folate, magnesium and calcium given either singly or in combination (Fernando et al., 2010:S3).

Any of the slight reduction in stillbirth incidence in high income countries which has occurred in recent years has resulted from four distinct strategies. These are effective management of risk factors such as RH alloimmunisation (immune response) and induction of labour for postdate pregnancies; effective management of maternal medical conditions such as hypertension and diabetes; increased intrapartum foetal monitoring and foetal surveillance; and undertaking appropriate screening tests for infection during pregnancy. However, it is likely that no single mechanism or causative pathway can explain stillbirth, hence proposed causal pathways leading to stillbirth cannot be detected easily to undertake preventive measures ahead of time. Indeed, many researches indicate that even risk factors with high odds ratio cannot be definitive cause of stillbirth,

rather they might be additive or interact together resulting in a stillbirth making prevention of stillbirth more complex (Jane & Edwin, 2014:1471).

Furthermore, many studies support the notion that good intrapartum care begins earlier in pregnancy: the antepartum course affects the foetus' reserve and ability to withstand stress, and is therefore relevant for determining the appropriate level of surveillance during labour. Most stillbirths occurred at gestation when the baby would be matured enough not only to survive but to do well, if it could be delivered in good condition. This shifts the emphasis on the identification, diagnosis, and management of foetal growth problems. Prospective surveillance can result in the timely delivery of a foetus at risk from an unfavourable intrauterine environment. However, the main problem facing expectant mothers and clinicians is the lack of recognition with in the general maternity population of foetuses with growth problems that need referral for further investigation. In everyday practice, only about a quarter of small for gestational age babies are detected during the antenatal period and lack of antenatal detection is considered the single largest factor associated with substandard care. The strong link between foetal growth failure and stillbirth has important implications for health policies and preventive strategies, including the need to enhance efforts to improve the antenatal detection of foetal growth restriction (Gardosi et al., 2005:1115).

3.3 LITERATURE REVIEW RELATED TO THE STUDY METHODOLOGIES AND DESIGN RELEVANCE

Designing a study requires making decisions about the type of case or samples to select, how to measure relevant factors and what research techniques such as questionnaires or experiments to be employed (Choy, 2014:99). Research designs particularly in epidemiologic studies can generally be categorised as either descriptive or analytical. The descriptive design attempts to quantify the frequencies of diseases or health conditions including their variation in terms of demographic characteristics, time and places without any concern to testing hypothesis. Conversely, analytical studies can be either observational or experimental with interest to measure whether certain exposure influences the risk of occurrence of a disease or health condition (Koepsell & Weiss, 2014:76).

The case-control design is one of the observational study method where individual subjects are classified according to their outcome status before determining their exposure status. In this design, the researcher would select the group of subjects with the outcome of interest and a comparable group of subjects without the outcome of interest. The cases and control are then examined if any of the variables considered as exposures are related to the outcome of interest (Oleckno, 2008:55).

Case-control studies are especially useful when a study must be performed quickly and inexpensively or when the disease under study is rare (e.g. Prevalence < 1%). Although case-control studies can consider only one outcome (one disease) per study, many risk factors may be considered, a characteristic that makes such studies useful for generating hypotheses about the causes of a disease (Katz et al., 2014:408).

Given stillbirth is a relatively rare event in health facilities, the case-control study design appeared to be the most appropriate option to undertake this research work. Cost, time, and ethical issues make other study design options including prospective cohort, retrospective cohort and experimental design less appropriate to study factors associated with stillbirth. Furthermore, this study focuses on chart review of cases and controls in the health facility setting and as such will not suffer from any recall bias or individual consent issues, which are common pitfalls of any retrospective studies. Detailed description of the methodological relevance and research design is presented in Chapter 4 of this thesis.

3.4 CONCLUSION

This chapter presented summaries of exiting knowledge and evidences on stillbirth. Accordingly, materials from wide ranging literature review on maganitude, definitions, causes and clasifications were articulated to provide a stong foundation for the current study. Literature review also covered the relevance of a case-control study design to assess detremnants of intrapartum stillbirth and existing evidences on effective interventions to prevent the occurrence of intrapartum stillbirth.

CHAPTER 4

RESEARCH DESIGN AND METHOD

4.1 INTRODUCTION

Research design and methods are influenced by several underlying choices a researcher makes including theory of knowledge claims, strategies of inquiry, and methods of data collection and analysis. Knowledge claims are related with choices of the underpinning theoretical perspectives including post-positivism, constructivism, participatory, and pragmatism. On the contrary, strategies of inquiry including quantitative, qualitative or mixed approaches provide scientific directions to procedures in a research design and are aligned with the different theoretical perspectives. For instance, the quantitative inquiry strategy is mostly applicable to post-positivists perspective whereas qualitative strategy is more relevant to the constructivist and participatory types of knowledge claims (Creswell, 2014:3). Methods of data collection also vary depending on the type of inquiry and theoretical perspectives setting the boundaries for the study. Quantitative inquiries heavily rely on data collected through structured questionnaires whereas qualitative inquiries collect information through unstructured or semi-structured observations, interviews, documents review, and visual materials.

The strength of a study design and corresponding evidence level vary based on the type of methods employed in collecting and analysing data. For instance, in epidemiologic studies, systematic review and meta-analysis are considered as the strongest evidences owing to the level of rigour involved in reviewing multiple studies and presenting evidences through critical analysis. In their book entitled, “Jekel's Epidemiology, Biostatistics, Preventive Medicine and Public Health”, Katz et al. (2014:3408) outlined the following diagram, which presents the order of strength of epidemiologic study designs.

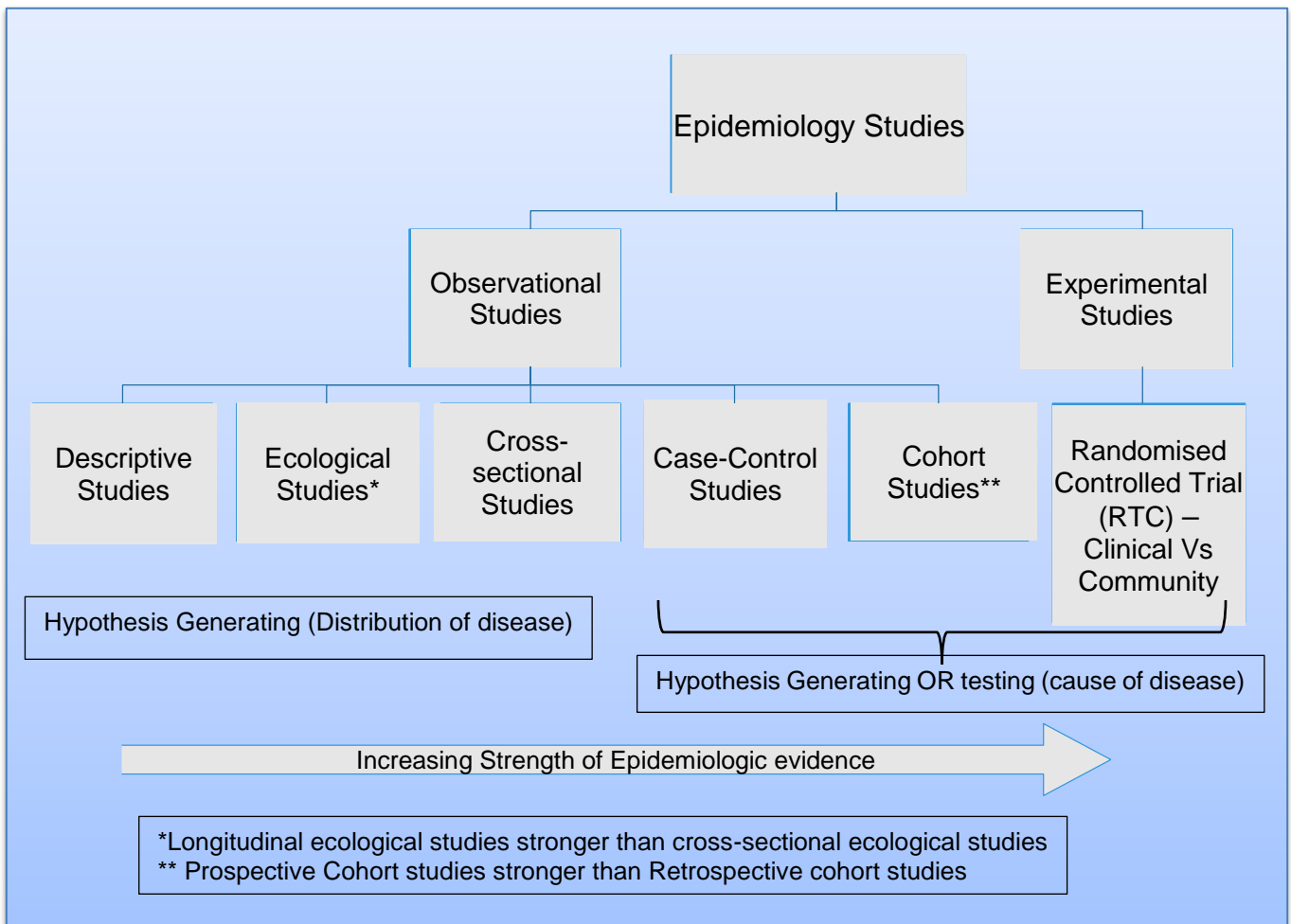


Figure 4.1 Types of epidemiologic studies

(Katz, Elmore, Wild & Lucan, 2014:408-1232)

As per the above framework, experimental studies are considered producing the strongest base of evidence followed by observational studies including cohort and case-control studies, which are relatively less expensive methods that could determine causal links or association between exposures and outcomes. Other descriptive study methods including case study and case reports can be referred as less rigorous designs helping only to generate hypothesis and describe the distribution of diseases or health conditions (Katz et al., 2014:408).

The choice of a study design is nearly always determined by the research question of interest and by feasibility constraints. For instance, case-control study offers a cost and time efficiency in terms of studying rare disease like cancer by making it possible for the researcher to include relatively large number of cases therefore avoiding prolonged follow-up of large cohorts. In addition, the reduced sample size of a case-control study,

compared to a full cohort study, can permit efficient resource allocation to refining exposure assessment and obtaining data on potential confounding factors, which may not be practical in a cohort study (Checkoway, Pearce & Kriebel, 2007:633) .

This current research employed a case-control design, which is one of the non-experimental quantitative approaches. With stillbirth being one of the relatively rare epidemiologic events and given other observational or experimental designs would be less appropriate to owing to ethical and cost related reasons, the case-control design was found to be the most appropriate choice for this study. Accordingly, the study utilised data collection and analysis technique relevant to the case-control approach to determine the underlying determinants and factors associated with intrapartum stillbirth for mothers who attended childbirth in public health facilities in Addis Ababa.

4.2 RESEARCH DESIGN

4.2.1 Introduction

A study design is a plan or roadmap for selecting the study subjects and for obtaining data on them (Koepsell & Weiss, 2014:76). As discussed in Chapter 2 of this thesis, a study design is dictated by the theoretical paradigm, research objectives and questions that researchers want to address in a certain scientific inquiry. Parallel to the analogy of architectural plan of a building project, study designs outline the methodological details ranging from the what, how, when and where data would be captured, analysed and interpreted using scientific principles. To this effect, research design helps to ensure that the evidence obtained enables us to answer the study questions as unambiguously as possible. Obtaining relevant evidence entails specifying the type of evidence needed to answer the research question, to test a theory, to evaluate a programme or to accurately describe some phenomenon (New York University, 2017). In other words, when designing research, we need to ask: given this research question (or theory), what type of evidence is needed to answer the question (or test the theory) in a convincing way?

Research design and methods can vary across the scientific disciplines including social science, natural science and epidemiology; study objectives and the type of evidence required from an inquiry. This thesis has an epidemiologic orientation in its approach

hence all subsequent discussions around the research design, method, data analysis and interpretation will be aligned to the key principles in the discipline of epidemiology.

The basic function of most epidemiologic research designs is either to describe the pattern of health problems accurately or to enable a fair, unbiased comparisons made between a group with and without risk factors, a disease, or a preventive or therapeutic intervention. A good epidemiologic research design should perform the following functions (Katz et al., 2014:408):

- Enable a comparison of a variable (e.g., disease frequency) between two or more groups at one point in time or, in some cases, within one group before and after receiving an intervention or being exposed to a risk factor.
- Allow the comparison to be quantified in absolute terms (as with a risk difference or rate difference) or in relative terms (as with a relative risk or odds ratio).
- Permit the researchers to determine when the risk factor and the disease occurred, to determine the temporal sequence.
- Minimise biases, confounding, and other problems that would complicate interpretation of the data.

Two mutually interrelated categorisations of study design are commonly used in epidemiologic inquiries. The first categorisation splits research design into experimental and observational domains. Accordingly, observational studies are epidemiologic studies where the researchers collect, record, and analyse data on subjects without controlling exposure status or the conditions of the study. The researchers simply observe the subjects as they naturally divide themselves by potentially significant variables or exposures. The observational category consists of study designs including descriptive and analytical. Case series, cases studies, cross-sectional studies, and ecological approaches are all part of the descriptive sub-category, whereas cohort and case-control studies are grouped under the analytical design. On the contrary, in experimental studies, the investigators control the conditions of the experiment, including the subjects' exposure status. Experimental studies can be recognised by a planned intervention, which involves the introduction of an investigational treatment, procedure, programme, or service so as to determine its efficacy or effectiveness with regard to a given outcome (Oleckno, 2008:55).

The second categorisation regroups the different epidemiologic study designs under descriptive and analytical approaches. Accordingly, study designs with the capacity to test hypotheses and reveal associations or causal links between variables including experimental, quasi-experimental, cohort, and case-control studies fall under analytical studies. All other designs including cross-sectional, ecological, case report and case series are referred as descriptive mainly because of their functions to describe occurrences of disease and health conditions by time place and person. The following diagram presents brief outline of this latter categorisation of epidemiologic studies.

4.2.2 Justification for considering a case-control design for this study

As briefly highlighted in Chapter 1 of this thesis, case-control is an analytical, observational design commonly used in epidemiology. There are essentially four key steps in carrying out a case-control study. They include the identification of cases, who exhibit the disease/outcome of interest; identification of controls, people who do not have the disease/outcome of interest; measurement of potential risk factors; and analysis of whether the cases were more likely to have been exposed to the risk factors than were the controls (Bruce et al., 2008:6).

In a case-control study, the researcher selects the case group and the control group based on a defined outcome and compares the groups in terms of their frequency of past exposure to possible risk factors. The selection process requires that clear criteria for defining cases and controls should be employed to avoid biases owing to potential misclassifications. Once the cases and controls are successfully identified, the researcher administers questionnaire directly to the individuals or consults relatives or medical records regarding past exposure to risk factors. Given this type of inquiry establishes data on past exposure, it is often referred as retrospective study thereby measuring the risk of having the risk factor among cases and controls (Katz et al., 2014:408; Oleckno, 2008:55).

Furthermore, Sullivan (2012:11-12) argues that reliable diagnostic confirmation including lab test results are necessary conditions to avoid any ambiguity on the presence or absence of the outcome of interest among cases or controls in a case-control study. In addition, controls should be comparable to the cases in all respects except for the fact that they do not have the outcome of interest. Usually, there are many more controls

available for inclusion in a study than cases. Therefore, it is often possible to select several controls for each case, thereby increasing the sample size for analysis. However, findings have shown that taking more than four controls for each case does not substantially improve the precision of the analysis. Because the exposure or risk factor might have occurred long ago, studies that can establish risk factor status based on documentation or records are preferred over those that rely on a participant's memory of past events (Sullivan, 2012:11).

4.2.2.1 *Strengths and limitations of the case-control design*

A case-control study offers numerous advantages over other observational epidemiologic studies. For instance, finding cases of rare diseases like genetic disorders, sarcoma and stillbirth in ordinary health facilities would require long years of waiting if a prospective study design was used. To this effect, case-control design is more appropriate to study diseases or health outcomes of rare occurrence usually less than 1% prevalence. Besides, a prospective study would require the follow-up of a large cohort to obtain a reasonable number of cases, which can be very expensive and time consuming. For rare outcomes, a prospective study would also involve exposure information being obtained for many non-cases, which would be equally cumbersome. Case-control studies are also efficient when studying diseases with long latency periods. Because the study starts after the disease has been diagnosed, researchers are not expected to wait for the disease to occur during the study period. In general, cost and time efficiency are some of the most important strengths that a case-control study offers. One other strength of the case-control study is the fact that it could provide findings as strong as a cohort study design if both cases and controls can be selected from the same source population (Keoghand & Cox, 2014:12; Sullivan, 2012:11).

Woodward (2014:211) concedes that case-control study design offers benefits beyond the time and cost efficiencies described in the preceding paragraph. One of the advantages is related to the fact that many risk factors can be studied simultaneously using a case-control design. Data can be collected on each of several potentially harmful exposures and can be analysed to see respective contributions in the causal associations. Moreover, case-control studies usually require much smaller sample sizes than do equivalent cohort studies, which ensure higher quality data and more rigorous analysis. The author further emphasised that because of a more equally balanced nature

of the samples, case-control studies are generally able to evaluate confounding and interaction rather more precisely than cohort studies (Woodward, 2014:23).

On the contrary, case-control study design displays quite a few methodological limitations in generating strong evidence. One of the disadvantages is related with the fact that case-control studies do not involve a time sequence and so are not able to confirm causality between risk factors and outcomes. For instance, because data on maternal hypertension and pregnancy-related complications like antepartum haemorrhage might be collected simultaneously in a case-control study, such data would not indicate whether the complication was owing to the hypertension or the latter was a physiological response to haemorrhage that was recorded coincidentally at the time of seeking medical attention for the complication. The other limitations are related to the fact that case-control studies could investigate only one disease outcome at a time and provided only approximate relative risks instead of establishing valid estimates of risk or odds (ibid).

Sullivan (2012:12) and Woodward (2014:212) further elaborated on methodological concerns related to different biases that are commonly observed in case-control study design. For instance, misclassification bias can be an issue in case-control studies and refers to the incorrect classification of outcome or exposure status of cases and controls. A similar extent of misclassification in both cases and controls would underestimate the magnitude of association. However, if more cases are incorrectly classified as having the exposure or risk factor, then association can be exaggerated. Another closely related type of bias refers to distortion of associations between exposure and outcome resulting from incorrect identification of cases or controls. The above two situations can be referred as selection bias in a case-control study (Sullivan, 2012:11; Woodward, 2014:23).

The second broad category of bias is related to the nature and extent of error in obtaining information from cases and controls. For instance, persons with a disease (cases) might be more likely to recall prior exposures than persons free of the disease (controls) leading to differentials in recalls which in turn would cause a bias in the whole study. The experience of having or not having the outcome might have qualitatively differing intensity of memories and coupled with the amount of time elapsed when the recall was triggered, it is likely that the accuracy of information obtained would be different between cases and controls. The interviewers' knowledge of cases, controls and disease processes could also potentially interfere with objectivity in eliciting information about exposure status,

which constitutes another source of information bias. Although valid and unbiased information that can be retrieved from records such as medical documentations are believed to address the recall and interviewer biases discussed above, the former could also be another source of bias if such records had flaws in the way they captured information on cases and controls at the time of recording. In addition, such records may not have recorded the information exactly as required by the study, and some may be incomplete, but these problems are less likely to lead to serious bias (Bruce et al., 2008:6).

4.2.2.2 *Suitability of the study design*

Many of the strengths related to case-control study design presented in the section above, have prompted its appropriateness to this current study. Intrapartum stillbirth is a relatively rare outcome of pregnancy in health facility settings. Therefore, alternative study designs including prospective cohort would have required longer time to obtain adequate number of cases for the study. Longer period of data collection and follow-up would have also incurred more costs particularly in relation to the data collection, which would have been incompatible with the scope and resources available for this research work.

This study collected first hand data from medical records of cases and controls which has reduced the informational biases associated to interviews. For instance, conducting an interview with a woman who experienced intrapartum stillbirth more than two years ago would have compromised the quality and quantity of information on risk factors including her own medical conditions or the type of interventions she received from health professionals at the time of the incidence mainly owing to recall bias. Tracing such women to administer the interview in person would have also created logistical constraints as addresses might have changed or not well recorded, not to mention the additional cost related to mobility in locating the interviewee in this context. Stigma, cultural and social norms around stillbirth would have been additional barriers in establishing accurate data on factors associated with intrapartum stillbirth.

Furthermore, this study was conducted in health facility settings where cases of intrapartum stillbirth and controls were taken from the same source population. This situation addressed concerns inherent to information bias that would have emerged if data from cases and controls were collected from a relatively heterogeneous population.

Relying on health facility records for both groups has also reduced chances of misclassifying cases and control as the definition for intrapartum stillbirth was a well-established fact and there was no ambiguity in differentiating it from livebirth incidences. Overall, the case-control study design was most suitable for this current research because of time, cost, ethical, logistical and data quality-related issues.

4.3 RESEARCH METHOD

Research method refers to the types of data collection, analysis, and interpretation approaches that a researcher proposes for a given study. It is a predetermined plan that correlates with the objectives, theoretical perspectives, and research design chosen for the study. A research study can opt for quantitative, qualitative or mixed methods with corresponding distinct data collection instruments including close-ended, open-ended or a combination of both. In the quantitative method, analysis usually focuses on numeric data whereas the qualitative method uses non-numeric data (Creswell, 2014:3).

Consistent with its objectives and owing to the case-control study design choice, this research study focused on the quantitative data collection methods. Accordingly, quantitative data on key variables that were considered as exposure factors to intrapartum stillbirth were collected from obstetric medical records of mothers who had given birth in the public health facilities in Addis Ababa from Jul 1, 2010–June 30, 2015. A structured questionnaire that contained most of the variables indicated in the maternity care services including during antenatal and intrapartum period was developed to capture relevant data from the records retrospectively. In addition, the medical records consisting of antenatal follow-up information and intrapartum clinical interventions were reviewed for each case and control. The variables of interest included socio-economic background, demographic characteristics, obstetric history, medical history, type and frequency of antenatal services, type, and timing of intrapartum care. Cases and controls were defined and inclusion and exclusion criteria were determined to ensure that data were collected from medical records of subjects who met these strict selection criteria. The level of exposure of cases and controls to the above variables were compared to see if there were any differentials in the occurrence of intrapartum stillbirth between the two groups and if any associations could be drawn between any of these independent variables and the dependent variable, which is intrapartum stillbirth.

Accordingly, chart review in this study covered cases of intrapartum stillbirth that taken place in the target facilities over the five years' period ranging from 2010 to 2015. In 2010, 26 public health centres offered Basic Emergency Obstetric and Neonatal Care (BEmONC) in Addis Ababa (FMOH 2010:68) out of which 20 were selected for this study. Similarly, chart reviews were conducted in three out of the five public hospitals in the City where Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) had been practiced since 2010.

The number of public health facilities particularly health centres that provide BEmOC or CEmOC have increased since 2010. However, this study focused only on facilities that were active since the base reference time to ensure consistency in data capturing. Those health centres omitted from this study were done so because of the insignificant number of cases across the years and the two public hospitals that were not included did not provide maternity care at the base time. Therefore, it can be asserted that this study had 100% coverage of public health facilities in Addis Ababa with one or more cases of intrapartum stillbirth per year.

4.3.1 Definitions of case and control

As indicated in Chapter 1 of this thesis, a case-control study design requires that both cases and control groups should be clearly defined from the outset to avoid any potential bias related to misclassification. Furthermore, the definition of cases needs to be consistent with the core problems that prompted the study itself. The accurate definition of cases and controls further determines the criteria for inclusion and exclusion of the study subjects.

More importantly, establishing clear definition of cases and controls from the outset is related to its capacity to reduce any potential biases in a case-control study. As indicated in the diagram below, this study compares the proportion of women-baby pairs who might have been exposed to risk factors during pregnancy and childbirth period and therefore experienced intrapartum stillbirth against those who had equal chance of being exposed to the risk factors but who did not experience intrapartum stillbirth. The study design allowed retrospective assessment of exposure status for both cases and controls to see if the cases had more doses of these potential determinants compared to their control counterparts.

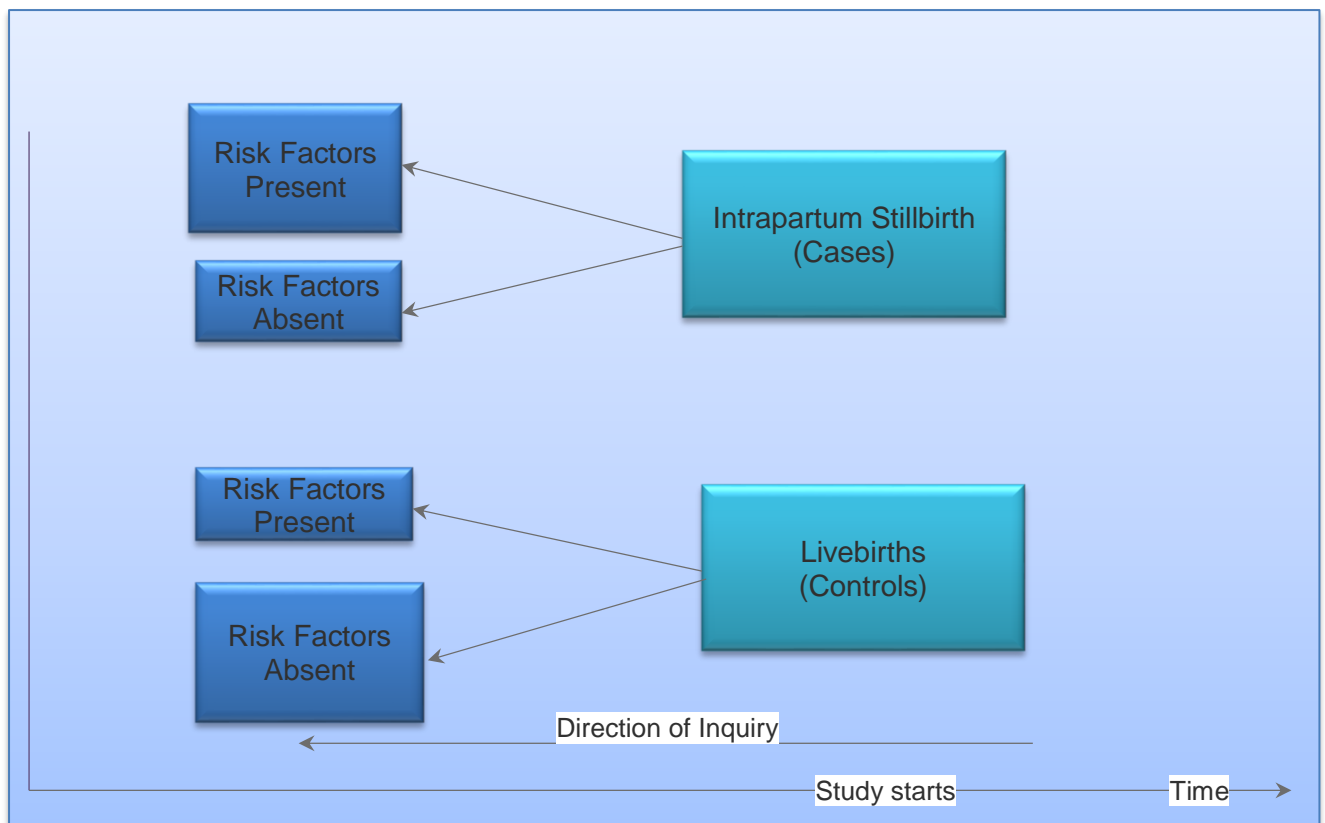


Figure 4.2 Outlines of a case-control study design
 (Sullivan, 2012:11-313)

Accordingly, cases and controls for this study have been defined in the following manner:

- **Case:** All mothers who were admitted to maternity units for childbirth in the 20 public health centres and three public hospitals in Addis Ababa during the period July 1, 2010–June 30, 2015; who were assisted by skilled health workers during intrapartum period; who were admitted for a childbirth with a live foetus and who experienced documented incidence of stillbirth as an outcome.
- **Control:** All mothers who were admitted to maternity units for childbirth in the 20 public health centres and three public hospitals in Addis Ababa during the period July1, 2010–June 30, 2015; who were assisted by skilled health workers during intrapartum activities, who sought intrapartum care services in the same health facilities as cases and who did not experience any documented incidence of stillbirth as an outcome of the childbirth event.

4.3.2 Sampling

Sampling is a procedure of taking a group of individuals, a sample, from a larger population in whom the research is interested and to whom the results of the study were applied. In a quantitative method, it is imperative that a sample is representative of the population to avoid sampling error or selection bias (Bruce et al., 2008:6).

Once the study population is defined, the next logical step in a research process would be to determine the actual sources of data and how these would be collected. There are fundamentally two options in deciding who should be targeted for data collection; either including all eligible members of the study population (census) or taking a representative sample based on clear criteria. Several factors including cost, time and quality of data would influence whether a complete enumeration or a portion of the study population should be considered for data collection. Furthermore, the study setting, whether it is population-based or facility level, also determines how sampling should be approached in general. The sampling procedure for this study focused on selecting medical records of mothers with intrapartum stillbirth from health facilities in Addis Ababa to undertake a retrospective comparison with medical records of mothers without intrapartum stillbirth in the same facilities and over the same period (ibid).

Accordingly, this current study was conducted in a health-facility setting with intrapartum stillbirth as an outcome of interest. Therefore, all cases of intrapartum stillbirth that occurred in the public health facilities in Addis Ababa constituted the sampling frame for this study. The study opted to conduct a complete enumeration of all cases of intrapartum stillbirth in 20 public health centres and three hospitals that taken place during the period July1, 2010–June 30, 2015. Therefore, this study included all cases of intrapartum stillbirths that were recorded in the maternity care registers of targeted public health facilities in Addis Ababa. The reason behind a complete enumeration of all intrapartum stillbirth cases from the target facilities for this study was because intrapartum stillbirth is a relatively rare phenomenon and taking only samples would reduce the power of this study. Therefore, all clinical charts of women who experienced stillbirth in the defined period and that qualified the selection criteria for cases were chosen as sources of data for this study.

Being a comparison design, this study focused on sampling controls that had similar experiences in terms of the maternity care characteristics except for the intrapartum stillbirth outcome. To increase its statistical power, the study selected control groups that had given birth in the same facilities and over the same period in two to one (2:1) control to case ratio. Therefore, in each facility, two medical charts of women with livebirths were selected for each case of intrapartum stillbirth. The charts of control groups were selected from the registers in a random manner using lottery method. On every page where cases of intrapartum stillbirth were detected, record numbers of women with livebirth were listed from the pages of registers where cases are picked and rolled on pieces of paper of which an individual other than the data collector randomly selected the required number of controls. Containing both cases and controls to the same page of the register would reduce any bias in comparison that might occur owing to difference in time or changes in the quality of service in the facilities.

The following diagram clarifies how this study defined and identified both cases and controls from the public health facilities in Addis Ababa, Ethiopia.

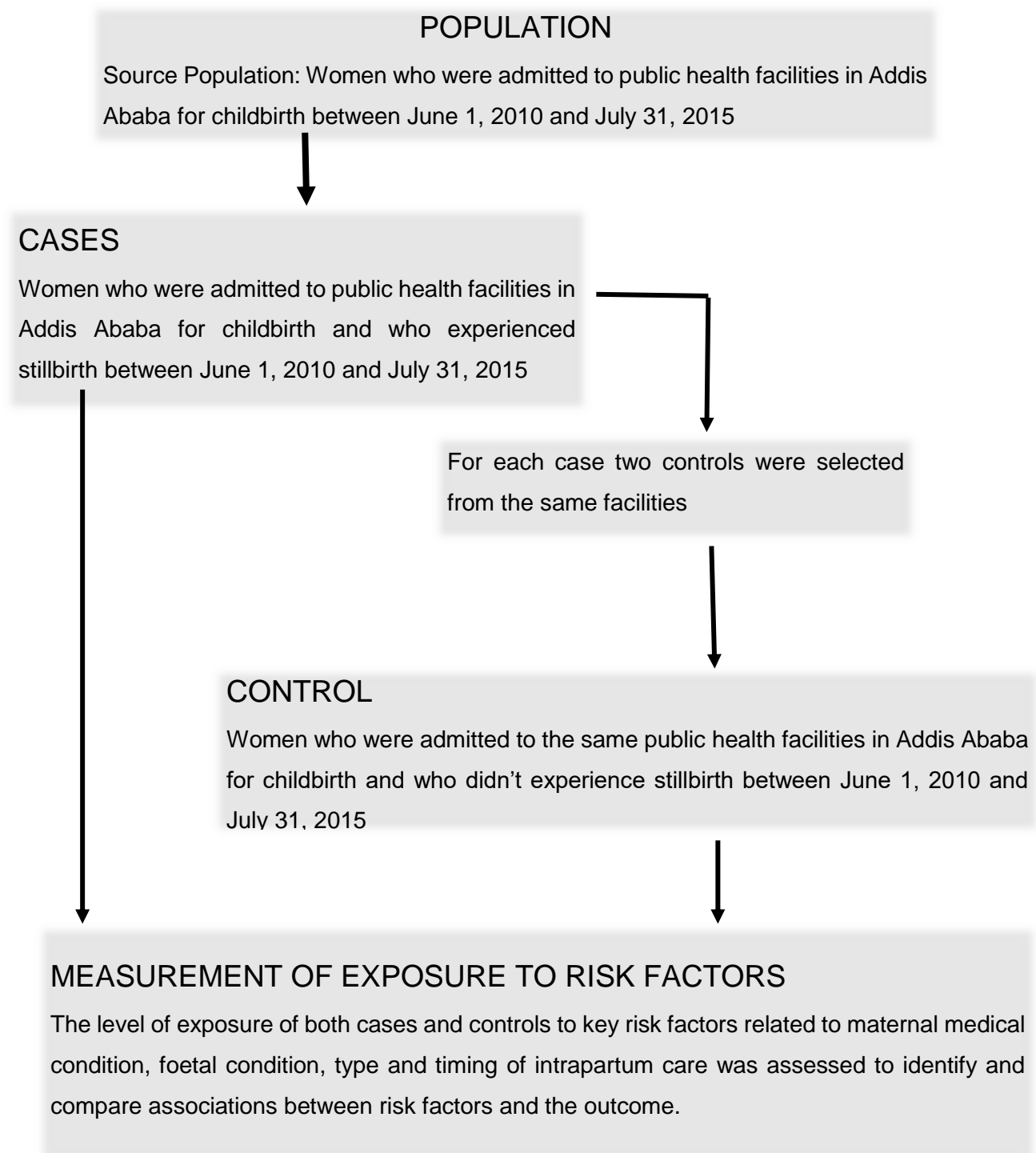


Figure 4.3 Schema showing the study design and sampling procedures

(Bruce, Pope & Stanistreet, 2008:6-370)

As per the above schema, this study collected primary data from health facility medical records of women who experienced stillbirth during childbirth in the public health facilities in Addis Ababa from July 1, 2010 to June 30, 2015. Medical records of women who experienced livebirth in the same facilities and during the same period were reviewed to

compare if any of the exposures including clinical interventions and medical conditions during pregnancy and childbirth were associated with the intrapartum stillbirth, which is the outcome of interest for this study.

4.3.3 Population and setting

The study population consists of all mothers who experienced intrapartum stillbirth while giving birth in public health facilities in Addis Ababa, Ethiopia. Mothers who had given birth in the 20 public health centres and three public hospitals in Addis Ababa during the period July 1, 2010–June 30, 2015 constituted a sample population for this study.

The study was conducted in 20 public health centres and three public hospitals that have had established Basic Emergency Obstetric and Neonatal Care (BEmONC) services with high volume clients in Addis Ababa since 2009. Therefore, this study was undertaken in health facility settings.

4.3.4 Ethical issues related to sampling

This study used medical records of women who had given birth in the public health facilities in Addis Ababa from July 1, 2010 to June 30, 2015. Data collection took place through chart review of medical records retrospectively, giving equal chance of being selected to all records meeting the eligibility criteria indicated below. Accordingly, the sampling process for this study did not have any ethicality concerns.

4.3.5 Sample

The sample for this study consisted of medical records of mothers who received intrapartum care from skilled health professional in the public health facilities of Addis Ababa from July 1, 2010 to June 30, 2015. Two categories of samples included medical records of women who experienced intrapartum stillbirth and medical records of women who did not experience stillbirth during childbirth in the referenced time. These samples were selected from the medical records of all women who received intrapartum care in the public facilities in Addis Ababa during this period and based on the selection criteria.

4.3.6 Sample size

In the five-year period covered by this study, there were 112 intrapartum stillbirth cases in the 20 public health centres in Addis Ababa out of which only 91 (81%) met the selection criteria for this study. Similarly, there were a total of 944 cases of intrapartum stillbirth in the three public hospitals of which 637 (67%) qualified the selection criteria for inclusion in the study.

Considering the minimum two-to-one case to control ratio, this study identified a total of 427 controls from the 20 public health centres in Addis Ababa of which only 273 (64%) were included. Similarly, a total of 1738 controls were also randomly identified in the three public hospitals in the City of which 1278 (74%) qualified being included into the study. Therefore, the sample size for this study comprised 728 cases of intrapartum stillbirth and 1551 controls from all the target public health facilities in Addis Ababa.

4.3.7 Sample selection

As indicated in the sampling section above, the maternity registers in the public health facilities were taken as entry points to identify cases of intrapartum stillbirth. Once record numbers of intrapartum stillbirth cases were obtained from maternity registers, the data collector traced the actual clinical charts of individual cases in the facilities' archives through the help of relevant staff of the unit. As it was the case, the intrapartum care charts contain comprehensive information on pregnancy-related follow-ups and detailed intrapartum care interventions for each woman. Intrapartum care interventions were presented either on a Partograph (in the case of public health centres) or on labour monitoring sheets that were attached to the charts where detailed descriptions of services including types and timing of intrapartum interventions were written by the midwives or obstetricians in charge of each deliveries. Once each chart was retrieved from the respective archives, the data collector screened the charts to see their eligibility based on the inclusion/exclusion criteria.

The selection of medical records of the control groups for this study was conducted concurrently with that of cases. Based on the sampling procedures described in the section above, the data collector traced the record numbers to find the actual medical charts of women in the control groups in the respective archives. The inclusion/exclusion

criteria were applied to all charts to screen for eligibility. Minimum of two charts of women with livebirth that met the selection criteria were reviewed for each case of intrapartum stillbirth.

The following inclusion and exclusion criteria were used to identify medical charts for cases and controls for considerations in this study:

Inclusion and exclusion criteria

Linked with the definition of cases and controls in a case-control study, it is imperative that clear criteria are set as how and why study subjects in both case and control groups would be enrolled into a study. The inclusion/exclusion criteria of cases and controls are similar except for the differentials in the outcomes. The following set of criteria was used for this study to ensure only eligible charts of both cases and controls would be enrolled and reviewed accordingly.

Inclusion criteria

- Birth undertaken in public health centres and hospitals in Addis Ababa.
- Age of the mother who given birth between July 1, 2010–June 30, 2015 is between 15–49 (this was referred as a standard reproductive age category and given the study relies only on chart review, ethical concerns are limited).
- Birth assisted by skilled health workers in a health facility setting.
- Complete documentation of intrapartum care intervention available.
- Foetus was alive during admission for intrapartum care.
- Mother received at least one round of ANC prior to admission for intrapartum care.

Exclusion criteria

- Mother who did not give birth in public health facilities in Addis Ababa.
- Mother who given birth between July 1, 2010–June 30, 2015 but outside of the age group 15–49.
- Mothers who were not assisted by skilled health workers during childbirth in the public health centres in Addis Ababa.

- Mother given birth in public health centres or hospitals in Addis Ababa who did not have complete documentation on intrapartum care intervention.
- Women who given birth in the public health facilities however admitted for labour with death foetus.
- Documented cases of immediate neonatal death.

4.3.8 Data collection

As indicated in Chapter 1 of this thesis, data refer to the values measured on different variables in in a research setting. There are different types of data including nominal, ordinal, interval, or ration depending on the scales of measurements. Nominal scales are presented in categories or classes whereas ordinal scales present data using ranks or orders. On the contrary, interval and ratio scales take values that can be either continuous or discrete numbers (Bruce et al., 2008:6) .

Data collection refers to the process if gathering such values on different variables of interest in a research context. There are multiple sources of data including different types of interview, observations, secondary sources, or routinely available data from public registers or service records (Oleckno, 2008:55).

The sources of data for this study were the routine health service records from public health facilities that were collected at all scales of measurements. For instance, the marital status of subjects was referred in the antenatal chart, which indicated a nominal scale measurement, whereas number of previous pregnancies or births was measured at an ordinal level. Many other questions in the questionnaire including age of the woman, foetal heart rate, status of cervical dilatation have generated data in interval or ratio scales. Bruce et al. (2008:78) argue that routinely available data is valuable resources, but researchers need to pay careful attention in reducing some limitations by checking the ways information were collected and prepared, the nature and extent of any error or bias that might have crept into the data collection and preparation process (Bruce et al., 2008:6).

4.3.8.1 Data collection approach and method

One advantage of selecting cases and controls retrospectively in a case-control study is that the researcher can go back as far as needed to get sufficient number of cases, which is why this study collected data over five-year period. Moreover, using medical records to collect data further reduces the burden of tracing cases or controls in their residences to undertake data collection. Accordingly, data for this study were collected from medical records of maternity care in the public health facilities in Addis Ababa. The study used a quantitative data collection method where quantifiable data on relevant variables were generated from the medical records of women who undertaken pregnancy follow-up and subsequent childbirth in the public health facilities.

Systematic chart reviews of all cases of intrapartum stillbirth that took place in the public health centres and hospitals in Addis Ababa from July 1, 2010–June 30, 2015 were conducted from April 1–July 31, 2016. Accordingly, all medical charts that met the definition and inclusion criteria for cases of intrapartum stillbirth were reviewed exhaustively to collect data on the study variables as per the structured questionnaire. This process continued until all eligible charts of cases were reviewed and relevant data were collected in each facility. Similarly, chart review was conducted for all controls that were selected as per the inclusion and exclusion criteria in this category.

A structured questionnaire that was consistent with the detailed standard antenatal and intrapartum services recording indicators being used in the public health facilities in Ethiopia (Annexure 5) has been adapted to capture data from individual medical records of women in both the case and control groups.

4.3.8.2 Development and testing of the data collection instrument

The Federal Ministry of Health of Ethiopia (FMOH) has put in place an integrated service-recording format that is being used by all public health facilities while rendering maternity services including antenatal, labour, delivery, newborn, and postnatal care. Health professional particularly in the public health centres strictly use the tool, which was evident from the chart review process of this study. Public hospitals often attach labour monitoring sheet to this card to describe detailed services provided by midwives and obstetricians during intrapartum period.

This current study developed structured questionnaire consistent with the standardised variables of the antenatal and intrapartum service recording form indicated above. This allowed easy capturing of data from the medical records of mothers who delivered in the public health facilities in Addis Ababa. The draft instrument was pilot tested by the researcher and the data collector in selected facilities to see the compatibility of the questionnaire with the existing records in the facilities, which were completed using the forms of separate service description sheets. In this regard, two public health centres and one hospital were visited for testing of the questionnaire. During the pilot-test, a total 14 and 28 charts of cases and controls were assessed and data were recorded into the questionnaire respectively. This process helped the data collector to grasp the necessary skills required in reviewing the registers and maternity charts and transferring the information to the questionnaire accurately. After testing, inputs were integrated and the final version was printed in adequate quantity to use one copy for each subject.

4.3.8.3 Characteristics of data collection instrument

The structured questionnaires which was used for this study was composed of variables relevant to antenatal, labour and delivery assessment and interventions in the public health facilities. These variables were quantifiable regardless of the levels at which they were measured including nominal, ordinal, scale, and ratio. Mimicking the Ministry of Health form for these services, the instrument was sub-divided into 10 sections with a few specific questions under each. The first two sections were related to the background information on the facility, data collection timing and overall magnitude of the intrapartum stillbirth cases in the respective public health facility. Section three and four focused on screening questions that helped undertake correct identification of eligible medical charts based on the inclusion/exclusion criteria including the completeness of records, ANC utilisation history and foetal heart rate on admission. Maternity records of both cases and controls that failed to meet the criteria on the screening section were removed from the study automatically.

Sections five through nine reviewed data from the antenatal information of women during the pregnancy being studied. Accordingly, key data on past obstetric history, maternal medical conditions and relevant data on current pregnancy including HIV status and foetal conditions during the last ANC visit were among the important variables in the

questionnaire. Section 10 puts complete attention to variables related to the intrapartum care interventions that took place in the public facilities between the time women were admitted for labour until the process of delivery was completed.

4.3.8.4 Data collection process

An experienced nurse with a midwife training background was employed as a fulltime data collector for a period of four months. A weeklong training that included theoretical explanations on the data collection instruments and practical sessions on chart review at health facilities was provided to the data collector. The researcher made an initial introductory visit to all selected public health facilities to introduce the data collector, secure authorisation from the facilities leadership and to explain the purpose and process of data collection.

The data collector was stationed in each health facility until the required number of charts were reviewed for both case and control subjects. When the required number of charts were reviewed and data collected from the medical records are captured in the structured questionnaire, the data collector moved to the next facility and this process continued until all the selected health facilities were visited. In addition, the researcher visited the data collection sites regularly to discuss any emerging challenges with the data collector and staff of the record units, to check the completed forms for consistence, completeness and accuracy and to gather filled questionnaires. Staff members of the record unit were provided with cash incentives to motivate them and enhance their collaboration so that the required charts from the archives could be retrieved and handed over to the data collector in timely manner.

Data related to antenatal and intrapartum care ranging from admission to discharge were reviewed from facility records of selected medical charts of mothers who delivered in the public health centres and hospitals in Addis Ababa.

Accordingly, chart reviews of all cases of intrapartum stillbirth that took place in the 20 public health centres and three hospitals in Addis Ababa from July 1, 2010–June 30, 2015 were conducted over four months' period. In each target health facility, the data collector started by reviewing the maternity registers to identify cases of intrapartum stillbirth in the birth outcome column. Using the registration number, the data collector moved to the

respective facility archive section where designated staff assisted to retrieve individual maternity medical record of each case. Each chart then reviewed using the inclusion criteria to be considered for the data collection or rejected if it did not meet the criteria. Further intensive reviews were conducted on medical records that met the inclusion criteria and data related to antenatal follow-ups as well as intrapartum care interventions that were provided to women from the time of admission to labour up to the end of childbirth process were transferred to the structured questionnaires.

Selection of medical charts of women in the control groups followed similar procedures in each health facility. Accordingly, for each case of intrapartum stillbirth, at least two records of normal birth were selected randomly from the maternity registers as controls to meet the two to one (2:1) control to case ratio. Based on the registration numbers, the data collector consulted the relevant health facility staff to retrieve the medical records, which were reviewed using the controls inclusion criteria. Those charts that did not meet the criteria were replaced by randomly selecting alternatives from the same page on the maternity registers. The diagram below is a pictorial illustration of the sequential process of collecting data for this study in each public health facility in Addis Ababa.

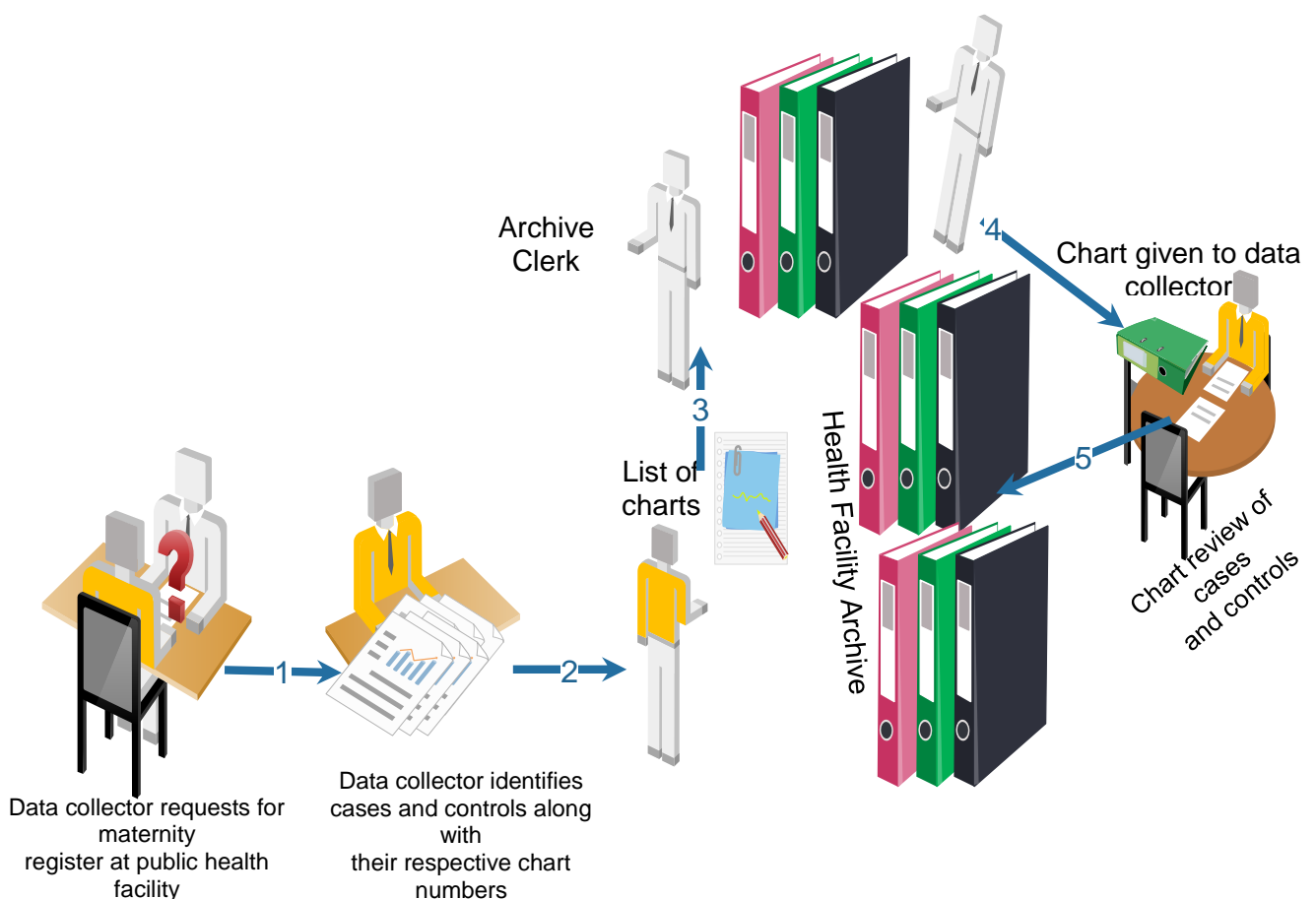


Figure 4.4 Data collection flow in the health facilities

Based on the data collection flow chart on Fig 4.4 that was used to identify medical charts for cases and controls, the data collector reviewed a total of 1056 charts for cases of intrapartum stillbirths of which 728 fulfilled the criteria and from which quantitative data were collected. Similarly, a total of 2165 charts were reviewed for control groups of which 1551 medical records were considered for data collection. Therefore, this study covered a total of 2279 medical charts for data collection in the 20 public health centres and three hospitals under the Addis Ababa Regional Health Bureau (AARHB). During the data collection, it was also noted that approximately 30% of charts for both cases and controls did not meet the inclusion criteria and hence rejected mainly owing to incomplete documentation of individual medical services and conditions. This limitation will be discussed in the results section of this thesis along with other missing information, which might be predictive of the quality of services and documentations in public health facilities in Addis Ababa.

Upon completion of collecting data from the public health facilities, the researcher further consulted with the AARHB to collect and compile annual data on stillbirth and livebirth from all public health facilities under the jurisdictions of the Bureau. Furthermore, secondary data sources were referred from the Federal Ministry of Health (FMoH) annual report to complement missing data elements to get a complete picture of trends and magnitude of stillbirth in the public health facilities of Addis Ababa during the period between 2010 and 2015.

4.3.8.5 Ethical considerations related to data collection

This study relied on medical records of women who gave birth in the public health facilities in Addis Ababa from July 1, 2010 to June 30, 2015. This implied that data were not collected freshly from human subjects thereby minimising the concerns of confidentiality and requirements for individual consents. More importantly, the data collector was trained and strictly monitored on the principles of confidentiality of clients' information on the records during the process of data collection. The chart review was conducted within the respective facilities through consented authorisation of relevant facility leadership. Individual data sources remained anonymous during analysis and report presentation. This approach ensured that the research addresses ethical concerns related to research participants should they arise.

Individual institution (public health facility) stayed anonymous for any sensitive information throughout the analysis and reporting of the study results. However, prior written permission was also obtained from the AARHB as part of the administrative approval and written authorisations were also secured from relevant institutions for any identifications when deemed important. Furthermore, health centres and public hospitals where data were collected received adequate explanations regarding the objectives of this research.

In general, ethical concerns under this study were seen along the four basic ethical principles including autonomy, justice, beneficence and non-maleficence to the participants, researcher, institutions as well as the domain of this research. Although data may not be collected directly from the participants owing to the design nature of this study, consents were obtained from the respective health facilities to respect autonomy of the study subjects. The sample selection criteria including age of the mother, completeness of medical record, signs of life of the foetus at admission for labour and skilled birth attendance were strictly applied to treat all charts equitably during data collection process. It was anticipated that recommendations from this research would improve the quality of intrapartum care and careful considerations were given so that such recommendations do not violate internationally recognised procedures of intrapartum care in facilities in order not to do any harm to clients who might receive services as per the recommendations from this study.

Similarly, access to and disclosure of any information from the public health facilities where the data for this research were collected would happen only based on the provisions in the formal consents. Furthermore, the study target institutions were identified based on transparent criteria. It is anticipated that any tools and framework of actions for intrapartum care that might be recommended through this research would also benefit the public health facilities in general. Furthermore, utmost precautions were taken during data collection, analysis and reporting not to cause any harm to the reputation and practice of public health facilities because of this research.

There is no recognised ethical concern in relation to the autonomy, justice and non-maleficence of the researcher and the domain because of this study. However, the additional knowledge and recommendations from this research would have beneficial

effect in promoting the causes of intrapartum stillbirth in Ethiopia and the researcher could meet the academic requirements owing to a successful completion of this study.

4.3.9 Data analysis

Data analysis is a planned process of inspecting, cleaning, transforming, and modelling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, in different business, science, and social science domains (Wikipedia, 2017). In a research undertaking, data processing and analysis is usually performed as part of the data collection process and immediately after the completion of data collection. The analysis of data broadly consists of two phases:

- An exploratory phase, in which measures of central tendency (e.g., means, medians), variability, and shape of distributions should be calculated and graphed.
- An inferential phase, in which population parameters are estimated and hypotheses about them are tested (Myers, Well & Lorch Jr, 2010).

In epidemiological studies, approaches used to analyse data depend on several underlying factors including the study design, research questions, types of data (quantitative/qualitative), level of measurements used to collect data (nominal, ordinal, ratio) and the appropriateness of statistical tests chosen to measure the relationships between the different variables. For instance, Woodward (2014:23) argues that research data can be analysed either descriptively where simple statements about the distributions population characteristics can be presented graphically or using text formats or inferentially where estimates of such distributions among source population can be predicted based on the data from samples. Furthermore, inferences can be made through hypothesis testing where a priori assertions about population values could be rejected or estimations of such values could be made based on sample data. Estimation also includes the specification of a confidence interval, a range of values which we are confident will contain the true value of the measure of interest in the overall population. Generally, 95% confidence intervals are customarily specified which means that we are 95% sure that a 95% confidence interval will contain the true value (Woodward, 2014:23).

The science of statistics offers diverse tools of analysis to measure relationships between variables while testing hypothesis or making inferences about population values based on sample data. For instance, Katz et al. (2014:408) concede that inferential analysis approaches should begin with a study of the individual variables, including their distributions and outliers, and a search for errors. Then bivariate analysis can be conducted to test hypotheses and probe for relationships if only two variables are being considered. Only after these procedures have been done, and if there is more than one independent variable to consider, should multivariable analysis be conducted (Katz et al., 2014:408).

This study had a rigorous plan for data analysis from the beginning, which was carefully observed throughout the different stages of the research. Accordingly, data validity, consistency and completeness checks were conducted throughout the data collection processes. The quality of data being a strong prerequisite for accurate analysis, due emphasis was given by the researcher in closely monitoring the integrity of data at the phase of collection, electronic recording and cleaning through on the spot checking of data collector and data entry clerk.

Upon completion of the data collection process, comprehensive data entry templates were created using SPSS statistical package version 24 and all data from the structured questionnaire were successfully entered to the software by an experienced data clerk over the period of 4 weeks (August 1–31, 2016). The following data analysis steps were applied using the SPSS version 24 software:

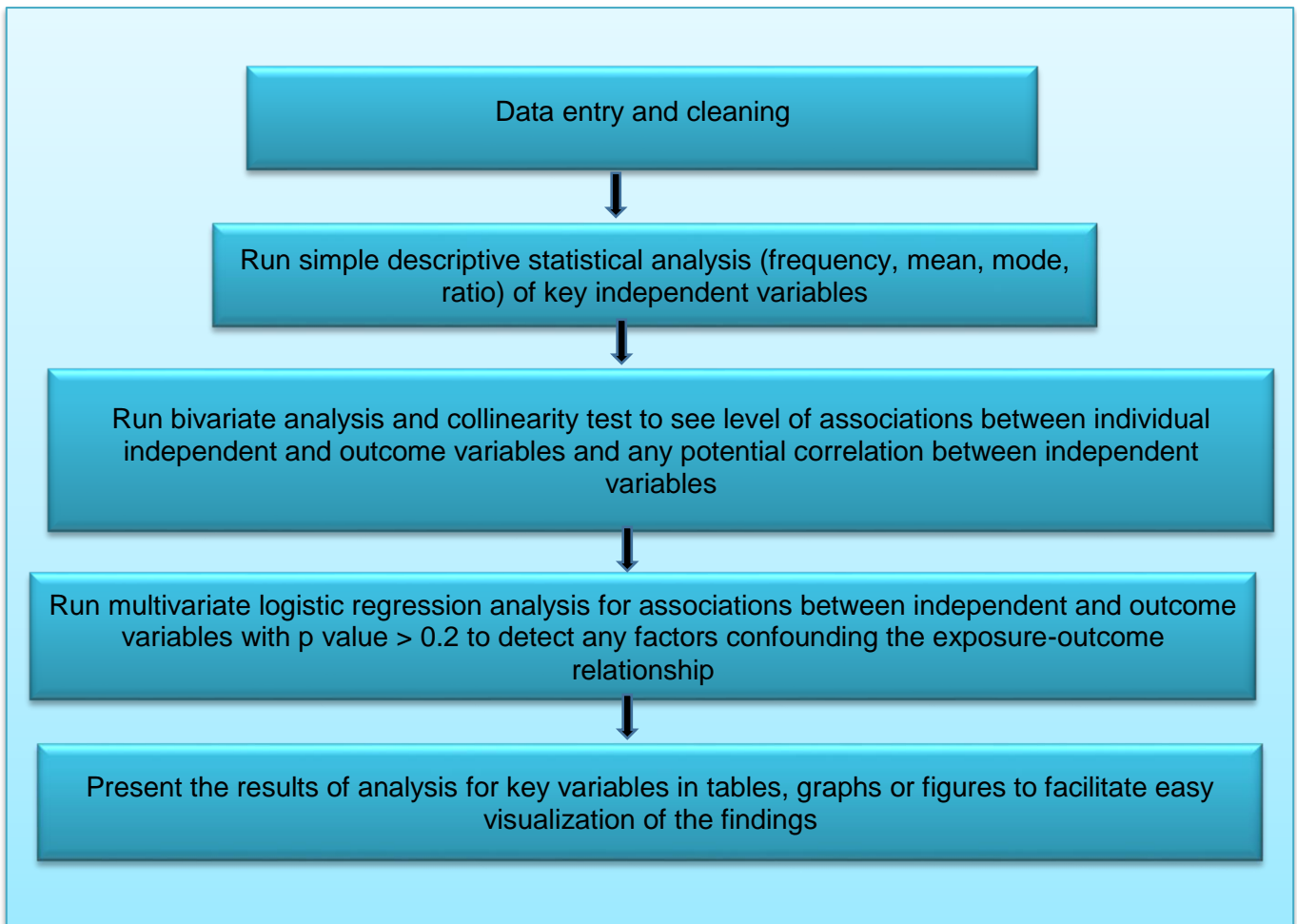


Figure 4.5 The data analysis steps for the study

An experienced statistician was hired to work closely with the researcher to conduct statistical analysis based on the above schema (Annexure 8). Accordingly, statistical analysis of the data was performed during Sept 19–30, 2016. Data cleaning, descriptive and inferential statistical analysis were conducted together with the statistician during this period. Accordingly, descriptive observations on key variables were presented in tables and graphs to show distributions of different characteristics of the study population.

Part of the data screening process involved checking the content including missing data, outliers and collinearity between the different independent variables to make sure that the data can be analysed using multiple regression techniques and that values can fit into the model. Several assumptions that are required for multiple regression were tested to give a valid result and to identify the variables to be considered in the model. The data screening process also involved checking the availability of sample size exceeding fifteen for each independent variable. For those categories or variables without adequate sample size, regrouping or elimination of the values were performed. For instance, the response

“five and above” on parity of women did not produce adequate values; hence the few cases in this category of response were regrouped to “four and above” category before running the statistical analysis. Furthermore, testing the normal distribution of the outcome variable and checking the existence of multi collinearity (relationship among independent variables) were undertaken as part of the preliminary data analysis. For instance, independent variables including “gravida” and “para” were highly correlated with the “number of children alive”. Hence, the former two were excluded from the regression model because they were less significant compared with the “number of children alive”.

The most preferred measure of association between the outcome and exposure variables in a case-control study design is the Odds Ratio (OR). This refers to the ratio of the odds of exposure among cases to the odds of exposure among controls. For dichotomous measures of exposure and outcome, the following 2 x 2 contingency table illustrates how the differentials in exposure between cases and controls can be assessed to demonstrate statistically significant associations that might be suggestive of causal relation between the variables(Bruce et al., 2008:6).

Exposure Status	Outcome Status	
	Case	Control
Exposed	a	b
Not Exposed	c	d

As per the above illustration the odds ratio can be calculated using the following formula:

OR = the odds of exposure among cases (a/b)

The odds of exposure among controls (b/d)

$$OR = \frac{a/c}{b/d} = \frac{ad}{bc}$$

Using a real example from the current study, non-vertex presentation of the foetus during intrapartum care and labour management showed association with the occurrence of intrapartum stillbirth as per the following calculation.

Intrapartum Stillbirth

Foetal Presentation	Case	Control
Non-Vertex	79	58
Vertex	617	1420

$$OR = \frac{a/c}{b/d} = \frac{ad}{bc} = \frac{112180}{35786} = 3.13$$

The results of OR are interpreted in relation to the confidence intervals (CI) determined by the researcher, usually set at 95%. So long as the confidence interval does not cross “1” and the result is different from “1”, the outcome of OR calculation would indicate that there were associations between the exposure and outcome variables. Accordingly, when OR = 1.0, there is no association between a given study exposure and outcome. When OR > 1.0, there is a positive association, and when OR < 1.0, there is an inverse association implying that the exposure had protective relationship (Oleckno, 2008:55). In the above example, the odds of experiencing intrapartum stillbirth among women whose foetus had non-vertex presentation during labour was approximately three times higher than women whose foetus had vertex presentation.

This study applied several relevant statistical analysis and measurement principles including descriptive statistics, bivariate and multivariate logistic regression approaches. Many of these techniques helped determine the level of associations between the various risk factors on which data were collected from cases and control and the intrapartum stillbirth where such relationships were assessed using measurements of statistical significance (p-value) or odds ratio as described in the preceding illustrations. Accordingly, many variables were first assessed using bivariate analysis. Those variables that were associated with intrapartum stillbirth on bivariate analysis at a statistical significance level or P-value of 0.2 and less were then fit into multivariate logistic regression model.

Multivariate analysis allowed the efficient estimation of measures of association while controlling for a few confounding factors simultaneously. To this end, the results of the multivariate analysis showed several independent variables. These included the following main predictors for having intrapartum stillbirth:

- Children alive.
- Sero-status for HIV infection.
- Number of ANC visits.
- Status of membrane on admission for labour.
- Foetal heart rate (FHR) on admission for labour.
- Foetal presentation during intrapartum period.
- Timing of uterine contraction observation.
- Timing of vaginal examination (VE) during labour.
- Episiotomy being conducted.
- Presence of eclampsia as a complication.

Data on trends of intrapartum stillbirth in the public health facilities in Addis Ababa were obtained from the regional health bureau in an excel format. These data were first correlated with the magnitude recorded in each facility during the data collection process to see consistency across the annual figures of respective facilities. Annual health reports of FMOH on key indicators were also referred to include data that were missing in the regional electronic database. The researcher further accessed the national HMIS data from FMOH to triangulate data obtained from the regional sources and published annual health and health related indicators. All these data were analysed using Windows 10 MS Excel application to demonstrate the trends of intrapartum stillbirth in public health facilities of Addis Ababa over the five-year period, July 1, 2010 to June 30, 2015. The findings were presented in graphs and tables along with descriptions on the phenomena.

In general, data for this study were analysed using the different features of SPSS software version 24 and the results were displayed in various format including graphs, tables and charts as presented in Chapter 5 of this thesis.

4.4 INTERNAL AND EXTERNAL VALIDITY OF THE STUDY

Validity in quantitative research refers to the extent to which a study accurately reflects or assesses the specific concept that the researcher is attempting to measure. Conversely, reliability refers to the extent to which any measuring procedure yields the same result on repeated trials (Hernon & Schwartz, 2009:73). In an epidemiologic study, the major concern validity deals with is the issue of measurement errors in accurately

capturing the true values related to the exposure or outcome status of the study subjects. Sources of such errors could be multiple.

Koepsell and Weiss (2014:179) argue that measurement error could occur for various reasons including faulty research instruments; flaws in data collection process; changing nature of the characteristics being measured; inaccurate diagnostic techniques or equipment; or limited skills and commitment of persons who established the diagnosis and made recording. For instance, interviews or questionnaires can obtain erroneous information because a subject may have been misinformed about his/her exposure status or may even intentionally misrepresent it. In addition, the methods used to make direct measurements on study subjects might contain error. Regardless of the characteristic or data-collection method, there is a true value of the characteristic being measured for each study subject. The true value for each subject may be unknown or only the measured value may be available. Any such discrepancy between the true value and the measured value is referred as measurement error (Koepsell & Weiss, 2014:76).

Measurement errors in a research undertaking could have several negative implications to the quality of the study. Therefore, careful attention need to be paid at various stages of the study including choosing appropriate research design, standardising the data collection instruments, adequately training data collectors, and sufficiently monitoring the data collection process. Retrospective study such as case-control design would require further vigilance in discerning the potential multiple notches where measurement errors could creep into a study. Accordingly, errors might have already existed in the records being reviewed to collect data retrospectively or mistakes can be made during the capturing and coding of such data. therefore, the errors need to be reduced by filtering the existing data sources through rigorous criteria or by strengthen the quality of instruments and data collection processes (ibid).

Oleckno (2008:197) accentuates that validity in a research setting can be divided into internal and external validity. Accordingly, internal validity represents the degree to which the results of a study, apart from random error, are true for the source population; that is, the population from which those eligible samples were chosen for the study. Internal validity can be threatened due to flaws in study design, conduct, analysis, or interpretation that usually have the effect of uniformly increasing or decreasing the true magnitude of the measure of association between a given exposure and outcome. Such systematic

errors tend to lead to either artificially elevated or lower measures of association in a study.

On the contrary, external validity, also known as generalisability, represents the degree to which the results of a study are relevant for populations other than the study population. For instance, if the findings from women who experienced intrapartum stillbirth in public health facilities of Addis Ababa could be safely generalised to all women experienced intrapartum stillbirth in Ethiopia, the study qualifies the principles of external validity (Oleckno, 2008:55).

This study was conducted with outmost attention to the principles of validity and reliability. Rigorous efforts were made to ensure that the design, sampling approaches, instruments, and procedures of the research adapted sound principles to ensure both internal and external validity of data as well as their reliability in producing comparable results if applied in similar contexts.

To this effect, measures including the development of appropriate instruments, adequate training of the data collector, use of structured questionnaire, close supervision during data collection, careful data entry and analysis were undertaken to ensure data integrity. Based on the rigour of the sampling procedure, the application of correct principles of data collection, clear definitions of cases and control, use of clear inclusion and exclusion criteria, this study demonstrated strong internal and external validity. The study instruments are standardised mirroring a nationally recognised obstetric service delivery format and hence if used in other similar settings they would produce the same results. The results of this study can be generalised to intrapartum stillbirth outcomes in similar facility settings in urban Ethiopia.

4.5 CONCLUSION

Intrapartum stillbirth being one of the relatively rare epidemiologic events, the **case-control design** was most appropriate choice for this study. Quantitative data on key variables potentially associated with intrapartum stillbirth were collected from antenatal and intrapartum care medical records of women who gave birth in public health facility in Addis Ababa from July 1, 2010 to June 30, 2015. A highly qualified midwife nurse data collector used structured questionnaire to collect data from medical charts of 728 cases

and 1551 controls that were identified based on clearly defined criteria. Data analysis was conducted using SPSS version 24 and both descriptive and inferential statistical techniques were applied to present trends, magnitude, determinants and risk factors related to intrapartum stillbirth.

CHAPTER 5

ANALYSIS, PRESENTATION AND DISCUSSIONS OF THE RESEARCH FINDINGS

5.1 INTRODUCTION

Several low-income countries have adopted the goal of achieving 100% of deliveries in healthcare facilities, and in many countries, an increasing number of births are taking place in facilities. Nevertheless, improvements in perinatal outcomes are not always observed with increasing facility deliveries. Consequently, poor quality obstetric and neonatal care seems to explain at least part of this failure. Reasons for the poor quality care are many including poorly trained and inadequate staff, delays in providing obstetric interventions, and failure to use effective treatments even if available. Several studies reported that one-third of stillbirths are related to intrapartum asphyxia, whereas one-fourth of neonatal deaths are also preceded by intrapartum asphyxia. Most asphyxia-related deaths are preventable by appropriate obstetric care and neonatal resuscitation (Goldenberg et al., 2013:230).

This current study aimed to assess the trends, magnitude, determinants and risk factors associated with intrapartum stillbirth in public health facility settings of Addis Ababa. Accordingly, a case-control study design was used to collect retrospective data from medical records of 728 women who experienced intrapartum stillbirth and 1551 women with normal birth as controls from twenty public health centres and three public hospitals over five years' period. The following result sections present findings on key variables by drawing comparisons between case and control groups to see any differentials in exposure to recognised risk factors and if intrapartum stillbirth could be explained owing to the statistically significant differences in exposure between cases and controls.

The results discussion will begin by providing summary background on administrative, socio-economic and health profile of the city of Addis Ababa to put the study findings into perspectives. Followed the description of general background, findings of this study will

be presented in two sections: descriptive and inferential results. Overview of the study findings and conclusion statements are presented as final sections of this chapter.

5.1.1 Profile of the City of Addis Ababa

Established in 1886, Addis Ababa is one of the oldest and largest cities in Africa. The City is located at an average altitude of 2400 meters and administratively divided into 10 sub-cities and 100 Woreda, the smallest administrative unit. With the estimated population of four million and 540 square kilometre physical space, the City plays a historic role in hosting the regional organisations such as the Organisation of African Unity / African Union and the Economic Commission for Africa (UN-HABITAT 2008:4).

The following map depicts the sub-city boundaries of Addis Ababa.

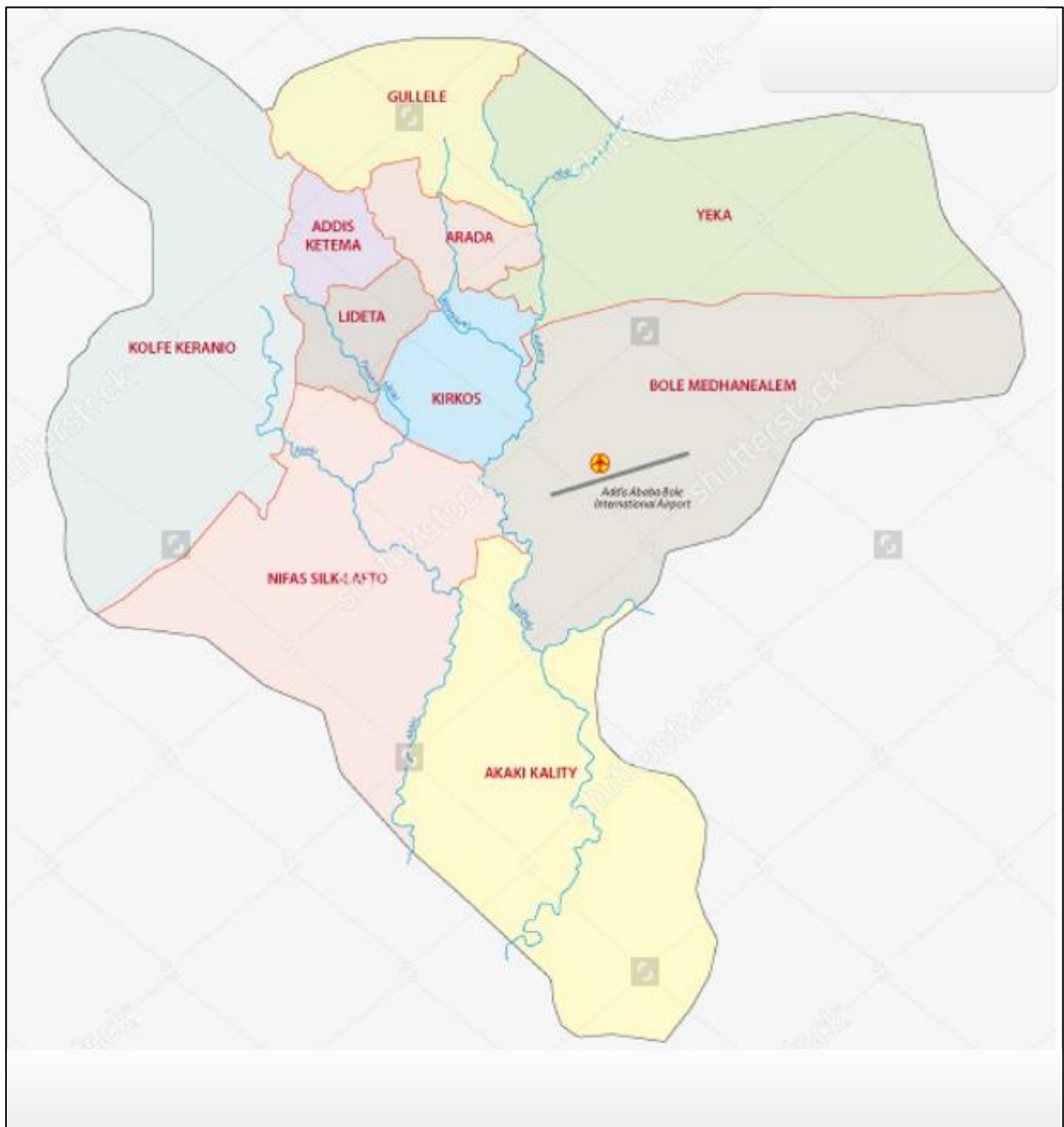


Figure 5.1 Administrative map of Addis Ababa City Administration
(<https://www.shutterstock.com/fr/image-vector/addis-ababa-administrative-map-255967021>)

5.1.2 Public health facility and health professionals distribution

The City of Addis Ababa has relatively higher concentration of health facilities compared to other regions of Ethiopia. In 2015, 88 public health centres and six public hospitals were functional under the AARHB. Although the number of hospitals remained constant, the number of public health centres was more than twice the number existed in 2010. On

the contrary, the gross number of health professionals in the public health facilities including doctors, nurses, midwives and health officers remained in the range of approximately 4000 during the five-year period 2010 and 2015. However, the number of midwives and health officers increased by threefold during the same period. Furthermore, in 2015, there were 816 private health facilities of which approximately over half had capacity of different levels to provide maternity care. Reports show that only 20% of deliveries take place in these private health facilities (MOH, 2010–2015).

Table 5.1 Distribution of health professionals and public health facilities in Addis Ababa

Health Professionals and Health Facilities	2010/11	2011/12	2012/13	2013/14	2014/15
Functional Health Centres	37	50	62	73	88
Public Hospitals under AARHB	6	6	6	6	6
Public Hospitals under FMOH	4	5	5	5	5
Number of Doctors	169	167	515	192	NA
Number of Midwives	160	144	416	349	409
Number of Health Officers	259	331	606	608	651
Number of Nurses	3159	3159	3980	2762	3276

(FMOH 2010–2015)

It was in the context of the above descriptions that this study collected data from selected public health facilities that had provided maternity care services in Addis Ababa from 2010–2015.

5.1.3 Data source and samples characteristics

Primary data for this case-control study were collected from 20 public health centres and three public hospitals in Addis Ababa City administration from April 1–July 31, 2016. Medical records of intrapartum care that had been provided to women who experienced stillbirth in public health facilities during the period July 1, 2010 to June 30, 2015 were thoroughly reviewed and relevant data on the study variables were captured using structured questionnaire for those meeting the screening criteria. In the same vein, a similar exercise was conducted in the same facilities to review charts of women who received intrapartum care and experienced livebirth for comparison. An experienced

nurse with a midwifery training background under the close supervision of the researcher undertook the data collection.

As described in Chapter 4 of this thesis, the maternity registers in each facility were reviewed first to establish list of all women who experienced intrapartum stillbirth during the period July 1, 2010–Jun 30, 2015. This was followed by the identification of intrapartum care charts in the medical record archives of each facility. Upon the identification of the respective charts, strict screening procedures were conducted to select eligible cases using the inclusion and exclusion criteria that were determined for the study. Similar processes were undertaken to identify charts of controls until the 2:1 control for case ratio was met.

Accordingly, a total of 3221 intrapartum care medical records were reviewed in the 20 public health centres and three public hospitals in Addis Ababa. Of these, 1056 charts were cases of intrapartum stillbirth whereas 2165 were for controls who did not experience intrapartum stillbirth. The inclusion criteria for both cases and controls were applied to identify charts that were eligible for this study and therefore, data were collected from 728 stillbirths and 1551 livebirths medical records only. The following diagram shows the quantity of chart reviews for both cases and controls that were included in this study.

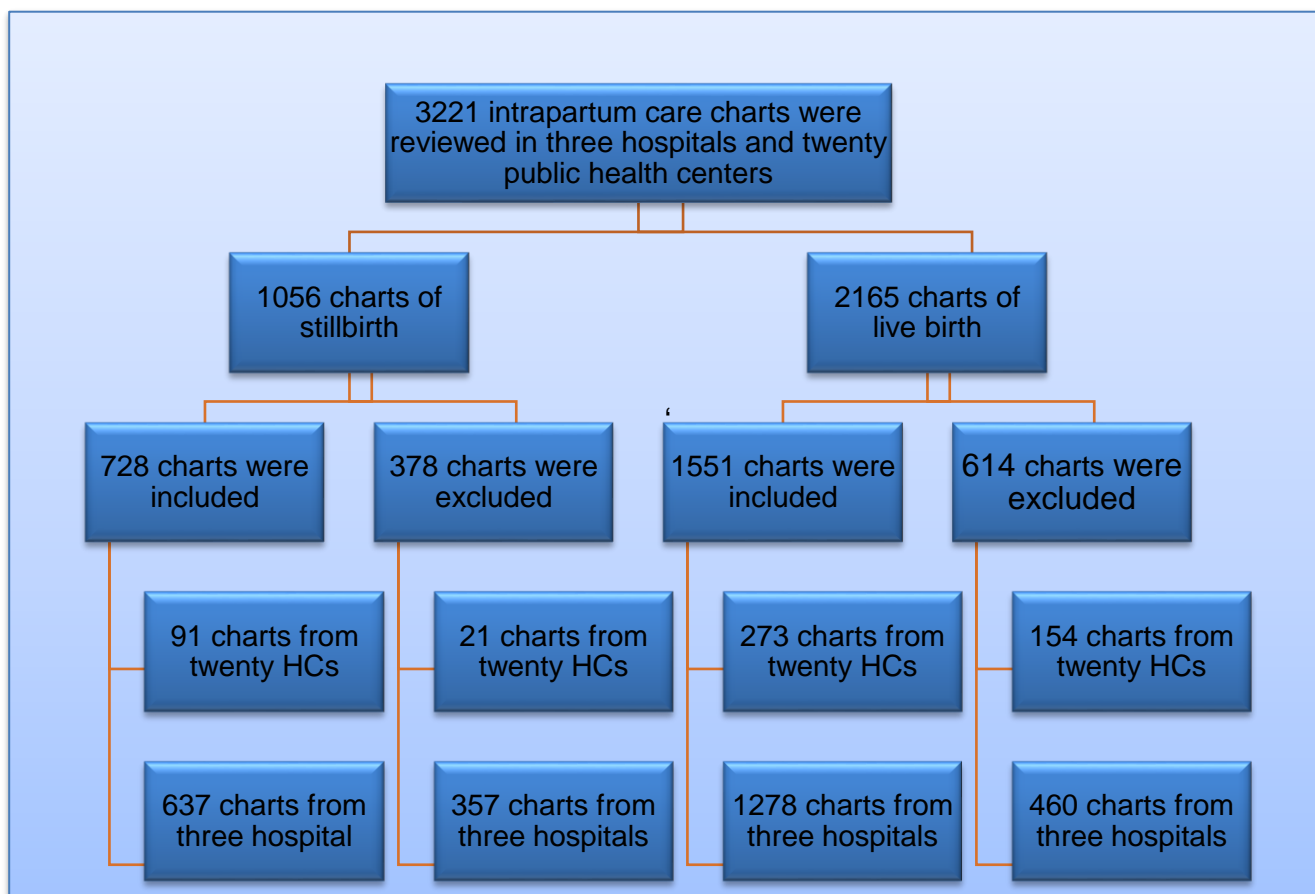


Figure 5.2 Data source flow chart for the study

5.2 DATA MANAGEMENT AND ANALYSIS

This study had a rigorous plan for data analysis from the beginning, which was carefully observed throughout the different stages of the research. Accordingly, data validity, consistency, and completeness checks were conducted throughout the data collection processes. The quality of data being a strong prerequisite for accurate analysis, due emphasis was given by the researcher in closely monitoring the integrity of data at the phase of collection, electronic recording and cleaning through on the spot checking of the works of the data collector and data entry clerk. The case-control study design used in this research ensures that similar approaches can be easily conducted in similar setting and due to the fact existing medical charts were reviewed as data source, the procedures can be replicated.

Upon completion of the data collection process, comprehensive data entry templates were created using SPSS statistical package version 24 and all data from the structured

questionnaire were successfully entered to the software by an experienced data clerk over the period of four weeks (August 1–31, 2016).

More importantly, an experienced statistician was hired to work closely with the researcher to conduct statistical analysis based on the data analysis plan. Accordingly, statistical analysis of the data was performed during Sept 19–30, 2016. Data cleaning, descriptive and inferential statistical analysis were conducted together with the statistician during this period. Accordingly, descriptive observations on key variables were presented in tables and graphs to show distributions of different characteristics of the study population.

Part of the data cleaning process involved checking for contents including missing data, outliers and collinearity between the different independent variables to ensure that the data can be analysed using multiple regression and that values can fit to the model. Several assumptions that were required for multiple regression were tested to give a valid result and to identify the variables to be considered in the model. The data cleaning process also involved checking for cumulative values to ensure the sample size for each independent variable was more than 15 to allow sound statistical analysis of data. For those categories or variables without adequate sample size, regrouping or elimination of the values were performed. For instance, the response “five and above” on parity of women did not produce adequate values. Hence, the few cases in this category of response were regrouped to “four and above” category before running the statistical analysis. Furthermore, testing the normal distribution of the outcome variable and checking the existence of multicollinearity (relationship among independent variables) were undertaken as part of the preliminary data analysis. For instance, independent variables including “gravida” and “para” were highly correlated with the “number of children alive”. Therefore, the former two were excluded from the regression model because they were less significant compared with the number of alive children.

This study applied several relevant statistical analysis and measurement principles including descriptive statistics, bivariate and multivariate logistic regression approaches. Many of these techniques helped to determine the level of associations between the various risk factors on which data were collected from cases, controls, and the intrapartum stillbirth where such relationships were assessed using measurements of statistical significance (p-value) or odds ratio. Accordingly, many variables were first

assessed using bivariate analysis. Those variables that were associated with intrapartum stillbirth on bivariate analysis at a statistical significance level or P-value of 0.2 and less were then fit into multivariate logistic regression model.

Multivariate analysis allowed the efficient estimation of measures of association while controlling for a few confounding factors simultaneously. To this end, the results of the multivariate analysis showed several independent variables. These included the following main predictors for having intrapartum stillbirth:

- Children alive.
- Sero-status for HIV infection.
- Number of ANC visits.
- Status of membrane on admission for labour.
- Foetal heart rate (FHR) on admission for labour.
- Foetal presentation during intrapartum period.
- Timing of uterine contraction observation.
- Timing of vaginal examination (VE) during labour.
- Episiotomy being conducted and presence of eclampsia as a complication.

Data on trends of intrapartum stillbirth in the public health facilities in Addis Ababa were obtained from the regional health bureau in an excel format. Furthermore, the researcher also obtained a complete set of national HMIS data from the FMOH to triangulate the data from the AARHB as well as to review situations related to stillbirth at a national level. More importantly, these data were first reviewed against the figures recorded in each facility during the data collection process to see consistency across the annual figures of respective facilities. Annual health reports of FMOH on key indicators were also referred to include data that were missing in the regional electronic database. All these data were analysed using Windows 10 MS Excel application to assess the trends of intrapartum stillbirth in public health facilities of Addis Ababa over the five-year period, July 1, 2010 to June 30, 2015. The findings were presented in graphs and tables along with descriptions on the situation.

5.3 RESEARCH RESULTS

5.3.1 Descriptive results

This section is dedicated to presenting results emanating from the descriptive analysis undertaken on key variables of the research. Following the sequence of the study objectives, trends and magnitude of intrapartum stillbirth are presented first. Accordingly, outputs of descriptive analysis from HMIS database of the AARHB and FMOH of Ethiopia are presented using texts, graphs, and tables to put them in perspective along with the global, regional and national trends and magnitude of stillbirth.

It should be noted that data from both national and regional database mostly contain stillbirth information with little differentiation in terms of prenatal, intrapartum and early neonatal deaths. To this end, stillbirth is often used interchangeably with intrapartum stillbirth particularly in analysing trends and magnitude of cases in Addis Ababa. However, the data from this study captured intrapartum stillbirth from the health facility records. Therefore, descriptive results focused on variables that were directly relevant to foetal death during the intrapartum period. Accordingly, all observations on socio-demographic characteristics of cases and controls, maternal and foetal medical conditions during antenatal and labour and the type and timing of the standard intrapartum interventions were presented using texts, frequency tables and figures generated from the descriptive statistics.

5.3.1.1 Trends and magnitude of intrapartum stillbirth

A recent global trend analysis for stillbirth showed an encouraging decline in 2015. Worldwide, approximately 2.1 million stillbirths occurred in 2015, representing a 47% decrease from 4 million in 1990. Similarly, stillbirth rates decreased from approximately 28.1 per 1000 in 1990 to 14.9 per 1000 in 2015. However, data from this analysis showed expansive disparity across geographies, which ranged from 1.2 per 1000 in Iceland to 56.3 per 1000 birth in South Sudan. Western and central sub-Saharan Africa recorded among the highest stillbirth rates, with eight countries experiencing rates exceeding 25 per 1000 in 2015. South and Southeast Asia saw stillbirth rates span from 3.4 per 1000 in Thailand to 27.6 per 1000 in Pakistan. In Europe, nine countries documented stillbirth rates lower than two per 1000, whereas no country or territory in the Americas had

stillbirth rates lower than 2.5 per 1000. Stillbirth rates decreased more quickly since 2000 than between 1990 and 2000 (Murray et al., 2016:1725). Another study that has been published in the lancet series puts the global stillbirth rate at a much higher rate of 18.2 per 1000 births (Lawn, Blencowe, Waiswa, Amouzou, Mathers, Hogan, Flenady, Frøen, Qureshi, Calderwood, Shiekh, Jassir, You, McClure, Mathai & Cousens, 2016:587).

A more recent data from WHO shows that the number of stillbirths has declined by 19.4% between 2000 and 2015, representing an annual rate of reduction (ARR) of 2%. This reduction noted for stillbirths is lower than that noted for maternal mortality ratio (AAR=3.0 %) and under-five mortality rate (ARR=3.9 %), for the same period (WHO, 2017a).

Global and regional reports on stillbirth usually rely on data from different sources including vital statistics, population-based surveys including DHS and health service data from facilities. However, evidence shows that most countries do not include stillbirth in their vital statistics reporting system, where available, and when stillbirth is included, these rates are generally underreported for various reasons (McClure et al., 2009:183). Particularly in low-income countries, there are a few population-based estimates of stillbirth rates, types of stillbirth, risk factors for stillbirth, or measures of health care associated with stillbirth. Demographic health surveys generally have excluded stillbirth as routine pregnancy outcomes or tend to report combined with early neonatal death (McClure et al., 2015:7).

Despite the declining trends in stillbirth, the absolute magnitude of loss of potentially viable human life to stillbirth was still of tragically high proportion. More disturbing trend is the reduced accountability in counting such losses in many countries. The review of the MoH data in Addis Ababa showed that stillbirths that had taken place in the public health facilities in Addis Ababa and elsewhere in the country were not differentiated to indicate the exact timing of the stillbirth including antepartum or intrapartum period.

Regardless of limited reliability of data on stillbirth, Ethiopia ranks among the top 10 high burden countries globally in relation to stillbirth incidence. Analysis of five-year HMIS data from FMOH indicated that the prevalence of stillbirth in the public health facilities across the country was above 25 per 1000 births with no clear pattern of decline from 2010 through 2015. These findings were consistent with trends observed in the public health facilities of Addis Ababa through data collection for this research. Moreover, the national

data indicated that areas that are being referred as emerging regions including Benshangul Gumuz, Afar and Somali had relatively higher magnitude of health facility level stillbirth during the reference years. Harari region followed by Dire Dawa also performed poorly across these years compared to other regions of Ethiopia, particularly given approximately more than 80% of their inhabitants live in urban or per-urban contexts where physical access to health facilities is believed to be less problematic (FMOH, 2010–2015).

Many factors might explain the high magnitude and unpredictable trends of stillbirth in public health facilities in Ethiopia. One of the most important challenges might be related to the inconsistency in documenting stillbirth in the health facilities records, which could lead to poor quality and unreliable reporting. The records do not provide clear diagnosis and categorisation of stillbirth to suggest whether the incidences occurred during prenatal, intrapartum or immediate neonatal period. Hence, reported figures were not specific enough to warrant corresponding interventions in response to the different situations. Given such a high magnitude and unabated trends in the stillbirth prevalence, the country's health system should refocus its efforts both on the demand and supply sides related obstetric interventions to improve the quality and coverage of skilled maternity and newborn care. More attention needs to be paid by health planners and service providers at health facilities to ensure that maternity care including intrapartum services meet standards and that necessary equipment and diagnostic techniques are available particularly in the public health facilities where large majorities of women seek care. Data in the following graph were extracted from the FMOH's HMIS sources to present national level trends and magnitude of stillbirth in Ethiopia.

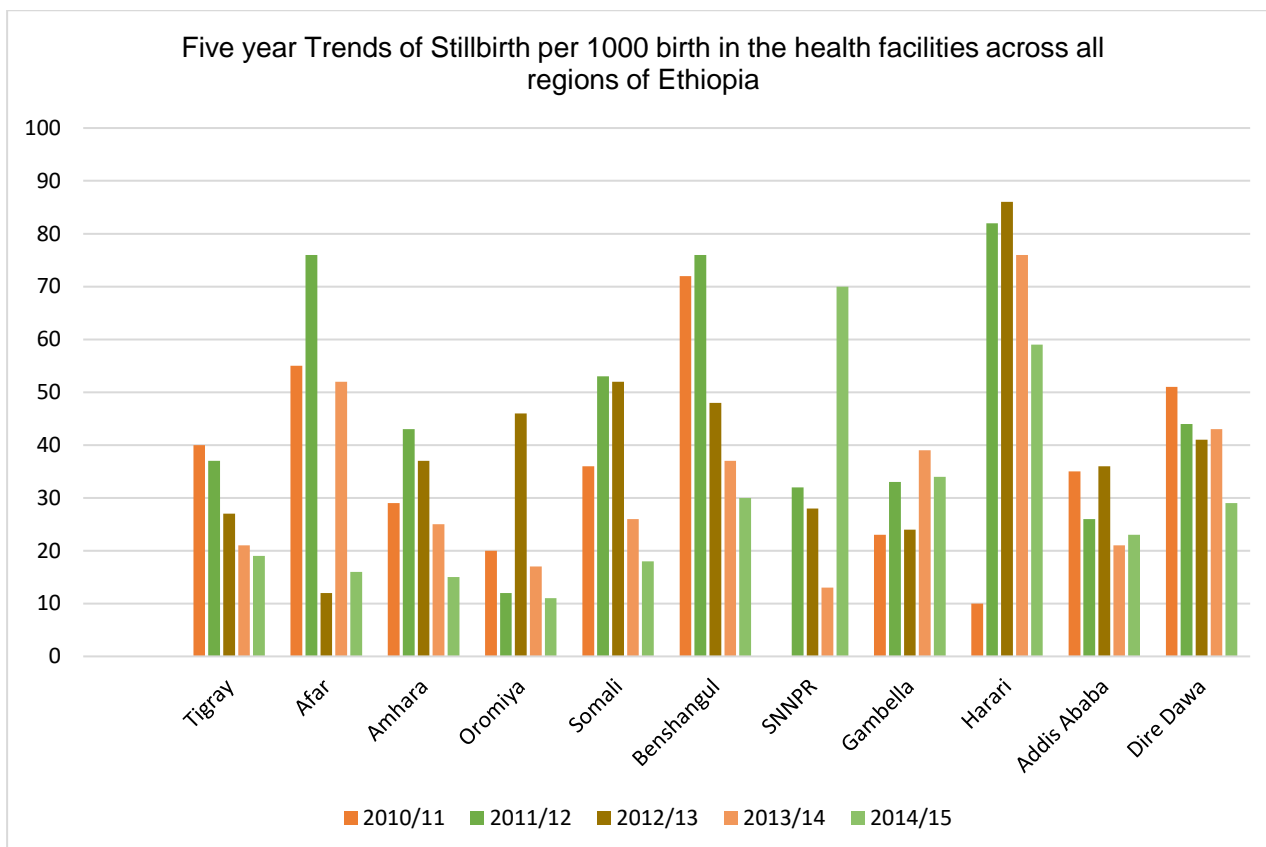


Figure 5.3 The distribution of stillbirth across the regions of Ethiopia (FMOH 2010–2015)

This study further analysed data from different sources including the annually published FMOH bulletins on health and health-related indicators, HMIS data from FMOH, HMIS data from AARHB and data collected for this study to present trends and magnitude of stillbirth in Addis Ababa. Accordingly, and as indicated in the above graph, the magnitude and trends of stillbirth in Addis Ababa was comparable with some regions of Ethiopia including Tigray, Oromiya, Amhara, and Gambella. Despite being the capital city of the country where the highest concentration of highly skilled service providers and better-equipped health facilities believed to exist, it appears paradoxical to observe such poor performance in terms of stillbirth rate, which gives the impression that the quality of maternity care is no better than elsewhere in the country.

As described in the introduction section above, in 2015, Addis Ababa had 99 public health facilities of which approximately 94% were administratively under the regional health bureau and the remaining under FMOH. Of these, 88 public health facilities were distributed across the 10 sub-city administrative divisions where over 400 professional midwives were deployed to provide maternity care. The distribution of both health

professionals particularly midwives and health facilities has more than doubled in 2015 compared to 2010. Reports also indicated that over 80% of pregnant women in the City access maternity care services from the public health facilities. It is noteworthy that sizable number of individuals seeking maternity care may have come outside of the City either from the surrounding peri-urban and rural villages or even from nearby regions. Some of these clients might have sought maternity care after experiencing difficulty in the progress of labour and owing to inferior services in their nearest facilities. However, the situation might have contributed to the soaring rate of intrapartum stillbirth in Addis Ababa (FMOH, 2015b:55).

Nonetheless, the data coming from these different sources point out that the stillbirth situation in Addis Ababa is alarming. Figure 5.4 below shows trends and magnitude of stillbirth in the public health facilities against total births that took place in the City during the period 2010-2015.

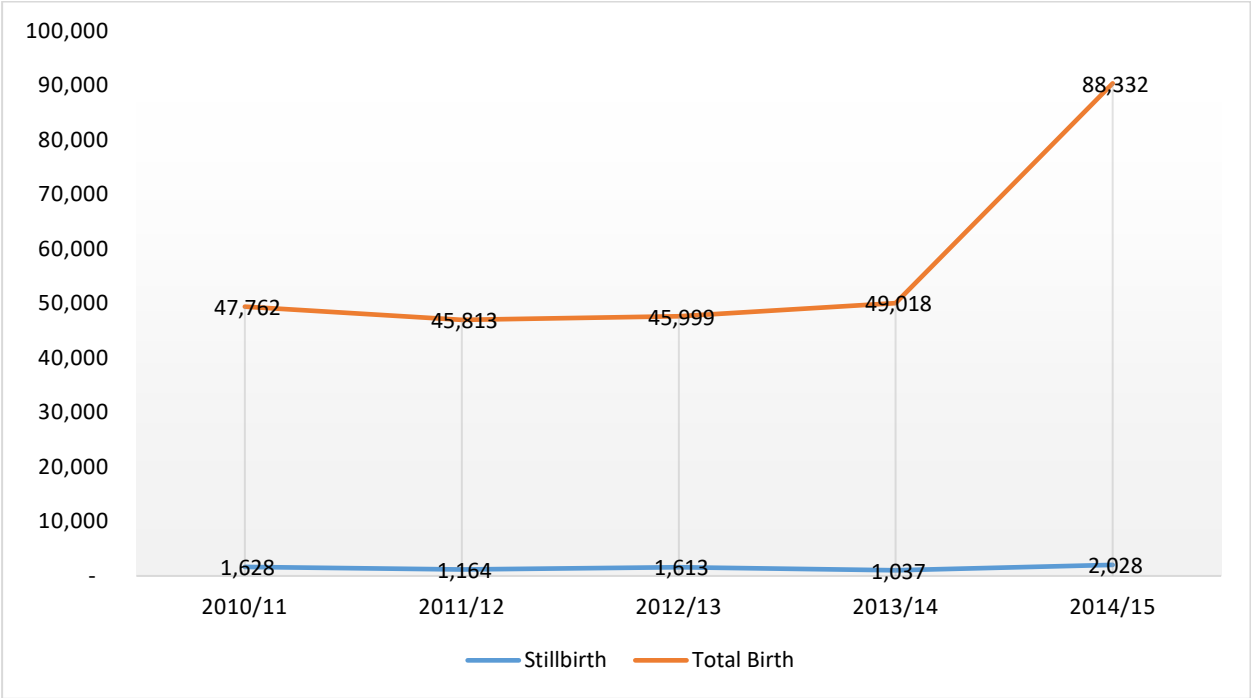


Figure 5.4 Trends of health facility stillbirth against total births in the public health facilities of Addis Ababa from 2010-2015

Accordingly, the City of Addis Ababa experienced staggering average stillbirth rate of 28 per 1000 total births during this period. This figure is comparable with the national stillbirth statistics that emanate from the DHS, which also indicated the prevalence of stillbirth at population level (Central Statistical Agency, 2011:115). Data from both national and

regional HMIS also confirmed inconsistent or little decline in trends of stillbirth in the City. In fact, in 2015 Addis Ababa performed worse (22/1000 birth) compared to a few capital cities in East Africa including Nairobi and Kigali. For instance, a study conducted in public health facilities in cities of Kenya including Nairobi in 2013 reported stillbirth rate of 20 per 1000 birth which is relatively lower than the rate in Addis Ababa which was 24 per 1000 birth (Aluvaala, Okello, Murithi, Wafula, Wanjala, Isika, Wasunna, Were, Nyamai & English, 2015:255). Similarly, in 2014, Kigali City registered a stillbirth rate of 16 per 1000 birth (NISR 2015:108). However, the result on stillbirth rate in Addis Ababa was better compared to a city in Nigeria during the same period (Suleiman, Ibrahim & Abdulkarim, 2015:5615). Many countries in sub-Saharan Africa are yet to establish a clear system in their HMIS or national surveys to better classify stillbirth. Hence, some of these statistics depict perinatal deaths occurring mostly in health facility settings.

One of the challenges in counting intrapartum stillbirth from the health facilities data is the fact that such records confuse case of children born dead with those who died immediately after birth. The failure in documenting these conditions using separate codes emerges from both lack of skills in accurately diagnosing the cases or avoidance of ethical responsibility particularly as early neonatal death could pose issues of medico-legal accountability if treated as professional negligence (Romola et al., 2010:1). This latter scenario might partially explain why the number of reported immediate neonatal deaths from health facilities in Ethiopia was relatively smaller. However, the data from FMOH's HMIS contains both stillbirth and neonatal death that occurred in the health facilities. As the graph below shows, the annual rates of both stillbirth and early neonatal deaths were relatively high in the public health facilities in Addis Ababa computed against the respective total births.

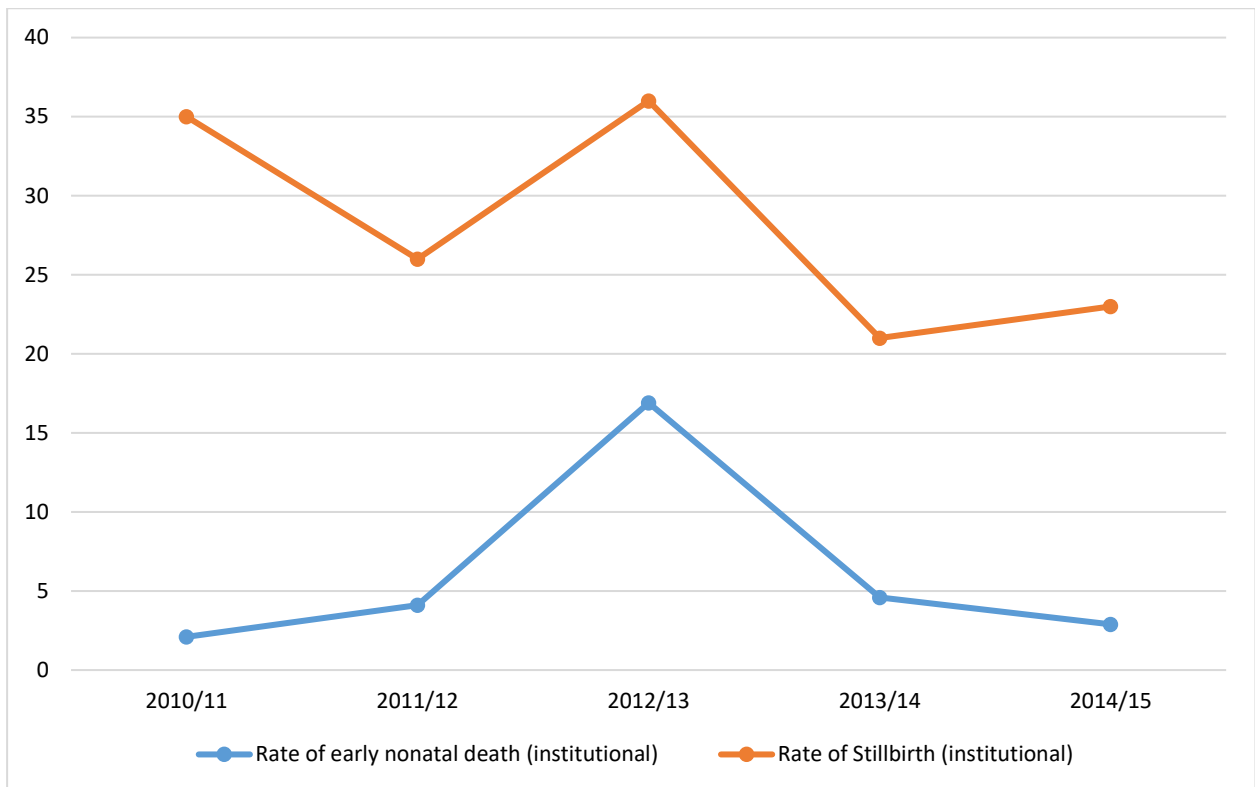


Figure 5.5 Trends of stillbirth against immediate neonatal death in the public health facilities of Addis Ababa from 2010–2015

While the preceding descriptions covered broader categories of stillbirth thereby presenting its trends and magnitude grossly to lack deficiencies in classification of the cases, this current study further collected data on the total numbers of intrapartum stillbirths occurred in 20 public health centres and three hospitals in Addis Ababa for the period ranging from 2010-2015. The data included all cases of intrapartum stillbirths recorded in the maternity registers that were computed to generate illustrative trends and magnitude on the specific category of stillbirth. Accordingly, the graph below shows that the absolute magnitude of intrapartum stillbirths that occurred in the assessed public health facilities in Addis Ababa declined over the five-year period in reference. Given one of the hospitals assessed (Gandhi Memorial Hospital) was a maternity specialised facility and because hospitals have larger service capacities compared to health centres in Addis Ababa, the average magnitude of stillbirth in the former was approximately tenfold higher than the health centres.

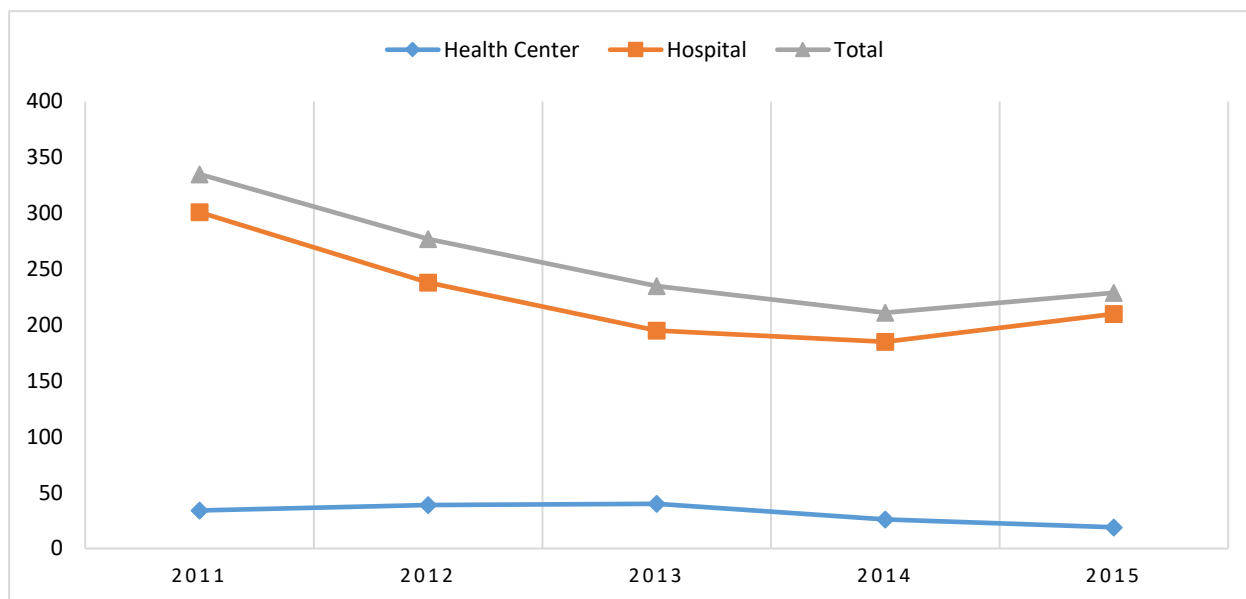


Figure 5.6 The magnitude of intrapartum stillbirth in the public health facilities included in this study

As indicated in Chapter 4 of this thesis, one of the criteria that determined the inclusion of medical charts of cases was the status of foetus on admission. To this effect, the data collected for this study had a better chance of capturing intrapartum stillbirth because of the selection criteria that ensured foetus of all cases were alive on admission for delivery in the public health facilities, which effectively ruled out any macerated stillbirth. Accordingly, results indicated that the overall trends in the rate of intrapartum stillbirth in the study facilities have consistently declined between 2010–2015.

Figure 5.7 was generated using data on total annual births in the target facilities, which were first added up separately for the three hospitals and 20 health centres to establish the annual denominators. Secondly, data on cases that qualified inclusion criteria were added up on annual basis for both health centres and hospitals categorically. The annual rate was then generated by dividing the yearly intrapartum stillbirth aggregates by the total births from respective categories of health facilities, which were presented against 1000 total births.

Consistent with the analysis above on the magnitude of intrapartum stillbirth, the graph depicted as Figure 5.7 shows that the rate of intrapartum stillbirth in the hospitals and health centres declined consistently over the period of 2010–2015. However, the rates of

intrapartum stillbirth in the public hospitals were consistently higher compared to the public health centres during this period.

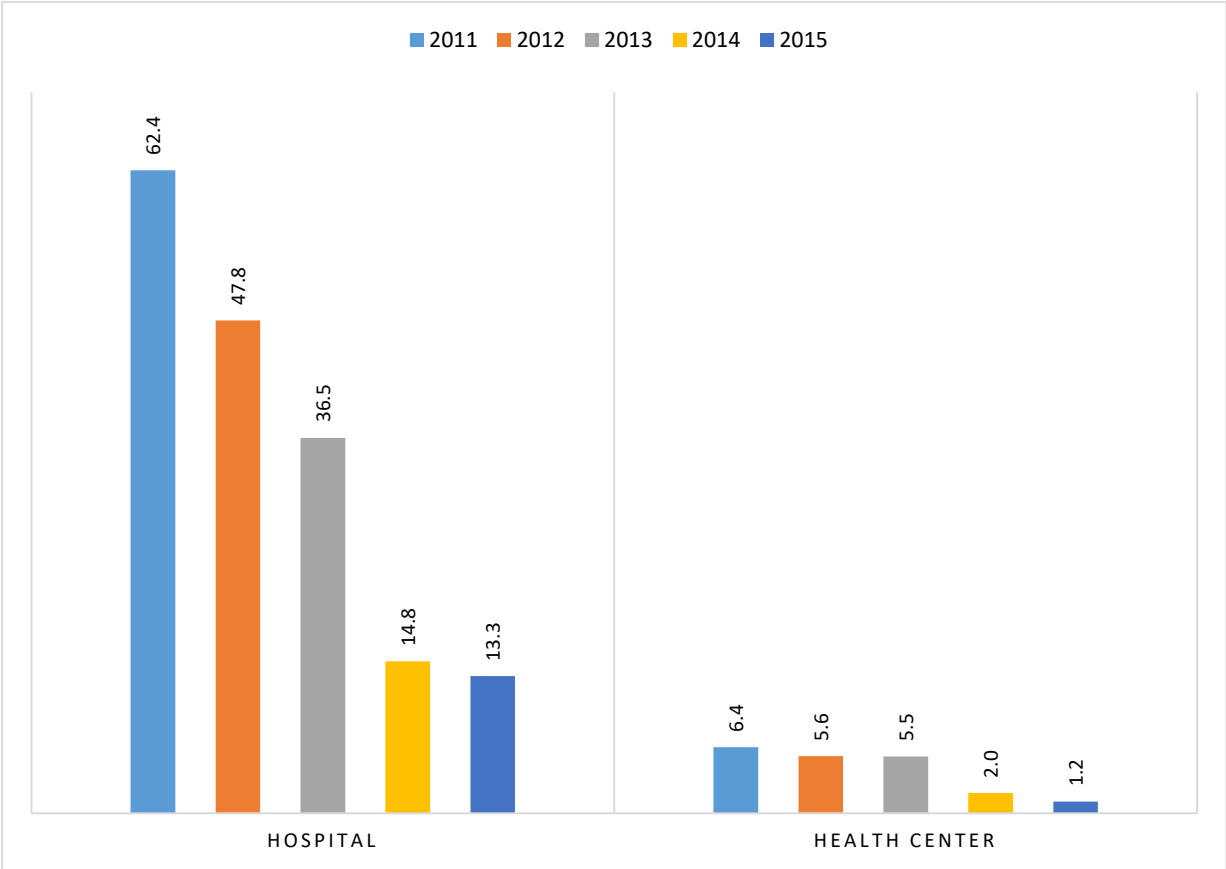


Figure 5.7 Trends in the rated of intrapartum stillbirth in the public health facilities included in this study

A few factors are believed to explain these phenomena. The health system in Addis Ababa had been encouraging pregnant women to utilise maternity care from their nearest public health centres. In addition, it is likely that women in labour might have transitioned through the respective health centres, which would mean that complications might had begun by the time hospital admissions took place. Furthermore, the limited competency of particularly health centre-based professionals in diagnosing and making accurate and timely decisions to appropriately address labour-related complications might also explain for the absence of decline in the trends of intrapartum stillbirth in the health facilities (Mirkuzie, Sisay, Reta & Bedane, 2014:1).

For instance, a study conducted in Addis Ababa in 2013 revealed that skilled birth attendants who received even additional training on EmONC had low mean scores regarding knowledge and skills required to successfully diagnose and manage progress

and complications of labour (Mirkuzie et al., 2014:1). This would mean that referrals to public hospitals might have occurred late after complications were developed leaving little chances for livebirth even after reaching to hospitals. It is true that over 85% of deliveries in Addis Ababa take place in the health facilities of which approximately 80% are undertaken in public health facilities (Central Statistical Agency, 2011:115; Mirkuzie et al., 2014:1). However, owing to the absence of well-enforced referral systems, self-referrals to hospitals during late stages of labour are still commonplace in the city, which leads to adverse foetal and maternal outcomes.

In general, the Addis Ababa City had experienced a heavy toll of intrapartum stillbirth during the period under review for this study. The magnitude and trends intrapartum stillbirth did not show convincing and consistent decline between 2010–2015 compared to global and regional trends. Therefore, this situation calls for rapid actions in terms of addressing both demand and supply side related bottlenecks of maternity service delivery in the City. Such actions should consider measures of improving the quality of intrapartum care in the public health facilities. Revision of the existing standards and tools being used to assess the progress of labour in the health facilities, managing complications and establishing effective referral linkages across facilities should be prioritised to avert such alarming loss of human life. Continuous improvement of the quality of maternity services through competency-based training programmes, increased accountability, and correct classification of stillbirth outcomes, strong documentation and accurate reporting practices are among critical steps to reduce the toll of intrapartum stillbirth in Addis Ababa and similar settings across the country.

5.3.1.2 Socio-demographic characteristics of the study population

This study observed only a few socio-demographic characteristics including age of the women, marital status, history of previous pregnancies, and number of children alive. The study was limited to these variables owing to the nature of data collection which relied on pre-recorded medical history of the study subjects.

There is strong body of evidence that socio-demographic factors including age, parity, educational status, place of residence, ethnicity, and wealth status are associated with the stillbirth outcomes (Afulani, 2016:132; Aminu et al., 2014:141). For instance, McClure et al. (2015:7) report that women over 35 years of age were more likely to have a stillbirth

compared with women 20-35 years of age. Similarly, women without formal education and those with parity of more than two pregnancies were more likely to experience stillbirth compared to those with higher education and lower number of births respectively (McClure et al., 2015:7). Another study from China also reported that stillbirth rate was particularly high for women younger than 15 years, unmarried, those with no education, or those who had had four or more births (Jun, Juan, Yi, Xiaohong, Sufang, Robert, Yanping, Li, Zheng, Mingrong, Chunhua, Changfei, Ling, Kui, Qi, Xia, Chunmei, Dezhi & Carine, 2016:109).

Consistent with the health facility format for maternity care service deliver, this study collected data on five key socio-demographic variables including age, marital status, gravida, para and number of children alive for the women whose charts were reviewed. Accordingly, approximately 57% of women who experienced intrapartum stillbirth and 60% who had livebirths reported to be in the age category 25–34 years. The second highest proportion of women in the study population for both intrapartum stillbirth (35.8%) and livebirth (33.6%) were found in the age group 15–24 years. These two categories depicted the highest proportion of women experiencing stillbirth, which could be attributed to the fact that most births in Ethiopia are occurring during these age brackets. The findings are comparable with studies from Kenya (Cheptum, Muiruri, Mutua, Gitonga & Juma, 2016:24). However, this study did not reveal any statistically significant associations between the different age groups and intrapartum stillbirth.

Most women (64.4%) who experienced livebirth in the study population were married against 42.7% for those who experienced stillbirth. The marital status of 55.4% of women in the stillbirth category was not recorded on both the antenatal and maternity follow-up documentations. On the contrary, approximately 32% of women who experienced livebirth had a missing record for marital status. Like the different age categories described above, there was no statistically significant associations between marital status and intrapartum stillbirth. This could be because proportionally large quantity of data on marital status was missing in the health facilities records thereby making statistical analysis incomplete. Maternity care service providers should be encouraged not to overlook the importance of key socio-demographic variables including marital status. The proper use of local HMIS data to make clinical and public health decisions and annual audit of health service records to check for completeness could increase the motivation of practitioners in capturing all variables on the service delivery records.

Gravida and Para are terms used to express the number of conceptions and childbirth a woman experienced in her life respectively. Per a midwives' textbook, 'Gravid' means 'pregnant', gravida means 'a pregnant woman', and a subsequent number indicates the number of times she has been pregnant regardless of outcomes. 'Para' means 'having given birth'; a woman's parity refers to the number of times that she has given birth to a child, live or stillborn, excluding termination of pregnancy (Marshall & Raynor, 2014:170). Many studies revealed that these variables fall among the recognised predictors for the occurrence of stillbirth. For instance, a study conducted in the UK reported that stillbirth rates were increased in first as well as third and subsequent pregnancies compared with second pregnancy (Jason, Vichithranie, Mandy, Asad & André, 2013:1).

Results from this study showed that proportionally more women in the stillbirth category (49.3%) than in the livebirth (37.1%) conceived for the first time. Conversely, the proportion of women conceived for the second time was lower among the stillbirth group (28%) than those in the live birth groups (34.8%). Consistent with the results on gravida, stillbirth was proportionally more common among women who had no previous childbirth experience (60%) compared to those who given birth to up to three children. These differences between stillbirth and livebirths based on birth orders and number of lifetime pregnancies were statistically significant. Accordingly, first childbirth imposes more risk on experiencing stillbirth compared to second or third birth. This result is consistent with well-established evidence that being a primigravida constitutes obstetrical risks that could result in adverse pregnancy outcomes if labour and childbirth are not managed with utmost diligence. Primigravida women are also less informed about the onset and physiological processes of labour, which could result in delayed solicitation of maternity services even though physical access to obstetric care was not an issue. To this effect, the quality of intrapartum care including professional competence, attitude and responsiveness of the midwives and obstetricians and awareness of women on signs of true labour can be considered as key determinants of the intrapartum stillbirth (Maaloe, Housseine, Bygbjerg, Meguid, Khamis, Mohamed, Nielsen & Van Roosmalen, 2016:1).

This current study did not reveal any statistically significant differences between stillbirth and livebirth categories for women of three and higher birth orders. However, the descriptive results from this study showed that women with one or more alive children were proportionally less likely to experience intrapartum stillbirth compared to women

without any child ($p=0.00$). There was little evidence from literature as how these variable affects stillbirth outcome, apart from the physiological risks associated with women who experienced childbirth for the first time in life.

Table 5.2 below presents the results on the socio-demographic variables affecting outcomes of stillbirth among the study population:

Table 5.2 Key socio-demographic characteristics affecting intrapartum stillbirth

Characteristics of Women	Categories	Women with Stillbirth N (%)	Women with Livebirth N (%)	P-value
Age (sears)	15-24	261 (35.8)	522 (33.6)	0.333
	25-34	416 (57.2)	931 (60.3)	
	35-49	51 (7.0)	98 (6.1)	
Marital status	Married	314 (42.7)	982 (64.4)	0.386
	Divorced	3 (0.4)	5 (0.3)	
	Widowed	0 (0.0)	3 (0.2)	
	Separated	0 (0.0)	2 (0.1)	
	Never Married	11 (1.5)	43 (2.8)	
	Missing	400 (54.9)	516 (33.2)	
Gravida	One	360 (49.3)	575 (37.1)	0.000
	Two	203 (28.0)	539 (34.8)	
	Three	84 (11.5)	256 (16.5)	
	Four	55 (7.6)	133 (8.6)	
	Five and Above	26 (3.7)	48 (3.0)	
Para	Zero	442 (60.3)	744 (48.1)	0.000
	One	185 (25.4)	542 (35.0)	
	Two	57 (7.9)	177 (11.4)	
	Three	31 (4.3)	61 (3.9)	
	Four	10 (1.5)	19 (1.2)	
	Five and Above	4 (0.5)	8 (0.5)	
Children alive	Zero	451 (68.8)	790 (55.2)	0.000
	One	134 (20.4)	435 (30.4)	
	Two	43 (6.6)	139 (9.7)	
	Three	21 (3.2)	49 (3.4)	
	Four and Above	7 (1.1)	17 (1.2)	
	Missing	72 (9.8)	121 (7.8)	

5.3.1.3 Past medical and obstetric history of the study population

Medical and obstetric histories of women have critical significance in determining the pregnancy outcomes. For instance, previous childbearing history was referred as

important variable in predicting possible outcomes of the current pregnancy and in relation to how the woman feels about the future. Previous obstetric and medical risk factors include history of unexplained stillbirth; hypertensive disorders encompassing pre-eclampsia and eclampsia; previous pelvic or abdominal surgery; history of other chronic diseases like diabetes; genetic or anatomical defects and lifestyle related conditions including history of smoking are believed to influence the outcomes of subsequent pregnancies (Marshall & Raynor, 2014:170).

For instance, a study from India reported that the history of previous stillbirth had significant association with subsequent incidence of stillbirth among the study population. Similarly, hypertension, anaemia, heart disease, and diabetes were associated with higher incidence of stillbirth (Sharma, Sidhu & Kaur, 2016:11). In another systematic review and meta-analysis, women who experienced a stillbirth in an initial pregnancy experienced nearly a fivefold increase in the odds of stillbirth in a subsequent pregnancy. Even when restricting the analysis to first and second pregnancies, the risk of stillbirth in the second pregnancy was increased if the first pregnancy ended in stillbirth (Lamont, Scott, Jones & Bhattacharya, 2015:1).

Evidence seems conclusive on the association between previous history of stillbirth and its recurrence during successive pregnancies. For instance, a study from the USA confirmed not only previous incidence of stillbirths but also host of other past medical histories including blood type, smoking and obesity being associated with stillbirth outcome (Stillbirth Collaborative Research Network Writing, 2011:2469).

This current study reviewed maternity care records particularly the antenatal follow-up cards to collect data on key variables tracking women's past medical history. The records contained only dichotomous information where a "yes" or "no" responses were included. Accordingly, most women in both intrapartum stillbirth and livebirth categories (96.7% and 96.5% respectively) did not have any history of previous stillbirth. Equally high proportion of women in both case and control categories (99.7% and 99%) did not report experiencing spontaneous abortion in their previous pregnancies.

A few studies further reported associations between previous underweight or overweight babies and stillbirth. For instance, a study from Democratic Republic of Congo (DRC) reported statistically significant association between previous overweight babies and

stillbirth (Tandu-Umba, Mbangama, Kamongola, Kamgang, Kivuidi, Kasonga, Kambashi, Kapuku, Kondoli, Kikuni & Kasikila, 2014:1011). Previous experience of giving birth to underweight babies were also reported as predictors of stillbirth in the subsequent pregnancies (Michael, Anne, Blandina, Joseph, Gileard, Rachel & Rolv, 2013:1). Furthermore, previous surgical interventions on women's pelvic area including Caesarean sections have been confirmed as risk factor to the occurrence of stillbirth during subsequent pregnancies (Michael et al., 2013:1; Tandu-Umba et al., 2014:1011).

Results from this study showed that almost all women in both stillbirth and livebirth categories of the study population had neither history of giving birth to underweight babies nor being hospitalised for any hypertensive disorders during past pregnancies. These findings seem inconsistent with results from other setting in African and elsewhere, which can be explained partly by the limited quality of record keeping in public health facilities in Ethiopia. It can also be associated with the challenge of analysing data, which were collected for a different purpose.

On the contrary, more than 91% of women in both the cases and control categories did not experience any previous surgery on their reproductive tracts with statistically significant protective associations between intrapartum stillbirth and not having had surgery on the reproductive tract. This finding is consistent with a study from Rwanda where women with previous pelvic surgery subjected to trial of vaginal delivery experienced increased chance of fresh stillbirth (Kalisa, Rulisa, Van Roosmalen & Van den Akker, 2017:272).

Table 5.3 Past obstetric and medical history of the study subjects

Characteristics	Response	Stillbirth N (%)	Livebirth N (%)	P-value
History of stillbirth	Yes	24 (3.3)	54 (3.5)	0.776
	No	704 (96.7)	1490 (96.5)	
	Missing		7	
History of three or more consecutive spontaneous abortions	Yes	2 (0.3)	15 (1.0)	0.114
	No	726 (99.7)	1536 (99.0)	
Birth weight	Under Weight	0	0	0.406
	Normal	728 (100%)	1545 (100)	
	Over Weight	0	0	
	Missing	0	6	
Hospital admission for hypertension or pre-eclampsia/ eclampsia	Yes	3 (0.4)	8 (0.5)	0.503
	No	725 (99.6)	1536 (99.5)	
	Missing		7	
Previous surgery on reproductive tract	Yes	29 (3.9)	136 (8.8)	0.000
	No	699 (96.1)	1407 (91.2)	
	Missing	0	8	

5.3.1.4 Maternal and foetal medical condition and ANC history during the index pregnancy

While previous medical and obstetric history can be useful in predicting the outcomes of subsequent pregnancies as discussed in the above section, medical conditions of the mother during the time of each pregnancy can equally determine pregnancy outcomes. Chronic illnesses including hypertension, diabetes, heart diseases can either be induced or aggravated by pregnancy threatening the wellbeing of both mother and babies. Maternal medical conditions during pregnancy also refer to anomalies caused by infections or nutritional deficiencies that could lead to adverse outcomes including stillbirth. For instance, of the 20,000 pregnancies that resulted in stillbirth (39% intrapartum stillbirth) in South Africa between 2008-2009, 20% were associated with hypertensive disease that could have been managed to avert the adverse outcomes (Beauclair, Petro & Myer, 2014:2).

Many of these risk factors could be screened and managed as part of the standard antenatal care practices being offered by skilled health professionals in the health facilities. Per findings from the study cited in the above paragraph, 24% of stillbirths and

neonatal deaths in South Africa could be prevented every year if families acted to prevent them through timely utilisation of ANC (Beauclair et al., 2014:2).

This current study reviewed the medical records of both cases controls to reveal if any of such indicators had determined the birth outcome of the index pregnancy. Accordingly, data on key maternal and foetal medical conditions including hypertension, diabetes, infections, ANC attendance, and foetal condition during the index pregnancy were collected from the health facility records to see if any of these had statistically detectable associations with the intrapartum stillbirth compared to the livebirth outcomes. The findings on some of the key risk factors are presented in the sections below.

5.3.1.5 Maternal medical condition

Maternal medical conditions during pregnancy play significant roles in determining the outcomes of pregnancies. Marshall and Raynor (2014:224) describe different medical conditions including hypertensive, metabolic, endocrine, respiratory, haematological disorders and infections as critical factors that could cause adverse pregnancy outcomes including stillbirth (Marshall & Raynor, 2014:170). As described at length in the literature review chapter of this thesis, many of these conditions could directly or indirectly attribute to intrapartum stillbirth. For instance, a study reported that maternal medical diseases including hypertension, diabetes, heart disease, hyperpyrexia and infective hepatitis were significantly associated with stillbirth outcome (Sharma et al., 2016:11). Similarly, hypertensive disorders are believed to be present in up to 10% of all pregnancies thereby increasing the risk of foetal death. Moreover, pre-eclampsia, gestational hypertension and chronic hypertension (hypertension prior to pregnancy) are among hypertensive conditions that impose varying degree of risks to pregnancy outcomes. The degree of risk also increases after 37 weeks of pregnancy rising the chances of intrapartum stillbirth (Ahmad & Samuelsen, 2012:1521).

A study from India showed that approximately 18% women experienced chronic kidney diseases had stillbirth (Singh, Prasad, Banka, Gupta, Bhaduria, Sharma & Kaul, 2015:194). Empirical evidence shows that both pre-gestational and gestational diabetes impose risks of stillbirth outcome. For instance, a study from the US indicated that pregnant women with pre-existing diabetes were more likely to experience stillbirth than those without diabetes (Trudell, Tuuli, Colditz, Macones & Odibo, 2017:e0173461).

Gestational diabetes mellitus (GDM) is the common cause of hyperglycaemia in pregnancy, accounting for about 90% of all diabetes during pregnancy and associated with stillbirth outcome (Mwanri, Kinabo, Ramaiya & Feskens, 2015:983).

Many studies reported the association between maternal infection during pregnancy and stillbirth outcome. Although research findings are not conclusive, HIV infection is widely believed to have statistically significant associations with stillbirth. For instance, a study from Namibia reported that approximately 26% of cases of stillbirth in the study population had history of HIV infection during their index pregnancies (Desire & Julia, 2016:2071). A population-based study in Zambia also reported that 28% of stillbirth cases occurred to mothers who tested HIV positive during their index pregnancies (Turnbull et al., 2011:894).

Syphilis infection is another risk factor to stillbirth. A study from North-Eastern Ethiopia showed that pregnant women with syphilis infection were three times more likely to develop stillbirth (Endris, Deressa, Belyhun & Moges, 2015:2).

Antenatal follow up records of women included in this study were reviewed to determine if any of the maternal medical conditions assessed during the index pregnancy had association with the stillbirth outcome. The result showed that over 93% of women in both the stillbirth and livebirth categories did not experience any of the key maternal medical conditions including hypertension, diabetes, cardiac, and renal diseases.

Accordingly, the data did not show a convincing association between any of the chronic maternal medical conditions including hypertensive disorder, diabetes, renal and cardiac diseases, and stillbirth outcome. Furthermore, the prevalence of many of these conditions among the study population was lower compared to findings from studies in the general population. For instance, only 6.3% of women in the stillbirth category and 6.1% of women in the livebirth category reportedly had higher blood pressure during the pregnancies in this study. These findings were not consistent with a population-based study that puts the prevalence of hypertension among women of reproductive age in Addis at 29% (Molla, 2015:514). However, the finding was slightly higher compared to a study from Kenya conducted by Ahmad and Samuelsen (2012:1521) which reported 10%.

Findings from this study did not show any statistically significant difference between stillbirth and livebirth data when computed for hypertensive disorder. It is worth noting that a systolic blood pressure ≥ 140 mm Hg or a diastolic blood pressure ≥ 90 mm Hg after 20 weeks of gestation is defined as gestational hypertension. Hypertension diagnosed prior to 20 weeks of gestation is thought to be chronic hypertension manifesting itself during pregnancy (Kilewo, Natchu, Young, Donnell, Brown, Read, Sharma, Chi, Goldenberg, Hoffman, Taha & Fawzi, 2009:25).

Similarly, findings from the record review of the study population revealed that the prevalence of other common maternal medical conditions including diabetes, cardiac and renal disease were less than 1%, without any significance in association between stillbirth and livebirth. On the contrary, the two variables related to infection during pregnancy including HIV and syphilis had statistically significant association between case and control categories. The ANC records of the study population indicated that 90% and 93% cases and controls were HIV negative during the index pregnancy respectively. This difference was statistically significant ($p < 0.05$). The observed HIV prevalence of 6.5% among the study population was comparable with a similar finding from Cameroon (Sama, Feteh, Tindong, Tanyi, Bihle & Angwafo, 2017:e0172102).

Furthermore, approximately 82% of cases against 91% controls tested negative for syphilis among the study population. The prevalence of syphilis was 0.7% and 0.8% among cases and controls respectively. Despite such low prevalence, the difference between cases and controls was statistically significant ($p < 0.001$). However, the prevalence of syphilis was relatively low compared to another study in the same context, which reported 2.9% among pregnant women (Endris et al., 2015:2). Review of the medical records of both cases and controls indicated considerable amount of missing data (17% and 8.4% respectively), which shows poor record keeping practice and limited diagnostic procedures in the public health facilities of Addis Ababa.

Checking for blood group, Rh factor status and red cell antibodies in pregnant women during pregnancy is recommended as part of the routine ANC screening to prevent haemolytic disease of the newborn (HDN). As a standard practice, blood should be taken at booking and again at 28 weeks of gestation to determine if antibodies are present due to exposure from previous pregnancies. All Rh negative women should be offered anti-D at 28 and 34 weeks gestation to prevent any adverse pregnancy outcome (Fraser &

Cooper, 2009:102). Furthermore, maternal alloimmunisation to anti-Rhesus-D (anti-D) antibody is recognised as a major contributor to stillbirth. Results from the current study showed that proportionally more women in the livebirth (91.9%) category than stillbirth (87.7%) were RH+, which was protective compared to being RH – during pregnancy. Ironically, there were slightly more RH negative women in the livebirth category than stillbirths however referring to the larger missing data among stillbirth women (7.7%) than livebirth (2.9%), the protective association of being RH + among livebirth category seems justifiable. The relatively high missing record of RH status of pregnant women in the public health facilities in the study setting might be indicative of gaps in the ANC services and limited sensitivity to potential risk factors that could negatively affect outcomes of pregnancies. Therefore, the proportion of women who were RH positive during the pregnancy captured in this study was comparable to a cohort study from Sweden, which also reported that maternal alloimmunisation with red blood cell antibodies was associated with increased odds of stillbirth (Fan, Lee, Wikman, Johansson & Reilly, 2014:1123).

5.3.1.6 Foetal medical condition during the index pregnancy

Assessing foetal conditions during pregnancy constitutes part of standard ANC practices in the public health facilities. Pregnant women are encouraged to receive recommended clinical and counselling services from skilled health professional during each pregnancy. As indicated in the ANC section below, routine diagnostic screening tests and physical examinations are conducted to rule-out any potential maternal and foetal risk factors that would determine pregnancy outcomes. Measuring uterine size compatibility with gestational age, assessing foetal movement, monitoring foetal heart rate and observing foetal presentations are among key interventions required to determine foetal wellbeing during pregnancies (Marshall & Raynor, 2014:170).

This study collected data on three important foetal risk factors including foetal heart rate, foetal presentation, and the presence of multiple pregnancy during the ANC visits in the public health facilities records for the pregnancies under investigation.

Accordingly, over 97% of women in both stillbirth and livebirth categories had normal FHR during the antenatal visit for the pregnancies in review. However, univariate analysis did not show any statistically significant differences between the two categories indicating

FHR during ANC visits was not a predictor for stillbirth outcome. Data were also collected on foetal presentation during ANC visits. Accordingly, proportionally more women in the stillbirth category (10.7%) than in livebirth group (3.7%) had non-cephalic presentation of foetus during the ANC visits. Conversely, proportionally more women in the control group (92%) than cases (83.7%) had their foetuses in vertex position during ANC visits. This result showed statistically significant difference between the two groups ($p < 0.001$). Presentation refers to the part of the foetus that lies at the pelvic brim or in the lower pole of the uterus. Presentations can be vertex, breech, shoulder, face or brow (Marshall & Raynor, 2014:170).

The data on FHR and foetal presentation during earlier ANC visits were not specific enough to make accurate predictions of pregnancy outcomes. For instance, change in foetal presentation is unlikely to occur after 36 weeks of gestation (Ferreira, Borowski, Czuba, Cnota, Wloch, Sadowski, Wielgos & Wegrzyn, 2015:660). Therefore, variables like FHR and foetal presentation in the uterus become critical in the last trimester, as the pregnancy approaches to term. Accordingly, these variables are discussed further in the section focusing on labour admission to see if the results were consistent at term.

The presence of multiple pregnancy during the current pregnancy was another variable reviewed in this study. Proportionally, more women in the stillbirth group (6.5%) than in the livebirth (3.7%) had multiple babies during their index pregnancies. In other words, over 92% of women in both stillbirth and livebirth categories had singleton that showed strong protective association against stillbirth ($p < 0.05$). This result was comparable with a similar study from Ghana where 8.7% of pregnancy that ended in stillbirth were multiple (Afulani, 2016:132). A study from Taiwan also showed that multiple gestations have markedly increased the risk of adverse fatal outcomes (Hu, Chen, Jeng, Hsieh, Liao, Su, Lin & Hsieh, 2012:105,). Another study using a systematic review method indicated that twin pregnancies are high risk, with up to thirteen-fold increase in the rates of stillbirth (Cheong-See, Schuit, Arroyo-Manzano, et al. 2016:1).

5.3.1.7 Antenatal care (ANC) attendance during the index pregnancy

WHO defines ANC as the care provided by skilled health-care professionals to pregnant women to ensure the best health conditions for both the mother and baby during pregnancy. The components of ANC include: risk identification and screening; prevention

and management of pregnancy-related or concurrent diseases; and health education and health promotion on nutrition; childbirth plan; infection prevention; prevention of tobacco use; and pregnancy related complications. Empirical evidence confirms that uptake of a standard ANC services would reduce incidences of adverse pregnancy outcomes including intrapartum stillbirth. Furthermore, implementing timely, appropriate and evidence-based ANC service provides the opportunity to communicate with and support women, families and communities at a critical time in the course of a woman's life where effective communication about physiological, biomedical, behavioural and sociocultural issues could save lives (WHO, 2016b:1).

In 2002, WHO recommended four ANC visit per pregnancy with preferred timing occurring between 8 and 12 weeks, 24 and 26 weeks, at 32 weeks, and between 36 and 38 weeks of gestation. However, a more recent guidance stressed that pregnant women should make at least eight contacts with skilled health care professionals to assess and manage pregnancy conditions. Each contact has a specific goal and entails different recommended interventions including screening and provision of health education (WHO, 2016c:1).

ANC plays a key role in reducing stillbirth outcome through increased detection and management of risk factors including hypertensive disease, foetal growth restriction and gestational diabetes as well as referring women to appropriate and skilled care for delivery when Caesarean sections or inductions when appropriate. In addition, ANC creates a great opportunity for health care providers to advise mothers on the prevention of malaria during pregnancy, prescribe folic acid supplements, test and treat syphilis, and encourage the use of balanced protein energy supplements, which are all said to improve pregnancy outcomes. Moreover, screening for congenital abnormalities as a part of ANC may help to reduce rates of stillbirth (Beauclair et al., 2014:2). Many studies emphasised on the role of nutritional status of the mother during pregnancy in reducing adverse pregnancy outcomes hence its relevance as an integral part of the ANC interventions (Mantovani, Filippini, Bortolus & Franchi, 2014:481).

Promotion of ANC services in the health facilities has been one of the key priorities in the Ethiopian health care delivery system. Uptake of the service has increased steadily over the last decade. Successive DHS reports indicated that the quality and quantity of ANC has increased between 2011 and 2016. For instance, in 2011, only 19% of pregnant

women made four or more ANC visits during their most recent pregnancies against 32% reported in 2016. Unban women were more likely to receive four or more ANC services during a pregnancy where the uptake increased from 45.5% in 2011 to 63% in 2016 (Central Statistical Agency, 2011:115; 2016:22).

Being the capital city, Addis Ababa exhibited steady increase in the rate of ANC uptake between 2010 and 2015. Although there was inconsistency in data reviewed from different sources including the DHS, annual national health indicators report and the regional health bureau database, both ANC utilisation and skilled delivery increased in the city across the years in review. However, most of these data sources indicated that the rate of stillbirth did not show any noticeable reduction. To this effect, the trend seems in sharp contradiction with the widely held belief that improved access to ANC and skilled birth attendance would bear positive impact on adverse pregnancy outcomes. Although DHS data presented population-based stillbirth, which might be undifferentiated, the health systems data indicate mostly intrapartum stillbirth, which heralds troubling trends about the quality of care and preventable loss of human life. The following graph is an extract from the annual health indicator reports, which showed performance of ANC and skilled delivery against stillbirth in Addis Ababa between 2010 and 2015.

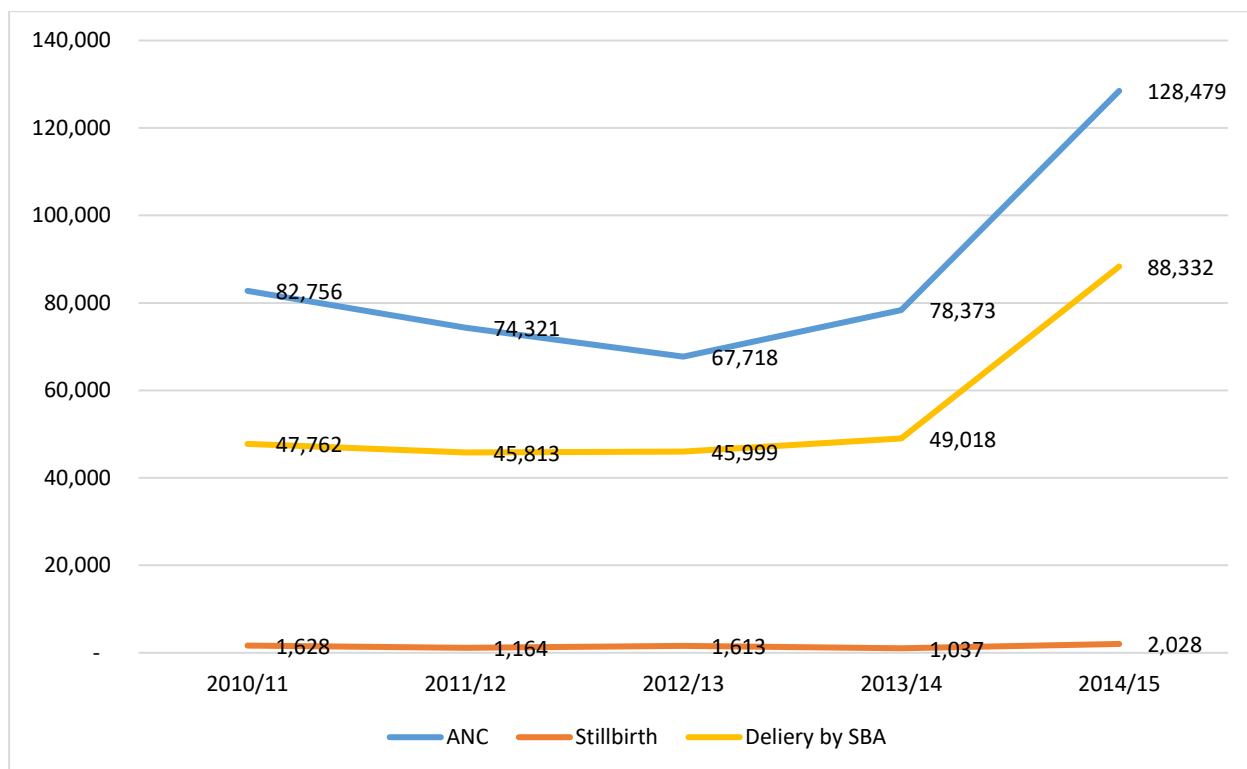


Figure 5.8 Prevalence of stillbirth against ANC and institutional delivery uptakes
(Annual Reports on Health and Health Related Indicators, (FMOH, 2010–2015))

The ANC service related finding from this research was consistent with other studies that identified statistically significant association between ANC and stillbirth outcome. Different studies focused on different aspects of ANC including the number of visits during a given pregnancy, type of services provided, place where the service provided, type of health professionals who delivered the service, and gestational age at which the first ANC visit was conducted.

Nevertheless, the relevance of ANC to successful pregnancy outcomes was well established in many of these studies. For instance, McClure et al. (2015:7) conceded that women without pre-natal care, who had not received syphilis test and who had not received tetanus toxoid were at increased risk of stillbirth relative to those women who had received these services during their pregnancy (McClure et al., 2015:7). Another study in Kenya also confirmed that the number of ANC visits during pregnancy was significantly associated with having a stillbirth (Cheptum et al., 2016:24).

Because of the way the facility data was structured, the current study focused on the frequency of ANC visit by both cases and controls. One of the remarkable findings of this study related to the relationship between the number of antenatal visits and stillbirth. Proportionally, almost two-thirds (65.3%) of women who experienced stillbirth had only one antenatal visit compared to women in the livebirth group (32%). Conversely, more than 45% of women in the livebirth category made four or more antenatal visits during the current pregnancy, which is more than twice the proportion reported for women in the stillbirth group.

Table 5.4 Maternal medical history during the index pregnancy

Characteristics	Categories	Stillbirth N (%)	Livebirth N (%)	P-value
Hypertension	Yes	46 (6.3)	94 (6.1)	0.880
	No	682 (93.7)	1448 (93.9)	
	Missing	0	9	
Diabetes	Yes	2 (0.3)	9 (0.6)	0.519
	No	726 (99.7)	1542 (99.4)	
Cardiac disease	Yes	0 (0.0)	3 (0.2)	0.556
	No	728 (100.0)	1548 (99.8)	
Renal diseases	Yes	3 (0.4)	3 (0.2)	0.397
	No	725 (99.6)	1548 (99.8)	
Sero-status for HIV infection	HIV positive	48 (6.5)	79 (5.1)	0.009
	HIV negative	657 (90.1)	1440 (93.2)	
	Don't know	29 (3.4)	31 (1.6)	
Sero-status for Syphilis	Positive	5 (0.7)	12 (0.8)	0.000
	Negative	600 (82.3)	1406 (90.9)	
	Don't know	123 (17.0)	133 (8.4)	
Blood group and Rh	Positive	643 (87.7)	1415 (91.9)	0.000
	Negative	32 (4.4)	80 (5.2)	
	Don't know	63 (7.9)	56 (2.9)	
Foetal heart rate (FHR)	Normal	721 (97.8)	1525 (98.8)	0.087
	Abnormal	0 (0.0)	0	
	Don't know	25 (2.2)	26 (1.2)	
Foetal presentation	Vertex	617 (83.7)	1420 (92.0)	0.000
	Breech	76 (10.3)	56 (3.6)	
	Shoulder	3 (0.4)	2 (0.1)	
	Don't know	69 (5.6)	73 (4.3)	
Multiple pregnancy	Yes	47 (6.5)	57 (3.7)	0.010
	No	672 (92.7)	1459 (95.7)	
	Don't know	9 (0.8)	35 (0.5)	
Number of ANC visits	Once	478 (65.3)	490 (32.0)	0.000
	Twice	60 (8.2)	180 (11.8)	
	Three times	52 (7.1)	163 (10.7)	
	Four times and more	142 (19.4)	696 (45.5)	
	Missing	474 (65)	512 (33)	

5.3.1.8 Observations during admission of women for intrapartum care

A human pregnancy lasts approximately 40 weeks with the anticipation of a normal labour occurring between 37–40 weeks of gestations. Normal labour is considered of relatively low risk and usually starts spontaneously with vertex presentation of the foetus and

culminates in the ejection of a live baby whereas the woman stays in healthy condition (Marshall & Raynor, 2014:170). The onset of labour is determined by complex physiological interactions and its diagnosis requires important clinical and midwifery competence. The ability to assess and gauge clinical parameters including the effacement and dilatation of cervix, strength of uterine contraction, descent of the head of the foetus, rupture of the uterus, and status of amniotic fluid and moulding of the foetal head are among the essential competencies required during admission to labour.

Furthermore, the transition from pregnancy to labour entails numerous physiological and physical changes including softening of the cervix, lightening resulting from lowering of the fundus and engagement of foetal head. Once physiological labour commences, its progress is measured by descent of the head and dilatation of the cervix. Although not definitive, the rate of cervical dilatation in a normal labour can be predicted along with expected time limits. Accordingly, the cervix dilates from 0 to 3-4 cm over the period of 6-8 hours in the latent phase followed by a more rapid dilatation in the active phase of the first stage which usually warrants admission for labour in the health facilities (Fraser & Cooper, 2009:102).

By far the greatest part of labour is taken up by the first stage and it is common to expect the active phase to be completed within 6–12 hours where the cervix is fully dilated stretching to 10cm. Previous empirical findings that indicate the cervix should dilate at a rate of 1 cm per hour has been challenged by more recent findings where 0.5 cm per hour still falls within the normal range of cervical dilatation (Marshall & Raynor, 2014:170). Another study reported that cervical dilation during 'active' labour should not be conceptualised as a linear process, a belief that likely contributes to the high frequency of dystocia diagnoses and subsequent interventions. According to this report, the 'active phase' of labour lasted an average of six hours while the average rate of cervical dilation during this period was 1.2 cm/hr (Neal, Lowe, Ahijevych, Patrick, Cabbage & Corwin, 2010:308). Another study indicated the rate of labour progression as measured by the slope of the dilation-vs-time partograph curve as approximately 1.5 cm/hr, making the argument more inconclusive (Incerti, Locatelli, Ghidini, Ciriello, Consonni & Pezzullo, 2011:30).

Furthermore, consensus seems lacking regarding the duration of first stage and indications related to the transition from latent phase to active phase of labour. Many

clinicians view 3 or 4 cm cervical dilation as the beginning of active phase of labour including the WHO's partograph which is based on the principle that active phase of labour commences at 4 cm of cervical dilatation and that during active labour the rate of cervical dilatation should not be slower than 1 cm per hour. However, the American College of Obstetricians and Gynaecologists (ACOG) postulates that labour progresses at a rate substantially slower than historically believed and that a cervical dilatation of 6 cm should be considered as a threshold for the active phase of most women in labour (Hanley, Munro, Greyson, Gross, Hundley, Spiby & Janssen, 2016:1).

Correct diagnosis of labour during admission to health facility for childbirth is critical to avoid any adverse outcomes or complications during delivery and immediate postnatal period. Several indicators including contraction of the uterus, cervical dilatation, status of membrane, and cervical effacement have been considered in the definition of the onset of labour (Hanley et al., 2016:1).

Skilled birth attendants are expected to make comprehensive assessment of pregnant women on arrival for labour to decide on the required intensity of follow-up and obstetric interventions. Making accurate diagnosis of the maternal and foetal conditions on admission for labour based on the above indicators depends on the competence of the obstetric care providers, maternal characteristics and availability of necessary supplies and equipment at the health facilities.

On the contrary, misdiagnosis of these conditions could result in unfavourable outcomes and unnecessary obstetric interventions. For instance, early admission to labour was associated with a significantly higher risk of delivery by Caesarean section during the first and second stages (Mikolajczyk, Zhang, Grewal, Chan, Petersen & Gross, 2016:1). Furthermore, evidence shows that the proportion of pregnant women who received key interventions including augmentation with oxytocin, artificial rupture of membranes and Caesarean section were significantly higher in the latent phase group than in the active phase group which shows misdiagnosis of labour progress can result in untimely interventions. Spontaneous vertex delivery was significantly higher in the active phase group than the latent phase group (Clotrida, Albert, Dismas & Marietha, 2014:1).

This current study collected data on four indicators, namely, status of membrane, FHR, cervical dilatation and foetal presentation on admission to examine their association with

intrapartum stillbirth in the targeted public health facilities in Addis Ababa. Accordingly, 610 (83.8%) cases of stillbirth and 1,347 (86.8%) livebirth women were assessed for the status of membrane on admission. Out of these, 46.8% of stillbirth and 59.9% of livebirth women had intact membranes on admission for labour.

On the contrary, proportionally more women in the stillbirth group (39.4%) than in the livebirth group (30.2%) experienced ruptured membrane on admission where the difference was statistically significant ($p = 0.000$). This finding was higher compared to a study from India where only 11.3% of women had Premature Rapture of Membrane (PROM) on admission to labour (Rahman, Renjhen, Dutta & Kar, 2012:522). Furthermore, a relatively larger proportion of records in the stillbirth category (13.8%) than in the livebirth (9.8%) was missing which indicates the quality of labour diagnosis was poorer in the former group.

It should be noted that premature rupture of membranes (PROM) at term (> 37 weeks) negatively affects between 8 and 10% of all pregnancies and misdiagnosing it at admission for labour could entail adverse outcomes including stillbirth, pregnancy-related complications and maternal and foetal infections (Marshall & Raynor, 2014:170). Empirical evidence shows that PROM combined with subclinical chorioamnionitis was indicated to be associated with foetal distress and stillbirth (Zhang, Wang, Wang, Hei & Ruan, 2015:561). The results from this current study showed that PROM is a risk factor to intrapartum stillbirth, which needs to be effectively diagnosed and managed during the intrapartum period.

The presence or absence of Foetal Heart Rate (FHR) on admission to labour is among the most critical indicators to determine whether the foetus was alive or dead. It is against this background that this study used it as one of the inclusion criteria for the review of medical records of the study subjects. In fact, the presence of FHR identifies foetuses that are viable on admission and that with appropriate care should be discharged alive as a neonate. Goldenberg et al. (2013:230) report on the use of FHR on admission for labour using reliable equipment. These include doptone and keeping accurate records of the results might form the basis of a low-cost and sustainable programme to monitor and evaluate efforts to improve quality of care and ultimately might help to reduce the facility based component of perinatal mortality in low-income countries (ibid).

Although over 84% of women in both stillbirth and livebirth groups had relatively normal FHR (110-160) on admission, a significantly higher proportion of women in the stillbirth group experienced FRH lower than 110/min. The result suggests of foetal distress on admission. Accordingly, 13% of women in the stillbirth group had foetal heart rate lower than 110/min on admission against only 0.8% of women in the livebirth group. The difference related to abnormally lower FHR on admission between the intrapartum stillbirth and normal birth categories was statistically significant ($p = 0.000$). Evidence shows that lower FHR on admission results in sustained foetal distress during labour which increases the risk of intrapartum stillbirth (Sandhu, Raju, Bhattacharyya & Shaktivardhan, 2008:43).

Measuring cervical dilatation is another routine intervention that helps determine admission decisions for intrapartum care. Data from the study population showed that over 97% of women in both intrapartum stillbirth and livebirth categories were examined for their cervical dilatation status on admission for the childbirth in review. This practice could be referred to as better compared to results from a study in Zanzibar where 61% of women experienced stillbirth were not assessed for dilatation upon admission to labour (Maaloe et al., 2016:1). Most women in both stillbirth and livebirth groups (over 61%) had cervical dilatation 4cm and above whereas 34.4% women in the stillbirth group and 38.7% in the livebirth group had cervical dilatation of 3cm and below on admissions to labour. The results on less than 3cm dilatation was comparable with a study based on the Danish dystocia research data which reported that 38.6% women had cervical dilatation less than 3cm on admission (Kjaergaard, Olsen, Ottesen, Nyberg & Dykes, 2008:1). Although Clotrida, et al. (2014:1) reported concerns related to admission at a latent stage of labour, delays in seeking admission for labour could result in labour abnormalities potentially leading to adverse outcomes (Clotrida et al., 2014:1; Wayu & Yifru, 2014:1).

Presentation refers to that part of the foetus entering the pelvic inlet first. The main presentations include shoulder, breech and cephalic (Kennedy & McMurtry, 2017:822). Cephalic presentation is the most physiologic and frequent foetal presentation and is associated with the highest rate of successful vaginal delivery as well as with the lowest frequency of complications. The foetal presentation might change during a pregnancy and needs to be monitored as part of antenatal follow-up particularly during late pregnancy to make appropriate decision about delivery options. For instance, from 22 to 36 weeks of gestation, the prevalence of cephalic presentation might increase from 47%

to 94%, after which chance of changes in foetal presentation becomes minimal. To this effect, spontaneous change from breech to cephalic is unlikely to occur after 36 weeks of gestation (Ferreira, Borowski, Czuba, Cnota, Wloch, Sadowski, Wielgos & Wegrzyn, 2015:660).

Foetal presentation is generally assessed by palpating the abdomen as part of a clinical examination, although its accuracy might vary depending on the provider and maternal factors. A study from Australia confirmed that the sensitivity of clinical examination in detecting non-cephalic presentation was only 70%. Many health facilities in developed countries address this limitation by using digital technologies including ultrasonography. Evidence shows that diagnosis of non-cephalic presentation after the onset of labour is associated with increased adverse pregnancy outcomes. However, correct detection of foetal presentation upon admission to labour could still reduce the risk of intrapartum stillbirth as immediate decisions to conduct Caesarean section or to make emergency obstetric referral could be undertaken to save lives (Natasha, Christine, Carolyn & Emily, 2006:578).

Results of clinical assessment on foetal presentation on admission for labour also indicated that proportionally more women in the livebirth group (81.2%) than in the intrapartum stillbirth group (71%) had normal (vertex) presentation. The finding of vertex presentation on admission was consistent with a study from India where (79.3%) had similar presentation at labour (Joy, Nair & Radhamany, 2014:3). However, the proportion was lower compared to a study from Australia where 95% of vertex presentations were correctly diagnosed at late pregnancy (Natasha et al., 2006:578). On the contrary, proportionally more women in the intrapartum stillbirth group (14.5%) than in the livebirth group (4.5%) had breech foetal presentation on admission to labour. Therefore, these differences are statistically significant.

The finding further revealed that data on foetal presentation during admission to labour was missing for approximately 13% of women in both intrapartum stillbirth and livebirth groups, which flags concern in relation to the quality of maternity care in the public health facilities of Addis Ababa. Findings were not specific enough as whether the missing data were owing to misdiagnosis or gaps in record keeping. However, the rates are very high compared to findings from a study in India which reported deficiency in the assessment

of foetal presentation and fundal height at 1.1% level (Sharma, Powell-Jackson, Haldar, Bradley & Filippi, 2017:419).

Table 5.5 Admission for intrapartum care

Characteristics on admission	Categories	Stillbirth N (%)	Live birth N (%)	P-value
Status of membrane	Intact	331 (46.8)	895 (59.9)	0.000
	Ruptured	279 (39.4)	452 (30.2)	
	Don't Know	118 (13.8)	204 (9.8)	
Foetal Heart Rate	<110	97 (13.2)	13 (0.8)	0.000
	110-160	632 (84.8)	1524 (98.2)	
	>160	15 (2.0)	14 (0.9)	
Cervical dilatation	Three and Below	250 (34.4)	599 (38.7)	0.048
	Four and Above	478 (65.6)	952 (61.3)	
Foetal presentation	Vertex	523 (71.9)	1245 (81.2)	0.000
	Breech	106 (14.5)	69 (4.5)	
	Shoulder	3 (0.4)	1 (0.1)	
	Don't know	96 (13.2)	236 (14.2)	

5.3.1.9 Description of intrapartum care interventions for births in review of this study

Evidence shows that approximately 1.3 million intrapartum stillbirths occur in the world annually. This magnitude accounts for half of all stillbirths occurring globally. However, the proportion attributable to intrapartum causes is thought to be higher in low-resource settings such as sub-Saharan Africa (Kozuki, Oseni, Mtimuni, Sethi, Rashidi, Kachale, Rawlins & Gupta, 2017:e0172492). A study from India revealed that intrapartum period associated cause stillbirth was as high as 48.3% among the study group (Kaistha, Kumar & Bhardwaj, 2016:73).

Intervention strategies to prevent antepartum and intra-partum stillbirths differ because they have largely different causes. Where women receive quality intrapartum care, as in many high-income countries, the proportion of intra-partum stillbirths is less than 10% of all stillbirths, indicating that a substantial proportion of intrapartum stillbirths are preventable with quality intrapartum care (Darmstadt, Yakoob, Haws, Menezes, Soomro & Bhutta, 2009:6).

Intrapartum stillbirths occurring in the health facilities imply that a foetus was alive on admission to labour however perished during childbirth. Given the advancement in medicine, obstetrics and medical technology in many settings, the death of unborn child in a health facility should be treated as a health scandal of international proportion. Proper investment both on the demand and supply side of obstetric care services are critical to redress this most neglected tragedy in global health today (Horton & Samarasekera, 2016:515). To that effect, high quality intrapartum interventions focusing on effective management of maternal and foetal risk factors that cause stillbirth are critical to achieve lower rates intrapartum stillbirth as found in high-income countries (Goldenberg, Griffin, Kamath-Rayne, Harrison, Rouse, Moran, Hepler, Jobe & McClure, 2016:1239).

The physiology of labour consists of regular, progressively intense uterine contractions that over time produce cervical effacement and dilation. This leads to the development of expulsive forces adequate to move the foetus through the birth canal against the resistance of soft tissue, muscle, and the bony structure of the pelvis (Kennedy & McMurtry, 2017:822).

The progress of labour is conventionally categorised into three stages. The first stage of labour is composed of two phases, namely, latent and active. The latent phase of labour occurs prior to the active phase and may last 6–8 hours depending on parity of a woman. The cervix dilates up to 4 cm with shortening its canal from 3 cm to less than 0.5 cm during the latent phase. These physiological phenomena lead to the active phase which is marked by rapid and progressive dilatation of the cervix up to 10 cm, presence of rhythmic contraction of the uterus, presence of a bloodstained mucoid called show and rupture of the membrane that encapsulated the foetus and amniotic fluid (Marshall & Raynor, 2014:170).

Once the onset of labour is correctly diagnosed, active monitoring and follow-up by skilled birth attendants becomes critical to determine the progress of labour and to prompt any emergency obstetrical care actions. WHO encourages the use of partograph in all health facilities to monitor the progress of labour. The latter is a chart on which the salient features of labour are entered in a graphic form and therefore provides the opportunity for early identification of deviations from normal (please see a sample below). This chart is designed to allow for recordings at 15 minutes intervals and includes foetal heart rate;

maternal temperature; pulse; blood pressure; details of vaginal examinations; strength of contractions; frequency of contractions in terms of the number in 10 min; fluid balance; urine analysis and drugs administered (Fraser & Cooper, 2009:102).

Accordingly, in a normal labour, plotting the partograph with a 4-hour action line should commence at 4 cm cervical dilatation level and each indicator is assessed subsequently at the following standard timeline until end of the active phase and expulsion of the foetus through the birth canal. The following table presents some of the key indicators along with recommended timing that are commonly used by skilled birth attendants to monitor the progress of labour particularly during the active phase (Northampton General Hospital, 2011:11).

Table 5.6 Recommended obstetric care interventions and their timing during intrapartum period

Timing	Care provided	Remarks
Every 15 Min & 1 minute after contractions	Foetal Heart Rate (FHR)	
Half-Hourly	<ul style="list-style-type: none"> • Uterine contraction (strengthen and frequency) • Membranes intact/ruptured • Colour of liquor 	
Hourly	<ul style="list-style-type: none"> • Maternal pulse 	
4 Hourly	<ul style="list-style-type: none"> • Maternal blood pressure (BP) • Maternal temperature • Vaginal examination (VE) to check the following progresses: <ul style="list-style-type: none"> ○ The cervix moves from posterior to anterior position ○ The cervix softens and ripens ○ The cervix effaces ○ The cervix dilates ○ The head rotates, flexes and moulds ○ The foetus descends 	Vaginal examinations should only be carried out when clinically necessary. Where possible, they should be conducted by the same midwife

Adapted from (Northampton General Hospital, 2011:11)

WHO Modified Partograph

Registration No. _____ Name (Last, First) _____ Age _____
 Date _____ Parity/Gravida ____/____ LMP _____ EDD _____ Gestation (wks) _____
 ROM (Time, Date) ____/____/____ Labour Duration (Hrs) _____ Facility/Clinic Name _____

FETAL HEAT RATE	190 180 170 160 150 140 130 120 110 100 90 80 70 60		190 180 170 160 150 140 130 120 110 100 90 80 70 60
	Liquor Moulding		
T Cervix (CM)	10 9 8 7 6 5 4 3 2 1 0	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">Alert</div> <div style="text-align: center;">Action</div> </div>	10 9 8 7 6 5 4 3 2 1 0
Plot X T Descent	10 9 8 7 6 5 4 3 2 1 0		10 9 8 7 6 5 4 3 2 1 0
	Hours		Hours
	Time		
Contractions per 10 mins	5 4 3 2 1		5 4 3 2 1
Oxytocin U/L Drops/Minute			
Drugs & IV Fluids			
Blood Pressure & Pulse	200 190 180 170 160 150 140 130 120 110 100 90 80 70 60		200 190 180 170 160 150 140 130 120 110 100 90 80 70 60
Temperature			
Urine	<div style="display: flex; align-items: center;"> { <div style="margin-left: 5px;"> Amount Protein Acetone </div> </div>		

Figure 5.9 The modified WHO partograph

(<http://www.hoajonline.com/womenshealth/2054-9865/2/2/figure/f1>)

This current study reviewed various intrapartum care interventions provided to women in both intrapartum stillbirth and livebirth groups in the public health facilities of Addis Ababa. These interventions were recorded either on partographs or on labour follow-up charts in

the respective facilities. Data on key variables including foetal heartbeat, maternal vital signs, uterine contraction, vaginal examination, and assisted delivery were collected from the intrapartum care records using structured questionnaire. It was further noted that most women both in the intrapartum stillbirth and livebirth groups received clinical interventions during the childbirths in review. However, the types and timing of these interventions varied across the groups and facilities. Furthermore, records were inconsistent particularly in relation to the timing of many intrapartum care interventions in the public health facilities included in this study.

5.3.1.10 Foetal heart rate monitoring

To reduce the incidence of intrapartum related stillbirths, it is necessary to assess foetal well-being in labour with routine monitoring of the foetal heart rate (FHR). More importantly, different technologies including Pinard Foetal Stethoscope (Pinard) and handheld Doppler ultrasound FHR monitor (Doppler) could be employed to conduct intermittent auscultation as a primary screening tool to monitor foetal well-being during labour. The use of Pinard is widely adopted as the standard of care in resource-poor settings since it is low cost and does not require a power source or repairs. However, inconvenience related to locating the foetal heart on the women's abdomen and midwives' bending over pubic area for auscultation might discourage the regular FHR monitoring using Pinards. Furthermore, accuracy of measuring FRH was weaker against Doppler as studies showed the use of the latter would reduce intrapartum stillbirth by 30% compared with the Pinard (Byaruhanga, Bassani, Jagau, Muwanguzi, Montgomery & Lawn, 2015:e006867).

Inadequate foetal heart rate monitoring (FHRM) and partogram use during labour are preventable risk factors associated with intrapartum stillbirth (Ashish et al. Incidence of intrapartum stillbirth and associated risk factors in tertiary care setting of nepal: A case-control study 2016:2). A study from Nepal showed that there was an increased risk of intrapartum stillbirth with decreasing frequency of FHRM where fourfold increase was observed when FHRM took place with the interval of more than 30 minutes and a likelihood of intrapartum stillbirth increasing seven times if the FHRM was performed hourly or more interval (Ashish, Johan, Robert, Clark & Mats, 2016:2). In general, evidence has been strong on the fact that delayed FHRM or undetected FHR during

intrapartum period predicted higher stillbirth outcome (Langli, Mduma, Svensen, Sundby & Perlman, 2012:23; Maaloe et al., 2016:1).

The main purpose of FHRM during labour is to identify the foetus in need of responsive management such as prompt delivery. FHR abnormality is defined as tachycardia, bradycardia, or atypical variable, late or prolonged decelerations. Tachycardia and bradycardia are defined as baselines of more than 160 and less than 110 beat/min respectively (Byaruhanga et al., 2015:67). Many studies further indicate that abnormal FHR was associated with foetal death during intrapartum period (Langli et al., 2012:235).

This current study collected data on FHRM from the maternity care records either on the partograph of labour follow-up sheets in the public health facilities of Addis Ababa. The results showed that over 99% of women in both stillbirth and livebirth groups were assessed for FHR during their recent childbirth without any statistically significant differences between the two groups. This observation was higher compared to similar studies from Zanzibar and Nepal where the rate of FHRM among women who experienced intrapartum stillbirth were 50% and 25% respectively (Ashish et al., 2016:2; Maaloe et al., 2016:1).

Similarly, overwhelming majority of women both in the intrapartum stillbirth and livebirth groups were not given the FHRM care consistent with the internationally recognised intervals during the labours in review of this study. Accordingly, over 99% of women both in the intrapartum stillbirth and livebirth categories were not monitored for FHR timely with no significant difference between the two groups. However, this finding was not consistent with a result from the Tanzania study where proportionally more women (83%) in the intrapartum stillbirth category did not receive timely FHRM compared to women in the livebirth category (67%) (ibid). This current study used only dichotomous categorisation with “yes” and “no” responses to assess whether standard FHRM intervals consistently applied during labour management which did not show the variability and extent of deviations from recommended interval across cases and controls warranting further follow up study to see clearer patterns and the impact of inconsistent FHRM on Intrapartum stillbirth outcome.

5.3.1.11 Monitoring the contraction of uterus during labour

Four characteristics of uterine contraction including frequency, regularity, duration, and intensity should be closely monitored during the active phase of labour to ensure a successful intrapartum outcome. Frequency denotes as how often the contractions are occurring, which usually begins at 10 to 15 minutes apart, but get closer together as labour progresses. On the contrary, regularity shows the establishment of a rhythmic pattern of uterine contraction whereas duration refers to the length each contraction which often evolves from 30 seconds to 90 second per session of contraction as labour progresses. Furthermore, intensity signifies the strength of each contraction, which can be determined as mild, moderate or strong depending on the power noted on the uterine muscles. Uterine contraction can be measured all along active labour either subjectively by asking the mother, using palpation techniques with the palmar surface of fingertips, or electronic foetal monitoring devices (Kennedy & McMurtry, 2017:822). Palpation is the most common method of assessment in resource-limited settings like Ethiopia. Empirical evidence shows that 12 or more contractions per hour are predictors of good progress of labour and when a regular and intense contraction reaches twenty-three, cervical dilatation would have reached to the maximum level meaning delivery should be imminent (Samira, Nahid, Seyyed, Nayyereh & Behjat, 2015:98).

This current study collected data on intrapartum care related to monitoring uterine contraction to assess if the service was provided consistent with the recognised standard. Proportionally, more women in the livebirth category (94.6%) than in the stillbirth category (87.8%) were offered any care related to monitoring uterine contraction during their labour in review of this study. The difference between the two groups was statistically significant ($p < 0.01$). This means that monitoring uterine contraction during active phase of labour had protective value against intrapartum stillbirth.

Observing the standard timing of contraction monitoring was equally important predictor of intrapartum stillbirth in the public health facilities of Addis Ababa. Proportionally, higher women in the intrapartum stillbirth category (87.5%) than in the livebirth group (79%) did not receive monitoring of uterine contraction within the recommended time intervals. Conversely, only 12.5% women in the stillbirth category against 20.9% women in the livebirth category received timely monitoring of uterine contraction, the difference being statistically significant ($p < 0.01$). This finding is consistent with a study from Zanzibar where proportionally lower women in the intrapartum stillbirth group than controls had their uterine contractions monitored within the recommended time interval (Maaloe et al.

2016:1). Furthermore, higher proportion of women in the stillbirth group (12.2%) than in the livebirth group (6.4%) had missing records regarding uterine contraction monitoring during the intrapartum period. A more rigorous and prospective type of study to measure the characteristics of the uterine contractions including the frequency, fall to rise ratio and duration would add value in determining the effect of uterine contraction on intrapartum stillbirth.

5.3.1.12 Monitoring maternal vital signs during labour

More importantly, the consistent measurement of maternal vital signs throughout the active phase of labour and childbirth is part of standard labour management practices particularly in health facility settings. Specifically, maternal blood pressure (BP), temperature and pulse are among the critical vital signs that need to be measured at least four hourly during labour. The results are compared to a woman’s baseline or historical vital signs and should be interpreted within the context of the woman’s history, her current status, and activities occurring during the labour and birth (Kennedy & McMurtry 2017:822). The following table indicates the normal ranges of key vital signs discussed in this study.

Table 5.7 Normal ranges and indications of deviations on key vital signs

Vital sign	Normal range	Potential reasons
Blood Pressure	Systolic: 90–140 mm Hg Diastolic: 60–90 mm Hg	Increase might be related to fear, anxiety, hypertension, or hypertensive disorder of pregnancy Decrease might be related to hypotension, infection
Pulse Rate	60-100 Beats/min	Increased rate might be associated with hypotension, pain, anxiety, hypervolemia, medications
Temperature	Less than 38 °C	Increased °C might be due to infection or medications

(Kennedy & McMurtry, 2017:822)

The current study collected data on three key maternal vital signs including blood pressure, temperature and pulse. These data were obtained from intrapartum care medical records of women who gave birth in the public health facilities targeted by this

study. Accordingly, the intrapartum care records revealed that proportionally more women in the livebirth category (92.7%) against women who experienced intrapartum stillbirth (89.7%) received care related to monitoring blood pressure during labour, the difference being statistically significant ($p=0.02$). Nevertheless, the timing of blood pressure monitoring was not consistent with standard for 64.4% of women in stillbirth category compared to 62.5% in the livebirth group. Failure to monitor maternal blood pressure was reported by a study from Zanzibar where approximately 70% of women in the stillbirth group had only one or more recorded of BP monitoring during the course of intrapartum period (Maaloe et al., 2016:1). Increased blood pressure during labour could predict the occurrence of complications including pre-eclampsia and eclampsia, which might lead to fatal pregnancy outcomes including stillbirth. Therefore, consistent monitoring of maternal BP during intrapartum period as per the recommended clinical standard would save lives (Fraser & Cooper, 2009:458).

Infection during intrapartum period could inhibit effective uterine activity thereby contributing to the diagnosis of dysfunctional labour. Various factors including infection, epidural anaesthesia, hormone changes, muscle exertion, and some medications can cause an increase temperature during intrapartum period (Kennedy & McMurtry, 2017:822). Increased temperature during labour could cause obstetric complications of adverse outcomes. A study in the USA indicated that the modest temperature elevation during labour is a risk factor for Caesarean and assisted vaginal delivery (Lieberman, Cohen, Lang, Frigoletto & Goetzl, 1999:506).

According to the data collected from public health facilities of Addis Ababa for this study, maternal temperature was monitored for approximately less than 7% of women in both stillbirth and livebirth categories where the difference between the two groups was not statistically significant. Of the women who were monitored for their temperature status, approximately less than 42% in both groups had received the care as per the recommended timing. It is noteworthy that clinical records regarding the timing of temperature monitoring were missing for most of the cases, which might imply the underestimated significance of care related to vital sign monitoring during labour.

Maternal pulse rate is another important vital sign that needs to be monitored during intrapartum period. Increased maternal pulse during labour could predict alterations of the foetal heart rate including the presence of variable decelerations or signs of foetal-

maternal distress thereby warranting immediate obstetrical actions to save lives (Fraser & Cooper, 2009:458).

Data from the public health facilities of Addis Ababa show that maternal pulse monitoring care was provided to 61.2% of women in the stillbirth and 64% in the livebirth groups during the index intrapartum period. Approximately over 86.8% of women in either group were not monitored as per the recommended frequency during intrapartum care. However, none of the differences related to pulse monitoring were statistically significant.

5.3.1.13 Assessing and assisting labour progress

Vaginal examination (VE) is one of the core procedures during childbirth to obtain necessary information about cervical dilatation, effacement, foetal head position, and status of membranes that would lead to making correct clinical decisions. These important markers are usually plotted into a partogram providing critical information about progress of labour and constitute the basis for key decisions to be taken to manage labour such as accelerating labour or deciding on Caesarean section if progress is not optimum (Hassan, Sundby, Hussein & Bjertness, 2012:1). Accordingly, VE can be performed digitally, or by using instruments such as a speculum. In midwifery care, a woman in labour is often subjected to at least one VE, and often these are repeated every four hours on obstetric orders or per the practice standards of the health facility. As the average labour lasts between 8 and 12 hours, most women can expect to have at least two or three VEs during their labour (Muliira, Seshan & Ramasubramaniam, 2013:442).

This study collected clinical data from intrapartum records of both cases and controls to assess if VE were provided routinely as per the recommended frequency for women giving birth in the public health facilities in Addis Ababa. Accordingly, more than 99.5% of women in both groups received VE in the respective health facilities during the index childbirth. However, more women in the livebirth group (49.5%) than in the stillbirth group (44.2%) proportionally received VE as per the recommended intervals during the index labour. This difference was statistically significant ($p=0.01$). This finding resonates with a study from Tanzania where VE was conducted less frequently among stillbirth group (19%) than women in the livebirth group (39%) (Maaloe et al., 2016:1). More importantly, a higher proportion of women in the stillbirth group (39.7%) had missing data on the interval of VE compared to women in the livebirth category (2.5%). Therefore, these

results might be suggestive of differentials in labour management where women in the intrapartum stillbirth group received relatively inferior quality intrapartum care and less accurate diagnosis of maternal and foetal conditions compared to women in the livebirth category.

Induction of labour is among the most common obstetric interventions during intrapartum period. The goal of induction of labour is to achieve a vaginal delivery when the benefits of expeditious delivery outweigh the potential risk of continuing pregnancy (Laughon, Zhang, Troendle, Sun & Reddy, 2011:805). Induction can be conducted to pregnant women who are at term or during post-term period. A pregnant woman is said to be at term when her pregnancy duration reaches 37 weeks. However, empirical evidence shows that up to 10% of pregnancies could continue beyond 42 weeks, a condition referred as post-term situation (Gulmezoglu, Crowther, Middleton & Heatley, 2012:CD004945). A study conducted in the UK reported that elective induction of labour was associated with decreased odds of perinatal mortality compared with expectant management at term gestation (Stock, Ferguson, Duffy, Ford, Chalmers & Norman, 2012:e2838).

Bishop score, which denotes a pelvic scoring system using cervical dilatation, effacement, station, consistency, and position with a possible range from 0–13 score is being used to predict the duration of labour and whether induction should be conducted to accelerate the process of childbirth. Another study from the USA reported that elective induction in multiparous women with uncomplicated pregnancies at term was successful when the Bishop score was 8 or greater (Laughon et al., 2011:805).

This study revealed that 14% of women in the intrapartum stillbirth group against 15% in the livebirth received induction during the index labour. This was lower than the anticipated 20% rate of induction in the developing countries context (Stock et al., 2012:e2838). However, the difference between the two groups was not statistically significant.

The current study also collected data on two more intrapartum care interventions, namely, episiotomy and assisted delivery. These interventions are intended to see if these interventions were conducted during the index labour and had any interesting associations with the birth outcomes. Episiotomy is a surgical cut of the perineum to

increase the diameter of the pelvic outlet which might be undertaken to expedite vaginal delivery in case a foetal compromise or prolonged labour were diagnosed (Kennedy & McMurtry 2017:822). These five-year data from the public health facilities in Addis Ababa indicate that 27.6% of women in the stillbirth category received episiotomy compared to 32.4% in the intrapartum stillbirth group. Conversely, more women in the stillbirth group (72.4%) did not proportionally receive episiotomy care compared to women in the livebirth group (67.6%). This difference was statistically significant ($p < 0.05$) indicating that not receiving episiotomy care could increase the chance of intrapartum stillbirth. A study conducted in the US showed relatively fewer incidence of episiotomy among women in the stillbirth group (2%). However, this result was lower compared to their expected national estimate of episiotomy, which was at 25% level (Gold, Mozurkewich, Puder & Treadwell, 2016:208).

Assisting the birth process using instrument like forceps and vacuum has been recommended when malposition of foetal head, foetal distress, breech presentation or maternal exhaustion that could result in poor progress of labour and subsequent fatal outcomes are diagnosed (Marshall & Raynor, 2014:4).

This current study found that only 7.3% of women in the intrapartum stillbirth group and 8% in the livebirth group received care related to instrumental delivery during the index pregnancy. However, this finding was much higher than a study from Nepal where assisted delivery care was provided to only 2.2% in the stillbirth and 2.4% in the livebirth categories (Ashish et al. 2016b:2). Moreover, data from the current study did not establish any benefit of instrumental delivery against intrapartum stillbirth as the difference was not statistically significant. The following table summarises all key obstetric interventions provided during intrapartum period in the public health facilities in Addis Ababa along with the differential in administering these cares between women in the stillbirth and livebirth groups.

Table 5.8 Types and timing of intrapartum care interventions in the public health facilities

Interventions	Categories	Stillbirth N (%)	Livebirth N (%)	P-value
FHRM care given	Yes	727 (99.9)	1549 (99.9)	0.434
	No	1 (0.1)	2 (0.1)	
Timing of FHRM – 15 min care consistent	Yes	3 (0.4)	12 (0.8)	0.870
	No	725 (99.6)	1539 (99.2)	
Uterine contraction monitoring	Yes	638 (87.8)	1464 (94.6)	0.000
	No	90 (12.2)	87 (5.4)	
Timing of uterine contraction monitoring	Yes	80 (12.5)	304 (20.9)	0.000
	No	559 (87.5)	1148 (79.1)	
	Missing	89 (12.2)	99 (6.4)	
Maternal Blood Pressure (BP) care given	Yes	652 (89.7)	157 (92.6)	0.018
	No	76 (10.3)	114 (7.4)	
Timing of Maternal Blood Pressure (BP)	Yes	232 (35.6)	532 (37.5)	0.417
	No	419 (64.4)	887 (62.5)	
	Missing	77 (10.6)	132 (8.5)	
Maternal temperature care given	Yes	50 (6.8)	82 (5.3)	0.156
	No	678 (93.2)	1469 (94.7)	
Timing of maternal temperature	Yes	20 (37.7)	37 (42.5)	0.576
	No	33 (62.3)	50 (57.5)	
	Missing	675 (92.7)	1464 (94.4)	
Maternal pulse Care Given	Yes	447 (61.2)	992 (64.0)	0.191
	No	281 (38.8)	559 (36.0)	
Timing of maternal pulse care consistent	Yes	52 (11.4)	132 (13.2)	0.329
	No	404 (88.6)	865 (86.8)	
	Missing	272 (37.4)	554 (35.7)	
Vaginal examination (VE) care given	Yes	726 (99.7)	1539 (99.5)	0
	No	2 (0.3)	12 (0.5)	
Timing of Vaginal Examination	Yes	321 (44.2)	749 (49.5)	0.019
	No	407 (55.8)	764 (50.5)	
	Missing	289 (39.7)	38 (2.5)	
Oxytocin care provided	Yes	100 (14.1)	235 (15.0)	0.601
	No	628 (85.9)	1316 (85.0)	
Episiotomy Care conducted	Yes	201 (27.6)	497 (32.4)	0.020
	No	527 (72.4)	1054 (67.6)	
Vacuum/forceps delivery care given	Yes	53 (7.3)	123 (8.0)	0.543
	No	675 (92.7)	1428 (92.0)	

5.3.1.14 Effects of labour complications on intrapartum stillbirth

Any falter in the process of spontaneous labour or changes in the medical conditions of the mother and foetus could lead to complications that might cause fatal outcomes.

Historically, terms such as 'failure to progress', 'prolonged labour' and 'dystocia' have been used when labour is perceived not following a pre-determined line of progress, whether that is the rate of cervical dilatation or exceeding the expected duration. Moreover, delayed labour could be owing to ineffective uterine contractions, malposition of the foetus leading to a relative or absolute Cephalo-Pelvic Disproportion (CPD), malpresentation, or any combination of these factors that are usually associated with difficulties in the passage, passenger or power "3 Ps") (Marshall & Raynor, 2014:4).

Childbirth related complications are among the common causes of intrapartum stillbirth. A South African study reports 16% obstetrical and foetal complications during labour and delivery. The most frequently observed incidence of complication in the above study was foetal distress followed by poor progress of labour (prolonged labour) (Hoque, 2011:1). Similar studies from Kenya, USA, and Nepal all confirmed the association between obstetric complications with stillbirth (Ashish et al., 2016b:2; Cheptum et al., 2016:24; Gold et al., 2016:208). Another study from Uganda reported that antepartum haemorrhage, ruptured uterus, severe pre-eclampsia and eclampsia, led to statistically significant attributable risk of stillbirth (Nakimuli, Mbalinda, Nabirye, Kakaire, Nakubulwa, Osinde, Kakande & Kaye, 2015:2). Yet another study reported that approximately 50% of intrapartum stillbirths were attributed to obstetric complications (Baqui, Choi, Williams, Arifeen, Mannan, Darmstadt & Black, 2011:1).

This current study collected data on key variables including eclampsia, haemorrhage, prolonged/obstructed labour, and ruptured uterus that are commonly associated with labour complications. These data were extracted from the few indicators included in intrapartum care records of women given birth in the public health facilities of Addis Ababa during July 2010-June 2015. Accordingly, 1.2% and 0.3% of women in the intrapartum stillbirth and livebirth groups developed eclampsia respectively. This finding was lower compared to the generally expected range of prevalence (3-6%), which has been reported by a study conducted in the US (Ananth, Keyes & Wapner, 2013:1). The relatively lower finding from the current study might be owing to limited diagnostic skills and facilities associated with the setting in the public health facilities in Addis Ababa. However, it is noteworthy that the difference between the stillbirth and livebirth groups was statistically significant implying that uncontrolled eclampsia or pre-eclampsia is a risk factor for intrapartum stillbirth.

Obstetric haemorrhage that occurs during antepartum, intrapartum or immediate postpartum period has been considered one of the risk factors for stillbirth (Jason et al. 2013:1). In addition, Kennedy and McMurtry (2017:13054) concede that the incidence of obstetric haemorrhage was 2.9% of all births. However, a study conducted in the Netherlands reported the prevalence of postpartum haemorrhage being up to 4.3% (Von Schmidt auf Altenstadt, Hukkelhoven, Van Roosmalen & Bloemenkamp, 2013:e81959). Furthermore, Gold et al. (2016:208) reported a much higher rate of obstetric haemorrhage that was estimated at 10%.

This study collected data on obstetric haemorrhage including immediate antepartum and postpartum period. Accordingly, only 0.4% of women in the intrapartum stillbirth category and 0.3% in the livebirth group had obstetric haemorrhage during the index childbirth. However, these differences were not statistically significant ($p=0.718$).

Prolonged labour or dystocia is a common complication of labour that requires agility in obstetric skills to establish its diagnosis and management. Labour becomes prolonged when the active phase extends beyond 12 hours. The causes are diverse including maternal factors like primiparity, obesity or foetal factors including heavy birth weight, large head circumference and poor presentations. Moreover, prolonged labour arrests the progress of childbirth and can lead to further complication including obstructed labour, uterine rupture and obstetric haemorrhage which can result in fatal outcome of pregnancy in the absence of assisted delivery or Caesarean section (Astrid & Ingegerd, 2014:1471; Fraser & Cooper, 2009:102).

Prolonged labour was the second important complication that showed statistically significant difference between the intrapartum stillbirth and livebirth groups in this study. To this effect, 2.3% of women in the intrapartum stillbirth group and 1.2% women in the livebirth group had prolonged labour ($p<0.05$). However, the prevalence of prolonged labour in this study might be underestimated compared to the global burden of obstructed labour, which is being estimated at 3-6% of labouring women. As indicated above, the diagnosis of prolonged labour takes solid obstetric competence, which might explain the underestimated prevalence in the public health facilities of Addis Ababa. To this effect, improved detection of prolonged labour through heightened observation of regular contractions, protracted cervical dilatation, protracted descent of presenting part, arrested

cervical dilatation, and severe moulding can contribute to improved outcome of labour (Mgaya, Kidanto, Nystrom & Essen, 2016:1).

Uterine rupture is another rare but catastrophic complication of labour that endangers the lives of both the foetus and the mother. The incidence of uterine rupture is estimated to be less than 1% with the highest risk factor being previous scar (Sinha, Gupta, Gupta, Rani, Kaur & Singh, 2016:45) . The data from public health facilities of Addis Ababa for the period 2010–2015 showed that the prevalence of uterine rupture was 2.2% among women who experienced intrapartum stillbirth. The finding was clinically significant compared to the 0.1% incidence among women in the livebirth group. The observed incidence among the stillbirth group was considerably higher compared to studies from Nigeria (0.84%) and India (0.061%) respectively (Igwegbe, Eleje & Udegbumam, 2013:415; Sinha et al., 2016:45). Furthermore, similar studies from Europe indicated a slightly lower incidence including 0.04% in Denmark and 0.036% in Belgium (Colmorn, Langhoff-Roos, Jakobsson, Tapper, Gissler, Lindqvist, Källén, Gottvall, Klungsøyr, Bøhrdahl, Bjarnadóttir & Krebs, 2017:176; Vandenberghe, De Blaere, Van Leeuw, Roelens, Englert, Hanssens & Verstraelen, 2016:e010415). The relatively higher prevalence of uterine rupture among the intrapartum stillbirth group of the study population can be indicative of the quality of obstetric care in the public health facilities of Addis Ababa. However, more focused and prospective studies could reveal stronger evidence regarding the underlying causes of such elevated prevalence of uterine rupture.

Table 5.9 Distribution of obstetric complications and birth outcomes

Observations	Categories	Stillbirth N (%)	Livebirth N (%)	P-value
Eclampsia	Yes	9 (1.2)	4 (0.3)	0.004
	No	719 (98.8)	1547 (99.7)	
Obstetric haemorrhage	Yes	3 (0.4)	5 (0.3)	0.718
	No	721 (99.6)	1518 (99.7)	
Prolonged labour	Yes	17 (2.3)	18 (1.2)	0.037
	No	711 (97.7)	1533 (98.8)	
Ruptured uterus	Yes	16 (2.2)	1 (0.1)	0.000
	No	712 (97.8)	1538 (99.9)	

5.3.2 Results from inferential statistical analysis

One of the objectives of this study was to assess determinants of intrapartum stillbirth in public health facilities of Addis Ababa. Accordingly, multivariate analysis was conducted using logistic regression model to determine associations between key independent variables that are considered risk factors and the outcome variable, which was intrapartum stillbirth. These independent variables included factors related to maternal past obstetric history; maternal medical and foetal conditions during pregnancy; maternal and foetal conditions on admission to the public health facilities; and obstetric interventions during childbirth. Odds ratio (OR) was used to measure the differential in exposure to certain obstetric and medical factors and how these factors affected the chances of experiencing intrapartum stillbirth compared to livebirth. As discussed in the methodology section of this thesis, the OR represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure (Magdalena, 2010:227).

5.3.2.1 Background characteristics and past obstetric history

Demographic characteristics including the number of previous pregnancy or birth and number of children alive were analysed to see their effect on the outcome of intrapartum stillbirth. Accordingly, there was no consistent pattern regarding the effect of previous number of pregnancies and childbirth on intrapartum stillbirth among the study population. However, women who were gravida three had statistically significant protective association against intrapartum stillbirth (OR 0.58, 95% CI 0.34–0.99) in this study. Furthermore, empirical evidence shows that nulliparous women have higher chance of experiencing stillbirth compared to multiparous women (Hogue, Parker, Willinger, Temple, Bann, Silver, Dudley, Koch, Coustan, Stoll, Reddy, Varner, Saade, Conway & Goldenberg 2013:755). Consistently, there was indication that having no previous child was a predictor of experiencing intrapartum stillbirth among the study population (aOR 1.48, 95% CI 1.12–1.95).

Previous surgery on reproductive system was another important determinant of stillbirth outcome among the study population. To this effect, women who had previous surgery on their reproductive tracts were more likely to experience intrapartum stillbirth compared to those who did not have surgery (OR 2.3, CI 1.56–3.55).

5.3.2.2 *Medical and obstetric conditions during the index pregnancy*

Important pregnancy-related risk factors include maternal infection, multiple pregnancy, ANC service utilisation history, and foetal presentation during the last ANC visit were fitted to the multivariate logistic regression model to observe if any of these variables were associated with intrapartum stillbirth. Accordingly, maternal infection including HIV and syphilis sero-status had interesting associations with intrapartum stillbirth. Being HIV negative had statistically significant protective association against intrapartum stillbirth (aOR 0.37, 95% CI 0.18–0.78). Similarly, the absence of syphilis infection during the index pregnancy was statistically significant predictor for absence of intrapartum stillbirth (OR 0.46, 95% CI 0.34–0.58). Conversely, HIV and syphilis infections during the index pregnancy had associations with the stillbirth outcome. This finding resonates with other similar studies that established statistically significant associations between HIV infection and stillbirth (Kim, Kasonde, Mwiya, Thea, Kankasa, Moses, Aldrovandi & Kuhn 2012:1; McClure & Goldenberg, 2009:182). It is imperative that pregnant women are screened for infections early and receive appropriate treatment including ART to prevent intrapartum stillbirth.

The frequency of antenatal care service utilisation was a strong predictor of intrapartum stillbirth. Accordingly, women who received only one ANC were more than three-time likely to experience stillbirth compared to those who received the service four or more times (aOR 3.9, 95% CI 2.85–5.05). The result shows a consistent trend of decreased risk of experiencing stillbirth as the frequency of ANC service utilisation increased. As indicated in the conceptual framework of this thesis, ANC creates an important window of opportunity for pregnant mothers to detect any risk factors that can affect the pregnancy outcomes.

Effective screening for medical or obstetrical risks such as infection, foetal growth, hypertensive disorders, nutritional deficiencies and multiple pregnancies will prompt the provision of appropriate promotive and preventive health services to pregnant mothers in a timely manner. This study further revealed that pregnant women who did not have blood group and RH in the ANC record were approximately three times more likely (OR 2.84, 95% CI 1.90–4.23) to experience intrapartum stillbirth compared to those who had data on these variables. It is also worth noting that women who had RH⁻ blood result were

more likely to develop intrapartum stillbirth compared to women with RH⁺ blood type although the finding was not statistically significant (aOR 1.27, 95% CI 0.87–2.25). However, the result was consistent with a recent study from Sweden (Fan et al., 2014:1123) where the exposure to RH related antibody increased the odds of stillbirth.

The status of foetal presentation during late ANC visits was another important risk factor that was assessed in this study. Accordingly, pregnant women with non-cephalic foetal presentations during the last ANC visit of index pregnancy were three times more at risk of experiencing intrapartum stillbirth compared to those with cephalic foetal presentations (OR 3.14, 95% CI 2.21–4.46). Interestingly, the risk level of non-cephalic presentation did not change when data from labour admission records of the study population were analysed implying that clinical decisions regarding the mode of delivery for women with non-cephalic foetal presentations should not delay until the onset of labour. In addition, A higher risk level was reported from a study conducted in Nepal where women with non-cephalic presentation were 12 times more likely to experience intrapartum stillbirth (Kozuki, Katz, Khatry, Tielsch, LeClerq & Mullany, 2017:1). Equally, important observation in this current study was the fact that unestablished diagnosis of foetal presentation during late pregnancy or admission to labour had increased the odds of intrapartum stillbirth albeit without any statistical significance (OR 1.47, 95% CI 0.87–2.51). Missed diagnosis of foetal presentation can be owing to combination of factors including limited obstetrical skills, absence of technology like ultrasound equipment, poor recording and follow-up of important pregnancy related tests and interventions, which can be indications of poor quality obstetric care services. Empirical evidence shows chance of correctly diagnosing non-cephalic foetal presentation particularly among nulliparous and obese women are lower; hence requiring strong competence coupled with diagnostic technologies (Natasha et al., 2006:578).

5.3.2.3 *Labour admission assessment outcomes of the index pregnancy*

Multivariate logistic regression analysis was conducted to see if the obstetric conditions observed during admission to labour had any predictive value towards intrapartum stillbirth. Accordingly, the status of the foetal membrane, foetal heart rate and dilatation of the cervix were among the variables included in the analysis. Women who had ruptured membranes on admission to labour were almost twice more likely to experience intrapartum stillbirth (OR 1.7, 95% CI 1.37–2.03). This might be owing to delays in seeking

obstetric care in the public health facilities, which can be owing to either ineffective inter-facility referral linkages or limited access to health care because of socio-economic factors. More alarming was the fact that women who had missing foetal membrane status in their obstetric records were more likely to develop intrapartum stillbirth (OR 1.80, 95% CI 1.36–2.40). As discussed above, the missing record related to foetal membrane on admission to labour could be indicative of poor quality of obstetric service in correctly diagnosing and recording important indicators and procedures.

One of the most striking findings from this study was the relatively strong association between sub-standard foetal heart rate on admission and intrapartum stillbirth outcome. Moreover, women who were admitted for labour management in the public health facilities of Addis Ababa with diagnosis of foetal heart rate lower than 110/bpm were almost seven times more likely to experience intrapartum stillbirth (OR 6.96, 95% CI 2.75–17.66). On the contrary, women who were admitted with FHR in the range of 110–160/bpm had protective association against intrapartum stillbirth (aOR 0.37, 95% CI 0.15–0.92). As a result, FHR of lower than 110/bpm suggests the presence of foetal distress that warrants emergency obstetrical care. This condition was diagnosed among 13% of women who experienced intrapartum stillbirth in the public health facilities of Addis Ababa over the five-year period. Consequently, this suggests that the level of sensitivity and responsiveness to obstetrical emergencies had been relatively low.

There has been a clinical consensus that the active phase of labour begins at approximately 4 cm cervical dilatation which is also a relatively good timing of admission for skilled delivery in the health facilities (Neal et al., 2010:308). Data from this study revealed that most women (over 65%) in the stillbirth group were admitted for labour with cervical dilatation of 4 cm or above and yet this was a predictor of intrapartum stillbirth (OR 1.2, 95% CI 1.00–1.45). Although this association was absent on the adjusted OR, a further study might be useful to investigate the cervical dilatation status in a more segmented manner to assess whether the difference due to delayed health seeking by women who experienced intrapartum stillbirth.

5.3.2.4 Intrapartum care interventions for the index pregnancy

The types and frequency of obstetrical care offered to women admitted for skilled delivery in the public health facilities of Addis Ababa were analysed using multiple logistic

regression model to assess any association between each intervention and intrapartum stillbirth. Accordingly, labour monitoring interventions including uterine contraction, maternal blood pressure, vaginal examination, and episiotomy care were key determinants associated with intrapartum stillbirth. To this effect, both absence and irregularities in monitoring uterine contraction were associated with intrapartum stillbirth. Therefore, women who did not receive uterine monitoring care at all were more than twice more likely to experience intrapartum stillbirth compared to those who received the service (OR 2.42, 95% CI 1.77–3.30). Similarly, women who received uterine contraction monitoring inconsistently were at an increased risk of having intrapartum stillbirth (aOR 1.55, 95% CI 1.09–2.18). This finding has strong policy significance as health providers' understanding of the risky signs of an abnormal labour and established timely interventions including effective monitoring of uterine contraction during intrapartum period is one of the key determinant of successful pregnancy outcome (Galanimoghaddam, Moslemizadeh, Seifollahpour, Shahhosseini & Danesh, 2014:200).

Maternal blood pressure (BP) monitoring during labour and childbirth period was another predictor of intrapartum stillbirth among the study population. This study further revealed that timely assessment of labour progress including cervical dilatation and descent of foetal head through vaginal examination by skilled birth attendant was an important predictor of intrapartum stillbirth among the study population. Accordingly, women who did not receive BP monitoring were 1.4 times more likely to experience intrapartum stillbirth compared do those who received the service (aOR 1.41, 95% CI 1.09–1.81). Given pre-eclampsia can affect up to 2.9% of pregnancies, close and timely monitoring of maternal blood pressure during labour is considered a good obstetrical practice that could save lives (Ahmad & Samuelsen, 2012:1521).

Evidence on the importance of episiotomy in reducing the adverse pregnancy outcomes including stillbirth is inconclusive (Victora & Rubens 2010:1). However, the practice is commonly cited in the obstetric textbooks and being exercised by many skilled birth attendants. As presented in the descriptive section, over 27% of women who gave birth in the public health facilities in Addis Ababa during the period 2010–2015 received episiotomy care. Furthermore, women who did not receive episiotomy during the index delivery were 1.5 times more likely to experience intrapartum stillbirth (aOR 1.51, 95% CI, 1.15–1.97) thereby making the service one of the determinants of intrapartum stillbirth.

The presence of pre-eclampsia/eclampsia was the most significant determinant of intrapartum stillbirth among the study population. Although the prevalence was only 1.2% among women who experienced stillbirth, the odds of women with pre-eclampsia/eclampsia developing intrapartum stillbirth was 14 times higher compared to those without it (OR 4.70, 95% CI 1.46–15.54). In addition, the finding related to both the prevalence and association of pre-eclampsia/eclampsia with stillbirth were comparable with a similar study from Nigeria (Jido, 2012:148). As indicated in the conceptual framework and literature review sections of this thesis, pregnancy induced hypertension (PIH) is associated with increased risk of stillbirth. For instance, an editorial article on *Global Health Journal* indicated that up to 9% of intrapartum stillbirth are caused by pre-eclampsia/eclampsia (Stephen, 2015:525). Timely detection and management of gestational hypertensive disorders using antihypertensive, MgSO₄ and C-Section was estimated to reduce the incidence of stillbirths by 20 % (Jabeen, Yakoob, Imdad & Bhutta, 2011:S6).

This study further revealed that women who experienced obstructed/prolonged labour during the index pregnancy were twice more likely to develop intrapartum stillbirth (OR 2.01, 95% CI 1.03–3.92). This finding was consistent with a study from Uganda where the obstructed labour had association with stillbirth (OR 2.26, 95% CI (1.56–3.62) (Nakimuli et al., 2015:2). Another study from Tanzania confirmed a higher level of association between obstructed labour and adverse foetal outcomes (Chuma, Kihunrwa, Matovelo & Mahendeka, 2014:1). Prompt obstetrical management including Caesarean section and instrumental delivery are critical interventions to save lives and avoid further complications resulting from obstructed labour. The relatively high association between obstructed labour and intrapartum stillbirth in this study is inconsistent with the high Caesarean section rate (over 24%) in Addis Ababa (Gebremedhin, 2014:1). To this effect, the quality, equitable access and competence of skilled birth attendants in making obstetrical decision should be reassessed considering the high intrapartum stillbirth burden in Addis Ababa.

The following table presents all variables included in the multiple logistic regression model along with their individual contributions to the intrapartum stillbirth outcomes in the public health facilities of Addis Ababa during July 1, 2010–June 30, 2015.

Table 5.10 Results of multiple regression analysis related to key determinants of intrapartum stillbirth in public health facilities of Addis Ababa

Independent variable	Birth outcome		Crude OR (95% CI)	Adjusted OR (95% CI)
	Stillbirth N (%)	Live birth N (%)		
Gravid a *				
One	363 (49.3)	573 (37.1)	1.1 (0.67-1.8)	
Two	206 (28.0)	537 (34.8)	0.67 (0.41-1.1)	
Three	85 (11.5)	254 (16.5)	0.58 (0.34-0.99)	
Four and above	83 (11.3)	179 (11.6)	1	
Para				
Zero	444 (60.3)	741 (48.1)	1.19 (0.35-4.00)	
One	187 (25.4)	539 (35.0)	0.69 (0.21-2.33)	
Two	58 (7.9)	176 (11.4)	0.66 (0.19-2.27)	
Three	32 (4.3)	60 (3.9)	1.06 (0.29-3.82)	
Four and above	15 (2.0)	26 (1.7)	1	
Children alive				
Zero	451 (68.8)	790 (55.2)	1.78 (1.47-2.17)**	1.48 (1.12-1.95)**
One or more	205 (31.2)	640 (44.8)	1	1
Previous surgery on reproductive tract ***				
No	29 (3.9)	136 (8.8)	1	1
Yes	706 (96.1)	1407 (91.2)	2.3 (1.56-3.55)**	1.43 (0.82-2.46)
Sero-status for HIV infection				
HIV positive	48 (6.5)	79 (5.1)	0.60 (0.31-1.18)	0.05 (0.21-1.21)
HIV negative	662 (90.1)	1431 (93.2)	0.46 (0.26-0.81)*	0.37 (0.18-0.78)*
Don't know	25 (3.4)	25 (1.6)	1	1
Blood group and Rh				
Positive	643 (87.7)	1415 (91.9)	1	1
Negative	32 (4.4)	80 (5.2)	0.88 (0.58-1.34)	1.27 (0.71-2.25)
Don't know	58 (7.9)	45 (2.9)	2.84 (1.90-4.23)**	1.62 (0.87-3.02)
Multiple pregnancy				
Yes	47 (6.5)	57 (3.7)	1.09 (0.35-3.39)	
No	672 (92.7)	1459 (95.7)	0.61 (0.21-1.77)	
Don't know	6 (0.8)	8 (0.5)	1	
Sero-status for Syphilis				
Positive	5 (0.7)	12 (0.8)	0.43 (0.15-1.26)	1.49 (0.41-5.43)
Negative	604 (82.3)	1401 (90.9)	0.46 (0.34-0.58)**	0.99 (0.65-1.50)
Don't know	125 (17.0)	129 (8.4)	1	1
Number of ANC visits				
Once	478 (65.3)	490 (32.0)	4.78 (3.84-5.96)**	3.79 (2.85-5.04)**
Twice	60 (8.2)	180 (11.8)	1.63 (1.16-2.23)**	1.34 (0.86-2.07)
Three times	52 (7.1)	163 (10.7)	1.56 (1.09-2.24)*	1.5 (0.99-2.38)
Four times and more	142 (19.4)	696 (45.5)	1	1
Foetal Presentation during ANC***				
Vertex	617 (83.7)	1420 (92.0)	1	1
Non-vertex	79 (10.7)	58 (3.8)	3.14 (2.21-4.46)**	1.01 (0.56-1.82)
Don't know	41 (5.6)	66 (4.3)	1.43 (0.95-2.14)	1.47 (0.87-2.51)
Status of membrane on admission				
Intact	331 (46.8)	895 (59.9)	1	1
Ruptured	279 (39.4)	452 (30.2)	1.67 (1.37-2.03)**	1.18 (0.91-1.53)
Don't know	98 (13.8)	147 (9.8)	1.80 (1.36-2.40)**	1.51 (1.03-2.19)*

Independent variable	Birth outcome		Crude OR (95% CI)	Adjusted OR (95% CI)
	Stillbirth N (%)	Live birth N (%)		
Foetal heart rate on admission				
<110	97 (13.2)	13 (0.8)	6.96 (2.75-17.66)**	5.63 (1.70-18.64)*
110-160	624 (84.8)	1512 (98.2)	0.38 (0.18-0.80)*	0.37 (0.15-0.92)
>160	15 (2.0)	14 (0.9)	1	1
Cervical dilatation on admission				
Three and below	252 (34.4)	593 (38.7)	1	1
Four and above	481 (65.6)	940 (61.3)	1.20 (1.00-1.45)**	0.96 (0.75-1.24)
Foetal presentation on admission **				
Vertex	525 (71.9)	1245 (81.2)	1	1
None-vertex	109 (14.9)	70 (4.6)	3.69 (2.69-5.07)**	3.26 (1.93-5.50)**
Don't know	96 (13.2)	218 (14.2)	1.04 (0.80-1.36)	1.28 (0.87-1.89)
Uterine contraction monitored				
Yes	646 (87.8)	1458 (94.6)	1	1
No	90 (12.2)	84 (5.4)	2.42 (1.77-3.30)**	0.37 (0.03-4.13)
Timing of uterine contraction observation consistent				
Yes	80 (12.5)	304 (20.9)	1	1
No	559 (87.5)	1148 (79.1)	1.85 (1.42-2.42)**	1.55 (1.09-2.18)*
Maternal blood pressure (BP) monitored				
Yes	659 (89.7)	1427 (92.6)	1	1
No	76 (10.3)	114 (7.4)	1.44 (1.07-1.96)**	1.02 (0.62-1.65)
Timing of vaginal examination (VE) care consistent				
Yes	321 (44.2)	749 (49.5)	1	1
No	405 (55.8)	764 (50.5)	1.24 (1.04-1.48)*	1.41 (1.09-1.81)**
Episiotomy care conducted **				
Yes	201 (27.6)	497 (32.4)	1	1
No	528 (72.4)	1037 (67.6)	1.26 (1.04-1.53)*	1.51 (1.15-1.97)**
Eclampsia/pre-eclampsia present				
Yes	9 (1.2)	4 (0.3)	4.7 (1.46-15.54)*	14.02 (2.66-73.77)**
No	716 (98.8)	1518 (99.7)	1	1
Obstructed/prolonged present				
Yes	17 (2.3)	18 (1.2)	2.01 (1.03-3.92)*	1.56 (0.67-3.64)
No	707 (97.7)	1504 (98.8)	1	1

** P ≤ 0.01, *P ≤ 0.05 -0.01

5.4 OVERVIEW OF RESEARCH FINDINGS

This study aimed to achieve several objectives including assessing the magnitude, exploring trends and establishing determinants and factors associated with intrapartum stillbirths taking place in the public health facilities in Addis Ababa. Moreover, the findings from this study offer useful inputs to improve the maternity care by highlighting key gaps in relevant tools and obstetric care practices particularly in the public health facilities of Addis Ababa. The recommendations that emanated from this study are captured in the

next chapter of the thesis. Furthermore, the key findings from the current study are highlighted in the following few paragraphs.

In this study, a total of 3221 intrapartum care medical records were reviewed in the 20 public health centres and three public hospitals in Addis Ababa. Of these, 1056 charts were cases of intrapartum stillbirth whereas 2165 were for controls who did not experience intrapartum stillbirth. The inclusion criteria for both cases and controls were applied to identify charts that were eligible for the study and therefore data were collected from 728 stillbirths and 1551 livebirths medical records only.

Accordingly, the City experienced staggering average stillbirth rate of 28 per 1000 total birth during the period 2010–2015. This rate is comparable with the national stillbirth statistics that emanate from the DHS, which also indicated the prevalence of stillbirth at population level. Data from both national and regional HMIS also confirmed inconsistencies or little decline in trends of stillbirth in the City. The absolute magnitude of stillbirths that occurred in the assessed public health facilities in Addis Ababa declined over the five-year period in reference. However, the trends in the rates of intrapartum stillbirth did not show convincing and consistent decline between 20110–2015 compared to global and regional figures.

Consistent with the health facility format for maternity care service deliver, this study collected data on five key socio-demographic variables including age, marital status, gravida, para and number of children alive for the women whose charts were reviewed. Bivariate analysis revealed that women who had one live child and three previous pregnancies were less likely to develop intrapartum stillbirth. Data from this study did not show any consistent relationship between the other social-demographic variables and intrapartum stillbirth.

Data from the current study also revealed that prevalence of common maternal medical conditions including diabetes, cardiac and renal disease were less frequent (1%) among women in both case and control groups without any significance to the occurrence of intrapartum stillbirth. Similarly, the prevalence of hypertensive disorder among the study population was relatively lower (approximately 6%). The findings regarding limited associations of chronic maternal medical conditions with intrapartum stillbirth and their lower prevalence status were not consistent with results from other similar studies in the

context. This might be owing to poor record keeping and limited diagnostic facilities existed in the public health facilities in the study setting.

On the contrary, the two variables related to infection during pregnancy including HIV and syphilis had statistically significant association between cases and control categories. The observed HIV prevalence of 6.5% among the study population was comparable with a similar finding from Cameroon. Although syphilis infection was lower among the study population compared with similar settings, not being infected with syphilis during the index pregnancy had a protective association against intrapartum stillbirth. Findings on predictive effects of RH-ve status during pregnancy was inconsistent compared to other studies in similar settings, which might be because larger amount of data were absent among women in the intrapartum stillbirth category than livebirths.

Findings from the bivariate analysis related to three important foetal risk factors including foetal heart rate, foetal presentation, and the presence of multiple pregnancy during the ANC visits showed that non-vertex presentation and non-singleton pregnancy were proportionally more common among cases than controls.

One of the remarkable findings of this study was related to the relationship between the number of antenatal visits and stillbirth. Proportionally, more women (65.3%) who experienced intrapartum stillbirth had only one antenatal visit compared to women in the livebirth group (32%). Conversely, more than 45% of women in the livebirth category made four or more antenatal visits during the current pregnancy, which is more than twice the proportion reported for women in the stillbirth group.

A few indicators considered as risk factors to intrapartum stillbirth including the status of membrane, FHR, cervical dilatation and foetal presentation on admission to labour were assessed to see their effects. Accordingly, more women in the stillbirth group (39.4%) than in the livebirth group (30.2%) proportionally experienced ruptured membrane on admission, the difference being statistically significant ($p=0.000$). Furthermore, significantly higher proportion of women in the stillbirth group experienced FRH lower than 110/min, a result suggestive of foetal distress on admission. Similarly, more women in the intrapartum stillbirth group (14.5%) than in the livebirth group (4.5%) proportionally had breech foetal presentation on admission for labour where the difference was statistically significant indicating that non-vertex foetal presentation during admission can

be a predictor to intrapartum stillbirth. On the contrary, data from this study did not show any convincing pattern regarding the predicative effects of the cervical dilatation on admission against intrapartum stillbirth.

Data on key variables including foetal heartbeat, maternal vital signs, uterine contraction, vaginal examination, and assisted delivery were collected from the intrapartum care records to assess the types and timing of intrapartum care interventions and how these affected the intrapartum stillbirth outcome in the public health facilities of Addis Ababa. The findings showed that foetal heartbeat monitoring during labour had been conducted to overwhelming majority (over 90%) of women in both case and control groups. However, the service was not provided as per the recommended time intervals in both groups albeit without any relevance to intrapartum stillbirth.

On the contrary, the findings from this study revealed that proportionally more women in the livebirth groups than intrapartum stillbirth received intrapartum care related to monitoring of uterine contractions in timely manner with the differences being statistically significant. Similarly, more women in the livebirth category (92.7%) against women who experienced intrapartum stillbirth (89.7%) proportionally received timely care related to monitoring blood pressure during labour, the difference being statistically significant ($p=0.02$). Furthermore, data from the public health facilities of Addis Ababa showed that more women in the livebirth than intrapartum stillbirth group proportionally received maternal pulse monitoring care during the index pregnancy. However, this difference was not statistically significant. Data related to monitoring of maternal temperature during labour were grossly missing from the intrapartum care records in the public health facilities and analysis did not show any associations between this variable and the occurrence of intrapartum stillbirth.

Bivariate analysis from this study further indicated that key interventions including vaginal examination (VE), labour induction, episiotomy, and assisted delivery were relevant to the occurrence of intrapartum stillbirth. To this effect, more women in the livebirth group (49.5%) than in the stillbirth group (44.2%) proportionally received VE as per the recommended intervals during the index labour, the difference being statistically significant ($p=0.01$). Data from this study further showed that labour induction among both livebirth and stillbirth groups was lower than commonly accepted rate. However, a slightly fewer proportion of women in the stillbirth group were induced during the index labour.

Furthermore, proportionally more women in the stillbirth group (72.4%) did not receive episiotomy care compared to women in the livebirth group (67.6%). Therefore, this difference was statistically significant ($p < 0.05$) indicating that not receiving episiotomy care could increase the chance of intrapartum stillbirth. Data confirmed that fewer (7.3%) women in the stillbirth group than livebirth (8%) group proportionally received care related to instrumental delivery during the index pregnancy. However, this difference was not statistically significant.

Variables related to labour complications including eclampsia, obstetric haemorrhage, prolonged/obstructed labour and ruptured uterus were assessed to see their relevance to intrapartum stillbirth. Accordingly, 1.2% and 0.3% of women in the stillbirth and livebirth groups developed eclampsia respectively, the difference being statistically significant. Data from this study showed that prevalence of obstetric haemorrhage among the study population was negligible. On the contrary, prolonged labour had statistically significant relevance to the occurrence of intrapartum stillbirth. The data from public health facilities of Addis Ababa for the period 2010–2015 showed that the prevalence of uterine rupture was 2.2% among women who experienced intrapartum stillbirth. The finding was clinically significant compared to the 0.1% incidence among women in the livebirth group.

Findings from inferential statistics using multiple logistic regression analysis revealed several independent variables. These include the following main predictors for having intrapartum stillbirth in the study setting.

- Children alive.
- Sero-status for HIV infection.
- Number of ANC visits.
- Status of membrane on admission for labour.
- Foetal heart rate (FHR) on admission for labour.
- Foetal presentation during intrapartum period.
- Timing of uterine contraction monitoring.
- Timing of vaginal examination (VE) during labour.
- Episiotomy being conducted and presence of eclampsia as an obstetric complication.

5.5 CONCLUSION

This quantitative study on the determinants and factors associated with intrapartum stillbirth in the public health facilities of Addis Ababa revealed several useful findings. Both bivariate and multiple logistic regression analysis were applied to assess the extent to which key independent variables including maternal socio-demographics, previous obstetric and medical conditions, foetal and maternal medical conditions during the index pregnancy, obstetric conditions during labour admission, types and timing of intrapartum care interventions during the index childbirth influenced the occurrence of intrapartum stillbirth. More importantly, the case-control study design helped comparison of data between women who experienced intrapartum stillbirth and those who had livebirth outcomes in the public health facilities of Addis Ababa.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

This research aimed at assessing the trends, magnitude, determinants and factors associated with intrapartum stillbirth in the public health facilities of Addis Ababa, Ethiopia. Literature revealed that stillbirths in general and intrapartum stillbirth in particular, occur owing to attributable underlying causes ranging from maternal medical and obstetric conditions; access to quality obstetric care services during pregnancy; and types, timing and quality of intrapartum care. The concept of series of delays in obstetric service delivery including clinical discernment of pregnancy-related risks, delays in arranging transportation to a medical facility, and delays in providing appropriate care at the facility all contribute to the high burden of stillbirth in low and middle income countries (Goldenberg & McClure, 2009:1). Being a low-income context, Ethiopia can be characterised as one of the countries experiencing a high burden intrapartum stillbirth. Despite challenges related to generalisability, this research revealed a staggering average annual stillbirth rate of 28 per 1000 births in the public health facilities of Addis Ababa during the period 2010–2015. This study further revealed findings on specific determinants and factors associated with intrapartum stillbirth including frequency of ANC, HIV and syphilis infections, foetal presentation during the last ANC visit or admission to labour, FHR during admission, monitoring of maternal vital signs during labour and delivery, obstetric complications including eclampsia and uterine rupture. This chapter presents some of the most important aspects of the research work including the overview of research design and methods, summary of research findings, conclusions, key recommendations from the study, contributions, and major limitations of this study.

6.2 RESEARCH DESIGN AND METHODS

This research used a case-control study design owing to its suitability in studying relatively rare diseases like intrapartum stillbirth based on retrospective data collection. Accordingly, a quantitative data related to obstetric cares provided to women who

experienced intrapartum stillbirth were collected from 20 public health centres and three public hospitals in Addis Ababa for the period between July 1, 2010 and June 30, 2015.

Similarly, obstetric care data of randomly selected women who did not experience intrapartum stillbirth during this period were collected from the same facilities for comparison. These data were extracted from the maternity care records of respective health facilities using a structured questionnaire that mimicked variables on the facility level obstetric care provision forms of the ministry of health in Ethiopia. Of the total maternity records reviewed, 728 carts of cases and 1551 charts of controls were considered using strict inclusion criteria and in the proportion of 2:1 control to case ratio. These data were further analysed using SPSS version 24 statistical software to obtain both descriptive and inferential results of the study. Moreover, objectives related to trends and magnitude of stillbirth were addressed using secondary data from study facilities, AARHB and FMOH HMIS database which were triangulated to determine relatively accurate results.

6.3 SUMMARY AND INTERPRETATION OF THE RESEARCH FINDINGS

As indicated in Chapter 5 of this study, the data from the public health facilities of Addis Ababa as well as from national HMIS have captured stillbirth data in a combined manner such that establishing separate data on intrapartum foetal death was not straight forward in this research. The challenges related to stillbirth classification and clinical differentiation into antepartum, intrapartum and immediate neonatal death categories were also highlighted in Chapter 2 of this thesis where many health systems opt to use these categories interchangeably (Goldenberg et al. 2004:79). To this end, this study has put much emphasis on establishing the magnitude and trends of the overall stillbirth cases occurred in the public health facilities across the City of Addis Ababa. However, because of the sample inclusion criteria, additional efforts were also exerted to make separate analysis on trends and magnitude of intrapartum stillbirth in the study target facilities, which offered useful information in addressing the first two objectives of this study.

Findings from this study showed a staggering high prevalence of stillbirth at an average rate of 28 per 1000 total birth during the period 2010–2015. This figure was comparable with the population level prevalence of prenatal death in Addis Ababa, which was 30 per 1000 birth (Central Statistical Agency, 2011:115). Data from both national and regional

HMIS sources confirmed inconsistent or little decline in the rates of stillbirth although its absolute magnitude showed reduction.

Data from this study did not show any consistent relationship between key socio-demographic variables including age, parity and marital status and intrapartum stillbirth. Similarly, no statistically significant associations were revealed against the effects of maternal medical conditions including diabetes, hypertension, cardiac, and renal diseases. These findings refuted results from other similar studies in the context warranting additional research using prospective designs.

On the contrary, HIV and syphilis infections during pregnancy had statistically significant associations with intrapartum stillbirth. Furthermore, findings on foetal presentations and the presence of multiple pregnancy during ANC visits showed that non-vertex presentation and non-singleton pregnancies were proportionally more common among cases than controls. One of the remarkable findings of this study was related to the relationship between the number of antenatal visits and intrapartum stillbirth. Accordingly, more than 45% of women in the livebirth category made four or more antenatal visits during the index pregnancy, which is more than twice the proportion reported for women in the intrapartum stillbirth group.

Data on a few labour admission indicators including the status of membrane, FHR, cervical dilatation, and foetal presentation revealed statistically significant differences between intrapartum stillbirth and livebirth groups where the latter performed better on those indicators. Accordingly, low FHR, non-vertex foetal presentations and ruptured cervical membrane were among risk factors for intrapartum stillbirth. Health facilities could avert unnecessary foetal loss by undertaking timely and correct diagnosis of these admission-related obstetric conditions. More importantly, any unfavourable observations in this regard should be treated with outmost sensitivity including immediate referrals, labour induction, assisted delivery, or Caesarean section depending on the appropriate clinical protocols.

Findings on intrapartum obstetric and clinical interventions including monitoring of foetal heartbeat, maternal vital signs, uterine contraction, and cervical dilatation during the index pregnancy showed deviations from the recommended intervals and quality of services among women who experienced intrapartum stillbirth compared to livebirth groups. For

instance, proportionally more women in the livebirth groups than stillbirth received intrapartum care related to monitoring of uterine contractions and blood pressure in timely manner with the differences being statistically significant. Similarly, women in the intrapartum stillbirth group received substandard care regarding the timely assessment of foetal decent, cervical dilatation, labour induction, and episiotomy care compared to women in the livebirth group. Furthermore, obstetrical complications including obstructed labour, eclampsia and preeclampsia were more common among women in the intrapartum stillbirth group. All these results suggest that poor quality of obstetric care during labour and childbirth can be a risk factor for intrapartum stillbirth.

Findings from inferential statistics using multiple logistic regression analysis showed that several independent variables include the following main predictors for having intrapartum stillbirth:

- Children alive.
- Sero-status for HIV infection.
- Number of ANC visits.
- Status of membrane on admission for labour.
- Foetal heart rate (FHR) on admission for labour.
- Foetal presentation during intrapartum period.
- Timing of uterine contraction monitoring.
- Timing of vaginal examination (VE) during labour.
- Episiotomy being conducted and presence of eclampsia as an obstetric complication.

6.4 CONCLUSION

This study assessed the trends, magnitude, determinants, and factors associated with intrapartum stillbirth in public health facilities of Addis Ababa. Rooted in deterministic conceptual paradigm, the research argued that intrapartum stillbirth as an outcome can be caused by various clinical, social and biological factors which could be revealed using relevant research methods. Wide-ranging types of published and unpublished literature were also reviewed in the context of this study. Moreover, the literature study sought to explore established knowledge-related to causal links or associations between the

outcome variable and many independent variables. The latter include socio-demographics, obstetric history, maternal medical conditions during pregnancy, foetal and maternal conditions during labour admission and types and timing of recommended obstetric interventions during childbirth process.

Different research design options and methods were explored to determine suitability and stillbirth being one of the relatively rare occurrences. However, this study opted for case-control study design along with quantitative methods of data collection. Accordingly, primary data were collected on 728 cases and 1551 controls from their respective medical records in 23 public health facilities of Addis Ababa. These data were analysed using SPSS statistical package version 24 and both descriptive and inferential results were presented based on the findings from the study.

Accordingly, Addis Ababa experienced a high burden stillbirth at an average rate of 28 per 1000 births without consistent decline during the period 2010-2015. The key determinants and factors associated with intrapartum stillbirth in the public health facilities of Addis Ababa were as follows:

- Frequency of ANC visit.
- HIV and syphilis infections.
- Foetal presentation during the last ANC visit or admission to labour.
- FHR during admission.
- Monitoring of maternal vital signs during labour and delivery.
- Obstetric complications, including eclampsia and uterine rupture during the index pregnancy.

6.5 RECOMMENDATIONS

Consistent with the findings from this study and internationally recognised obstetric and clinical standards, the following recommendations are deemed useful to address the high burden of intrapartum stillbirth in the public health facilities of Addis Ababa and other similar settings in Ethiopia.

6.5.1 Policy and program level recommendations

The primary targets for this set of recommendations include but not limited to the FMOH, AARHB, different donors supporting the Maternal and Child Health programming efforts in Ethiopia, programme managers and planners with the government or partner organisations at national and regional levels.

- Ethiopia has various guidelines, service standards and obstetrical care protocols including a comprehensive BFmONC training manual developed in 2013. Health professionals with basic training on midwifery skills and subsequent in-service trainings on BEmONC are also providing obstetric care in public health facilities. Furthermore, over 85% of women in Addis Ababa deliver in health facilities of which approximately 80% seek maternity services at the public health facilities. The most important question that stands out amidst this labyrinth of technical resources and vast physical coverage of maternity services is “why is there such a high prevalence of intrapartum stillbirth in the public health facilities in Addis Ababa?” Considering the third delay model of maternity care, the answers should be examined in the fabrics of provider competence, motivation, availability, adequacy and consistency of health supplies, and equipment. Therefore, the national and regional leadership should pay closer attention through budget allocation for adequate health supplies and equipment and by undertaking ongoing assessment to assure and certify competencies of the health workforce in the public health facilities to enable effective diagnosis of management of labour.
- It is also recommended that the existing guidelines, maternity service protocols, and HMIS tools should be reviewed to incorporate accurate classification of the different types of stillbirth based on internationally recognised categorisations including, Relevant Conditions at Death (ReCoDe), Cause of Death and Associated Conditions (CODAC) or consistent with the WHO’s International Classification of Disease for Perinatal Mortality (ICD-PM). This modification would help avoid the current gross aggregation of all facility level stillbirths into “fresh” and “macerated”, which obscures the chance of clinical analysis as what the real underlying causes were hence the limitations in finding specific solutions to the causes.

- As part of elevating stillbirth to national policy and strategic discussion agendas, it is also recommended that policy makers and health sector leaders at national and regional levels should institute clear system of accountability so that maternity service providers, health facilities, data managers take responsibility for accurate recording, reporting and storage of data related to intrapartum stillbirth. More efforts should be exerted to create awareness among health service providers and program managers on the clinical and programmatic advantages of good classification of stillbirth, effective documentation and accurate reporting of case of stillbirth in health facilities.
- Furthermore, a clear system of accountability should be instituted so that obstetrical service providers take responsibilities for accurate diagnosis, recording and reporting of birth outcomes in health facilities. Obstetric service providers should be educated more on ethical, moral and legal issues surrounding stillbirth and early neonatal death and the importance of transparency in recording and reporting these cases so that the problems can be researched in depth and appropriate interventions and solutions could be sought. Therefore, policy makers and programme planners are encouraged to improve the practices in diagnosing, recording and reporting intrapartum stillbirth in accurate and complete fashion by providing specific guidelines and standard procedures (SoP) that clearly outline roles, expectations, and potential consequences of any malpractices in this regard. Therefore, it is recommended that these guidelines should contain mechanisms and tools to monitor and reinforce the process of promoting good documentation as well as steps to ensure accountability around intrapartum stillbirth.
- Stillbirth audit in the health facilities through routine monitoring data and periodic assessments provides a rational framework for quality improvement by systematically assessing clinical practices against accepted standards with the aim to develop recommendations and interventions that target modifiable deficiencies in care (Hasan, Stuart, Nathanael, Atul, Angela & Priya, 2014:1). Therefore, it is recommended that the regional health bureau and relevant FMOH authorities introduce the stillbirth audit practice along with necessary tools and resources to undertake the exercise in the public health facilities of Addis Ababa and similar settings in the country on a defined periodicity.

- The findings from this research showed that data on stillbirth are undifferentiated, inconsistent and incomplete across the ladders of HMIS such as facility registers, regional database and some of the published national resources. It is advisable that national and regional level health decision-makers take necessary steps to tighten the requirements and tools on establishing a complete and differentiated data from the health systems. Stillbirth data is missing from the recent annual health and health-related indicators bulletin, which might give a wrong impression that the indicator was less important. Therefore, it is recommended that due attention at national and regional level should be given to the process of collecting, compiling and publishing stillbirth through proactive initiatives
- Consistent promotion and advocacy to keep intrapartum stillbirth as one of the priority public health agendas at national and regional levels is imperative to redress the underlying causes of intrapartum stillbirth. The national and regional health discussion fora including the annual health sector review meetings, town hall discussions and regional health sector performance review meetings should consider stillbirth and intrapartum stillbirth indicators as one of the collective discussion topics.
- Although it was not part of the objective of this research to assess the supply side constraints in the public health facilities in Addis Ababa, evidence showed that intrapartum stillbirth is one of the quality indicators of obstetric care services. On the contrary, quality improvement in health facility setting requires technical competence from service providers and availability of affordable and appropriate technological tools and equipment as well as medical supplies. Therefore, the AARHB should examine its annual budget allocation or partner engagement process to ensure that these resources are in optimum supply to the public health facilities in the City to ensure improvement in the quality of obstetric care services.
- Technological innovations like digital paragraph that can generate automated alerts in the form of physical signals like colour lights on a designated maternity follow-up dashboard, SMS alerts to obstetricians in charge, and medical emergency preparedness messages to potential referral destinations could enhance responsiveness to obstetric emergencies in the public health facilities. Therefore, the policy makers at national and regional levels are advised to work

with relevant partners and donors to explore such technological options, pilot their applicability and viability and then to standardise their use in all health facilities as a long-term solution to address the issues of intrapartum stillbirth.

6.5.2 Health facility leaders and health professionals level recommendations

Most health facilities included in this study were public health centres that are first contact points for maternity care provision. The urban health extension services in Ethiopia focuses mainly on demand creation and promotion of positive health behaviours whereas any clinical services including maternity care are sought first at health centres and then at hospitals through appropriate referrals. Health facility and Woreda level leadership have important roles to play in administering and coordinating human resources, supplies, logistics, monitoring and reporting of clinical and outreach service delivery processes in the catchments of respective facilities. Accordingly, the following recommendations are channelled to the leadership at the health facilities, service providers and Woreda structures so that the different aspects of maternity care including technical skills of service providers, medical supplies and equipment and data management could be well organised to avoid the occurrence or to track any intrapartum stillbirth cases in the public health facilities:

- It is imperative that maternity care standards, guidelines and protocols which are approved at national level are strictly followed and applied by the service providers during the continuum of maternity service delivery. To this end, it is recommended that proper orientations, regular update/exchange meetings and minimum once-a-year refresher training workshops should be conducted at each facility level on the obstetric care guidelines and protocols to keep the health workers abreast with the standard obstetric practices.
- This study reviewed over 3200 charts of maternity care records in the public health facilities in Addis Ababa. Approximately 30% of these charts were rejected owing to incompleteness, inconsistency or inaccuracy in documenting the obstetric service procedures during antenatal, admission to labour or childbirth processes. Therefore, it is highly recommended that the process of documenting maternity care services in the health facilities should be tightened up. This includes the following:

- Completing the background information of pregnant women during their first antenatal visit.
 - Taking complete medical and obstetrical history of pregnant women and appropriately recording them on the charts.
 - Making accurate diagnosis and observations during subsequent ANC visits and transferring all relevant information on the charts.
 - Assessing the maternal and foetal health conditions during admission.
 - Keeping all the findings and observations on the records.
 - Applying the recommended labour monitoring interventions timely and registering them on the recommended charts accordingly.
- One of the commonly observed inconsistencies in the documentation of the maternity service delivery was related to the use of partograph in the public health facilities. To this effect, many facilities were not plotting the indicators on the partograph as per the standard procedures or some cases were managed without partograph or any other follow-up sheets. Heads of the public health facilities and Woreda structures are strongly encouraged to rectify these documentation challenges in respective sites.
 - One of the approaches to address gaps related to poor maternity service delivery and record keeping can be by introducing a system of regular supportive supervision that involves senior technical experts, district/Woreda health officials, relevant partner staff, and relevant staff from other health facilities. If carried out successfully with formalised checklists, onsite practical discussions, and adequate debrief each time supportive supervision is conducted, such exercise has a potential to improve the quality of maternity care services without criminalising the practitioners. To this effect, the leadership at the respective health facilities and their supervisors are highly encouraged to develop and run such a system to reduce intrapartum stillbirth and to improve maternity care services.
 - Maternity service providers' motivation and commitment are vital to reducing intrapartum stillbirth in the public health facilities. Localised and creative efforts to incentivise the obstetric care service providers including public recognition of best achievements, annual symbolic award to emphatic and high-quality service

providers, cross-learning and experience sharing with similar facilities in the vicinity, and supportive supervision as stated above could enhance the passion and motivation of service providers. Hence, its application is recommended to the relevant health facility leadership.

- Building the technical competency of maternity service providers can take both personal initiatives from the health professionals and intentional and well-planned interventions from the supervisors and health service managers at various levels. Based on the findings of this study, there were numerous technical areas including missed diagnosis of important signs of labour progress, lack of proper follow-up of labour progress using monitoring tools, incorrect plotting or inconsistent timing of clinical interventions during labour monitoring that were indications of inferior technical skills. These and other competency concerns should be addressed through regular learning and supervision opportunities as indicated above. A routine and planned maternity emergency drills or simulation of obstetrical emergency responses at facility level are recommended as part of the competency building and learning exercises. The service providers in the public health facilities should be required to demonstrate measurable efforts to self-develop through technical readings, case-presentations, and participation in training workshops as part of the expectations to qualify for annual licence renewal criteria. These inputs and processes should be traced through annual performance appraisal system with clear indicators to observe, track progress and document improvements in the obstetric care skills.
- To this effect, the facility and Woreda leadership should play a key role in instituting and tracking obstetric care skills including risk identification, accurate diagnosis of labour, provision of complete and comprehensive ANC services, effective communications with pregnant and labouring women and familiarity with national obstetric guidelines and protocols. Therefore, these skills should be observable and any deviation from the standards should be dealt with per ethical and HR policy provisions.
- Findings from this study further confirmed that successful uptake of recommended ANC visits and not being infected by HIV or syphilis during the index pregnancy had protective values against intrapartum stillbirth. Therefore, the health facilities

are highly encouraged to make universal coverage of recommended pregnancy-related screening tests and provision of comprehensive ANC services. Therefore, the health workers and facility leadership should make it a priority to promote early initiation of ANC and to ensure all required tools and supplies are in place to facilitate effective delivery of the ANC services to pregnant mothers without any interruptions.

- Many of the long-established risk factors including non-vertex foetal presentation at term, twin pregnancy and abnormal FHR on admission to labour remained among the key determinants to intrapartum stillbirth in the public health facilities of Addis Ababa. The facility level health workers and leadership are urged to adhere to the pregnancy risk identification and timely referral protocols with most sensitive responsiveness to such conditions.
- Leaders of the health facilities and relevant health professionals in the respective sites are responsible to initiate timely requests and to ensure the availability of critical medical supplies, facilities and equipment that are necessary to deliver high quality obstetrical care services. Although findings from this study did not suggest any gaps in this area, the widespread misdiagnosis of labour progress, oversight in undertaking important obstetrical interventions during labour admission or subsequent monitoring could be associated to the use of substandard technologies or medical supplies. For instance, the uses of doptone or digital FHR monitoring technologies improved obstetrical outcomes. Hence, it is recommended that the public health facilities should constantly gauge the relevance and availability of important medical inputs and supplies to reduce the incidence of intrapartum stillbirth.

6.5.3 Recommendations related to potential future research topics

Addressing the underlying determinants of intrapartum stillbirth would require continued research efforts to harness more specific and up-to-date scientific knowledge that can shape existing thoughts and practices around obstetric care service delivery. This research suggests that further studies using prospective research designs such as cohort or randomised controlled trial (RCT) should be conducted in similar settings to assess the causal effects of risk factors that were revealed in the current study that had had

associations with intrapartum stillbirth. This recommendation is based on the methodological superiority of prospective designs in establishing causal relationship between variables thereby to address the limitations identified earlier in this chapter. To this effect, the following topics are recommended for future studies to complement this current research endeavour:

- The findings on the effects of maternal medical conditions on intrapartum stillbirth were inconsistent with other studies. Therefore, it is recommended that a more rigorous study to determine the causal links between conditions like hypertension, diabetes, cardiac, and other chronic diseases and intrapartum stillbirth should be undertaken in similar settings.
- This study reported that women who received recommended quantity of ANC services were less likely to develop intrapartum stillbirth. However, owing to the absence of data on the medical records, it was not possible to explore the protective strength of each ANC visit and which preventive and promotive care services had impacts on the outcome variable. Therefore, it is recommended that a more detailed prospective study should be conducted to explore the specific causal relationships between the frequency, types and timing of ANC service on intrapartum stillbirth outcomes.
- Establishing intrapartum stillbirth was one of the biggest challenges this study encountered since there was limited classification of stillbirth data in the public health facilities. More importantly, the differences between intrapartum stillbirth and death of neonates in the first hour after birth have technical and ethical dilemma hence with chances of data overlap. Therefore, it is recommended that an observational prospective study that institutes clinical observations and accurate diagnostic techniques should be conducted to assess the exact magnitude of intrapartum stillbirth in the public health facilities.
- As indicated earlier in this chapter, the effects of medical supplies, equipment and health service providers' obstetric care competence were not directly assessed through this research for scope related reasons. However, there were indications from this study and clear findings from elsewhere regarding how the supply side of obstetric care affects pregnancy outcomes negatively. Therefore, it is

recommended that an observational comparative study should be conducted to establish more concrete empirical evidence on the potential causal links between the supply side factors including providers' skills, availability of medical supplies and equipment and intrapartum stillbirth.

- Admission to labour requires critical clinical decisions that emanate from correct assessment of maternal and foetal conditions using key obstetrical indicators including cervical dilatation, rupture of membrane, descent of fetal head and the condition of FHR. This study revealed that many of these indicators were significantly associated with intrapartum stillbirth. However, it is further recommended that a more rigorous design like prospective cohort should be considered to establish causal relations between the status of these indicators on admission, timing of labour admission and the intrapartum stillbirth outcome.
- Prospective observational study on the type and timing of standard labour monitoring interventions including FHR, maternal vital signs, vaginal examination, and episiotomy care is also recommended to establish causal links between these variables and intrapartum stillbirth through strict observation of these interventions and by collecting data prospectively.

6.6 CONTRIBUTIONS OF THE STUDY

This research aimed at assessing the trends and determinants of intrapartum stillbirth in the public health facilities of Addis Ababa. Intrapartum stillbirth has rarely been studied separately as many research efforts both in the health facility or population level had been focused rather on combined stillbirth. Despite the challenges with getting accurate data from the maternity care records in a retrospective manner, this study made important contribution in pioneering a research endeavour on intrapartum stillbirth. Intrapartum stillbirth accounts for about a third of total stillbirth cases globally and therefore research in this area should get due attention to understand the specific underlying causes so that appropriate course of interventions can be promoted.

This research further contributed by generating evidence on determinants and factors associated with intrapartum stillbirth. One of the strengths of this study was that the

assessment covered diverse aspects of obstetrical variables including medical and obstetrical conditions of risk factors during pregnancy, admission to labour, labour, and delivery. Accordingly, the study revealed several determinants that were associated with the occurrence of intrapartum stillbirth in the public health facilities. As presented in Chapter 5 of this thesis, the following were among the main predictors of intrapartum stillbirth in the public health facilities in Addis Ababa:

- Sero-status for HIV infection.
- Number of ANC visits.
- Status of membrane on admission for labour.
- Foetal heart rate (FHR) on admission for labour, foetal presentation during intrapartum period.
- Timing of uterine contraction monitoring, timing of vaginal examination (VE) during labour.
- Episiotomy being conducted and presence of eclampsia as an obstetric complication.

Accordingly, the study revealed key gaps in obstetrical care services ranging from ANC, quality of labour admission assessment and intrapartum clinical interventions in the public health facilities of Addis Ababa.

The study assessed these risk factors by comparing data from women who experienced intrapartum stillbirth against those who gave livebirth in the same facilities and time. Another important contribution of this study was its use of labour admission diagnosis on foetal status to exclude antepartum stillbirth, which will give a useful methodological perspective for future similar studies to harness more evidence on intrapartum stillbirth causes.

Stillbirth documentation and reporting has been less differentiated in the health facilities across the study setting limiting the ability of planners and health care providers to render focused interventions with appropriate timing. This study contributes to the domain by characterising intrapartum stillbirth as a sub-set of the bigger stillbirth category but with distinct and potentially modifiable determinants, the underlying factors of which could be addressed through improved obstetrical and clinical practices. Recommendations from

this study will contribute towards the improvement of antenatal and intrapartum care, classification of stillbirth, accurate documentation, and proper reporting of stillbirth in the health facilities. Furthermore, the frameworks and reminder tools on the timing of intrapartum care that are suggested in Chapter 7 of this study are among the important contributions to potentially improve the outcomes of pregnancy and childbirth in public health care system in Ethiopia.

6.7 LIMITATIONS OF THE STUDY

Stemmed from the study design, data collection methods and appropriate quantitative analyses, this research demonstrated many strengths. To this effect, the research relied on a case-control research design that was found most appropriate to study rare diseases and health conditions like stillbirth. One of the advantages of a case-control study design was related to the fact that many risk factors can be studied simultaneously where data can be collected on each of several potentially harmful exposures and can be analysed to see respective contributions in the causal associations. Moreover, case-control studies usually require much smaller sample sizes than do equivalent cohort studies, which ensure higher quality data management and more rigorous analysis. Accordingly, this study was conducted in the most rigorous manner including its choice of the study design and methods, data collection instruments and processes, data entry, cleaning and analysis using relevant tools and scientific techniques.

However, owing to the recognised limitations of the study design and owing to the nature of data obtained from health facility medical records, the following points can be considered as limitations of this study:

- The case-control research design does not involve a time sequence and not able to confirm causality between risk factors and outcomes. Accordingly, it was not evident whether the key obstetric interventions and medical conditions after admission to labour that were revealed as having significant associations with intrapartum stillbirth preceded the incidence. For instance, not receiving an episiotomy care was associated with intrapartum stillbirth. However, owing to the data having been collected retrospectively and given there was no evidence suggesting the baby was alive at the time the episiotomy was conducted, it was not possible to determine the sequence of the two events. Because of this potential

limitation, concrete recommendations to promote episiotomy could not be made with certainty.

- Unbiased information that can be retrieved from records such as medical documentations are believed to address the recall and interviewer biases. However, relying on pre-recorded data could also be another source of bias if such records had flaws in the way they captured information on cases and controls at the time of recording. To this effect, this current research used maternity medical records from the public health facilities. Although all medical charts with incomplete and inaccurate information were excluded from this study through strict inclusion criteria, the analysis and findings could have been more robust if a prospective design was employed and first-hand data were collected on the important variables.
- The maternity medical records in the public health facilities had a large quantity of missing or less detailed data owing to incomplete recording of intrapartum or any other obstetric care services. Accordingly, many charts were excluded from the analysis. This might have affected the strength of measuring aggregate associations between the key variables and intrapartum stillbirth.
- This study did not attempt to establish causal relationship between the different study variable and intrapartum stillbirth because the medical records of obstetric care in the public health facilities in Addis Ababa did not contain data on underlying causes of the incidence. The absence of such data limited the ability of this research to recommend or develop appropriate interventions to respond to the heavy toll of intrapartum stillbirth and to equip service providers with more relevant set of skills and additional knowledge.
- Despite the use of an inclusion criterion that focused on the presence of foetal heart rate at admission to labour that helped to exclude any antepartum stillbirth cases from the data, a few cases of immediate neonatal deaths might have crept into the dataset simply because of limited differentiations of death around childbirth in the public health facility records. Any records indicating immediate neonatal death were removed during screening and data collection. However, if any undocumented immediate neonatal death cases were included because of

undifferentiated recording system, the corresponding findings from this study should cover a timespan between admission and immediate neonatal period elapsing particularly the first hour after delivery.

- Trends analysis relied on HMIS data from the AAHRB and FMoH, which had some inconsistency with the number of public health facilities reported on stillbirth across the five years in this review. Furthermore, the HMIS data did not categorise stillbirth into intrapartum and otherwise therefore aggregated trends at the city level were analysed only for the broader stillbirth category. This limitation was partially addressed by showing illustrative trends on intrapartum stillbirth based on the data obtained from the health facilities sampled for this study.

6.8 CONCLUDING REMARKS

Given the relative little attentions in studying intrapartum stillbirth separately in the health facility setting in Ethiopia, this research sets a strong precedence in assessing risk factors and determinants associated with the latter. The research enjoyed strong methodological relevance where quantitative data was collected and analysed using scientifically appropriate tools and methods. The findings indicated that the City of Addis Ababa experienced a high burden stillbirth at an average rate of 28 per 1000 births without consistent decline during the period 2010-2015. Frequency of ANC, HIV and syphilis infections, foetal presentation during the last ANC visit or admission to labour, FHR during admission, monitoring of maternal vital signs during labour and delivery, obstetric complications including eclampsia and uterine rupture during the index pregnancy were among the key determinants and factors associated with intrapartum stillbirth in the public health facilities of Addis Ababa. Recommendations corresponding with the key findings were generated from this research and it is envisaged that their applications are deemed useful in addressing some of the underlying determinants of intrapartum stillbirth.

CHAPTER 7

FRAMEWORK OF SUGGESTED ACTIONS TO CLASSIFY AND REDUCE INTRAPARTUM STILLBIRTH IN THE PUBLIC HEALTH FACILITIES OF ETHIOPIA

7.1 INTRODUCTION

The death of a child before birth is a tragedy for families. Evidences indicate that stillbirth can be addressed by tackling the underlying causes including the quality of care, uptake of maternity care services and socioeconomic disparities in societies. The conceptual framework that was presented in Chapter 2 of this research clearly outlined potential risk factors and evidence-based interventions along the reproductive lifecycle of a woman. The lancet series on stillbirth further revealed that stillbirth can be reduced through improvements in the health status of women, through improvements in quality of maternity care and with reductions in social inequities (Flenady et al., 2016:691).

Findings from this study confirmed that several modifiable risk factors including maternal infection, low uptake of ANC, multiple pregnancy, poor diagnosis at admission to labour, substandard monitoring of labour and obstetric complications like eclampsia or pre-eclampsia have contributed to the high burden of intrapartum stillbirth in the public health facilities of Addis Ababa. Against this background, intrapartum stillbirth should be considered as one of the quality indicators of obstetric care in health facilities as many of these determinants could have been averted if standard and evidence-based obstetric interventions were applied during pregnancy, labour or childbirth process. Concrete recommendations were further provided in Chapter 6 of this thesis to respond to some of these key determinants of intrapartum stillbirth. Chapter 7 focuses on issues related to poor classifications and recording of intrapartum stillbirth in the health facilities where more practical frameworks and tools are suggested for actions by obstetric care providers. This chapter further addresses the last two objectives of this research which aimed to explore tools to differentiate intrapartum stillbirth from antepartum and early neonatal deaths as well as to develop a reminder system so that labour monitoring could take place as per the recommended intervals and quality in the public health facilities of Addis Ababa.

These actionable steps should be considered as extensions of the recommendations from this study and by no means should be treated as binding guidelines given the purpose was to inspire policy makers and practitioners to further evaluate the current tools and approaches around stillbirth classification and labour monitoring in the public health facilities in Ethiopia. It is hoped that the framework of actions and other recommendations from this research will trigger policy discussions around among relevant authorities at the FMOH and AARHB.

7.2 SUGGESTED FRAMEWORK OF ACTIONS TO CLASSIFY STILLBIRTH IN THE PUBLIC HEALTH FACILITIES

As it was extensively discussed in the literature review chapter of this research, accurate classification of stillbirth would help to identify deficiencies in the provision of obstetric care, focus attention where improvements are already possible and to indicate where new developments or knowledge may be expected to lead to further advancements in the obstetric science. Furthermore, classification of stillbirth, which involves systematic assembly, storage and retrieval of the underlying cause of death and/or other relevant information, is accepted as a crucial step towards the goal of reducing the occurrence of stillbirth. On the contrary, suboptimal classification systems may lead to a loss of important information and contribute to a high proportion of unexplained deaths thereby diminishing the potential of immediate and longer term prevention strategies including research to address knowledge gaps (Flenady et al., 2009:1).

As indicated in the data capturing tools of the public health facilities in Addis Ababa (Figure 7.1 below), the current practice of classifying stillbirth consists of two categories, namely, macerated and fresh stillbirth. Although maceration indicates that the death of foetus had occurred at least eight hours earlier, it does not necessarily imply that the foetal death had occurred during antepartum period unless supported by admission documentation of FHR and other indications of foetal life (Gold, Abdul-Mumin, Boggs, Opare-Addo & Lieberman, 2014:223). Given the findings from this study where over 30% of public health facilities had incomplete documentation regarding the labour admission assessments and intrapartum care interventions, it is likely that the current stillbirth categorisation may not represent accurate timing of foetal death and the interval between death and delivery.

Delivery Summary										
Date	Time:	SVD	<input type="checkbox"/>	C/Section	<input type="checkbox"/>	Vacuum/Forceps	<input type="checkbox"/>	Episiotomy	<input type="checkbox"/>	
AMTSL: Ergometrine		<input type="checkbox"/>	Placenta: Completed		<input type="checkbox"/>	Laceration rep: 1st degree		<input type="checkbox"/>		
Oxytocine		<input type="checkbox"/>	Incomplete		<input type="checkbox"/>	2nd degree		<input type="checkbox"/>		
Misoprostol		<input type="checkbox"/>	CCT		<input type="checkbox"/>	3rd degree		<input type="checkbox"/>		
			MRP		<input type="checkbox"/>					
NEWBORN: Single		<input type="checkbox"/>	Multiple		<input type="checkbox"/>	Alive		<input type="checkbox"/>	Apgar score	
SB: Mac		<input type="checkbox"/>	Fresh		<input type="checkbox"/>					
Sex: Male		<input type="checkbox"/>	Female		<input type="checkbox"/>	Birth wt.(gm.)			Length (cm.)	
Term		<input type="checkbox"/>	Preterm		<input type="checkbox"/>					
BCG (Date)			Polio 0			Vit K		<input type="checkbox"/>	TTC	<input type="checkbox"/>
Baby mother Bonding										<input type="checkbox"/>
Obstetric Cx: Managed			Referred			Managed			Referred	
Eclampsia		<input type="checkbox"/>				PPH		<input type="checkbox"/>		<input type="checkbox"/>
APH		<input type="checkbox"/>				PROM/Sepsis		<input type="checkbox"/>		<input type="checkbox"/>
Ruptured Ux		Repaired	Hysterect			Obst/prolg labor		<input type="checkbox"/>		<input type="checkbox"/>
HIV counselling and testing in the past		<input type="checkbox"/>	Y		<input type="checkbox"/>	HIV Couns. and testing offered		<input type="checkbox"/>	Y	<input type="checkbox"/>
HIV Testing accepted		<input type="checkbox"/>	Y		<input type="checkbox"/>	HIV Test result		R	<input type="checkbox"/>	NR
ARV Px for mothers (by Type)						ARV Px for NB (by type)				
Feeding Option		EBF	RF							
Mother referred for care & sup.		<input type="checkbox"/>	Y		<input type="checkbox"/>	Newborn referred for Chronic care		<input type="checkbox"/>	Y	<input type="checkbox"/>
Remark:										
Delivered by:				Sign:						
Post Partum Visit										

Figure 7.1 Excerpt from the obstetric service delivery form in the public health facilities

Figure 7.1 is taken from the summary page of obstetric care service delivery in the public health facilities in Addis Ababa. Accordingly, the stillbirth (SB) section indicates that only two variables namely Macerated (Mac) and Fresh are included. These categories of stillbirth lack accuracy in classification of the event. Such absence of clear segmentation on the timing of foetal demise might also extend to the immediate neonatal period where babies born with signs of life but died shortly afterward might have been counted as stillbirth owing to limited diagnostic skills or ethical concerns on the side of service providers. This likely scenario was described in Chapter 3 of this thesis as “grey nexus” characterising potential confusions surrounding stillbirth recording and reporting in the public health facilities in Addis Ababa. For instance, a survey conducted by FMOH in 2008 documented the combined institutional stillbirth and early neonatal death at 45 per 1000 births. The survey further noted large number of stillbirths against very few early neonatal deaths (in the ratio of 14:1) which raised a question of accurate classification and recording of newborn deaths (FMOH, 2008:20).

It is against this background that the following steps and materials have been proposed by the researcher as actionable framework to improve the situation regarding classification of stillbirth in the public health facilities.

7.2.1 Short-term actionable steps for stillbirth classification

The first and most important step in estimating the timing of stillbirth for deliveries taking place in health facilities comes from an accurate diagnosis of FHR on admission to labour. This action should be taken as a watershed for differentiating institutional stillbirth from pre-admission foetal loss. It will be considered fallacious to report macerated stillbirth when the labour admission record indicates that the foetus was alive on admission. This would require revisiting the current categorisation of stillbirth on the delivery summary sheet changing it to antepartum and intrapartum classification instead of “fresh and macerated”. The cut-off point being the presence or absence of FHR on admission, the antepartum stillbirths can be further classified into “fresh” and “macerated” depending on the appearance of the stillborn baby. On the other hand, stillborn babies with FHR on admission should be referred as “intrapartum stillbirth.”

The second biggest challenge in establishing clarity around stillbirth documentation in the health facilities was related to the overlap between intrapartum stillbirth and the neonatal death that might have occurred in the first few hours after birth. A study conducted in six sub-Saharan African countries including Ethiopia revealed that approximately 11% of babies born alive but with some breathing difficulties died immediately after birth. It was further noted that simple, evidence-based essential newborn care (ENC) interventions including giving appropriate stimulation for newborns unable to breathe, providing additional neonatal resuscitation measures and proper positioning of the baby that can be conducted by skilled providers and supported with available commodities could save these losses (De Graft-Johnson, Vesel, Rosen, Rawlins, Abwao, Mazia, Bozsa, Mwebesa, Khadka, Kamunya, Getachew, Tibaijuka, Rakotovao & Tekleberhan, 2017:e014680). As reported by the Ethiopian national survey indicated in the previous paragraph, it is highly likely that many of these babies who died in the first “golden hour” after birth could have been misclassified as “fresh” stillbirth for ethical reason or misdiagnosis. The latter situation could be addressed by enforcing service standards including strict measurement and recording of Apgar scores, essential newborn interventions, simple resuscitation practices, correct diagnostic skills and timely referral

to advanced neonatal care facilities. Recording of any immediate neonatal death could also be made easier by adding a space in the delivery summary section of the integrated maternity care card. The following diagram and bullet points present the suggested modifications to improve stillbirth classifications in the public health facilities in Addis Ababa as short-term measures. These suggestions call for only minor modification of the recording forms, strengthening the existing supervision systems, and refreshing the skills of obstetric service providers. Therefore, the financial and logistical burdens can be considered as minimal.

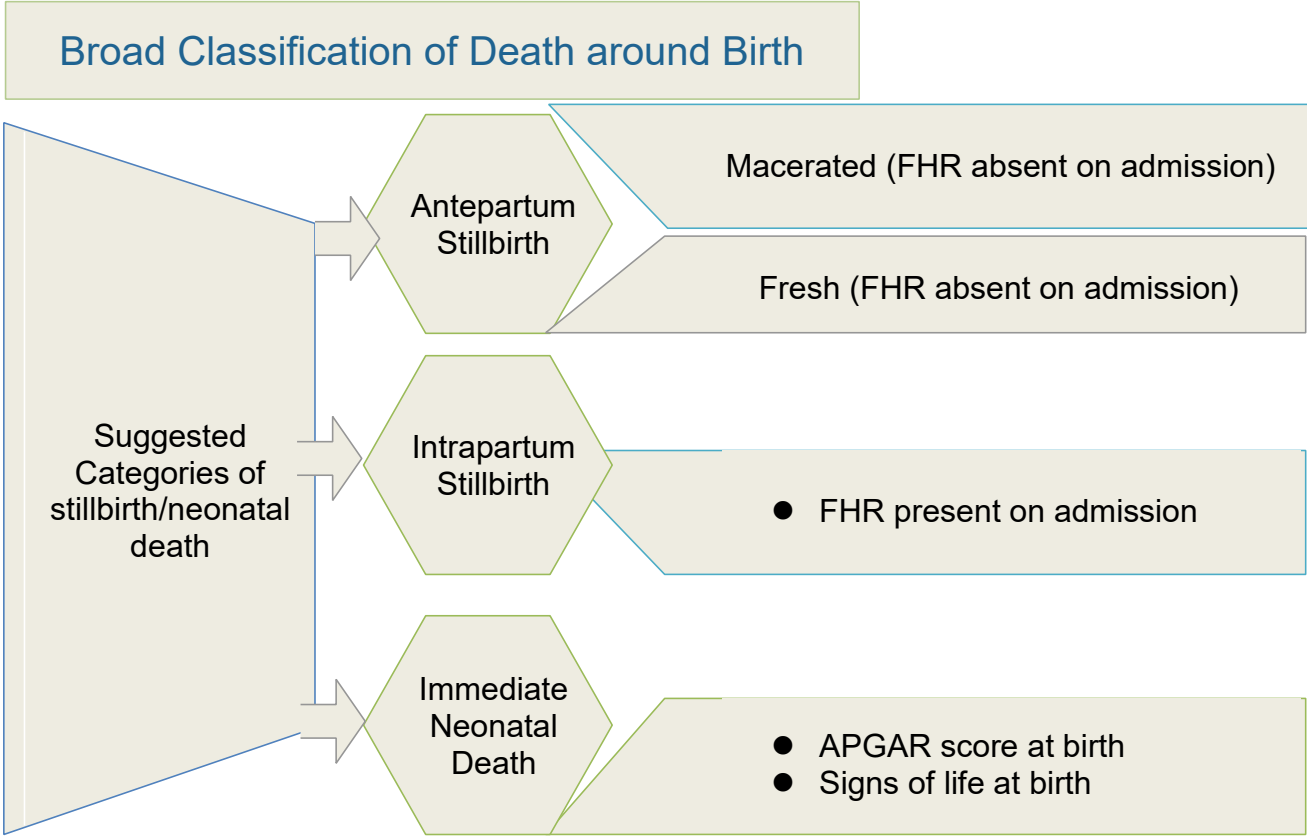


Figure 7.2 Suggested short-term options to address gaps related to stillbirth categorisation

To integrate the above three classifications into health facility level obstetric service data, the following key steps and activities are recommended. These activities presuppose that FHR on admission and during labour monitoring as well as accurate diagnosis of immediate newborn status using the existing Apgar score technique are critical tools to classify stillbirth around delivery time.

- Include FHR indicators to admission notes on the Partograph or any admission sheet depending on the practice a given public health facility undertakes. This will make measuring FHR on admission a requirement.
- Accordingly, ensure that FHR is measured and correctly recorded on the admission sheet for every woman admitted for labour and delivery in the health facilities. It is likely that Partograph plotting might not begin immediately depending on the cervical dilatation status. However, keeping record of FHR on admission regardless would provide critical indication on the foetal condition on admission.
- Conduct ongoing measurement of FHR as per the recommended interval during labour monitoring.
- The Apgar score is considered as one of the most important tools to rule-out stillbirth from livebirth. Chart review in the context of this study showed that public health facility records were incomplete regarding this indicator; hence, the relevance of strict follow-up and enforcement by authorities and service providers alike.
- Institute a system to cross-check FHR record on admission and during labour monitoring period against the first Apgar score result before making a final documentation of the status of the foetus as a still or live birth.
- Classification of stillbirth based on appearance of the foetus at delivery as “macerated” and ‘fresh” might obscure the estimation of timing of foetal death particularly given the current gaps in consistently measuring FHR on admission and during labour monitoring. This lack of differentiation will further limit appropriate prevention efforts. Therefore, health facilities and obstetric care providers are strongly advised to consider using the “antepartum/intrapartum” calcifications as proposed in the next bullet point. It is also recommended that immediate neonatal death should also be captured on the integrated maternity care card separately as this seems missing currently.

- Revise the delivery summary data capturing page on the integrated maternity care card to revise the stillbirth indicators in the following proposed manner:
 - SB: Antepartum SB – 1) Macerated 2) Fresh
 - : Intrapartum
 - Immediate Neonatal Death
- Create additional space in the maternity register to capture the three classifications of death around delivery so that subsequent reporting and any quick review could reveal the data corresponding with what was recorded on delivery summary card.

7.2.2 Medium- to long-term steps for stillbirth classification

The literature review chapter of this thesis has discussed several stillbirth classification options based on research findings and internationally recognised systems. Accordingly, over 80 different stillbirth classification systems of varying characteristics had been identified. These systems are in addition to the WHO's international classification of disease 10th version (ICD-10). Different justifications including the need to add features and missing categories, increase accuracy, reach new user groups, enable identification of underlying causes, and reduce the number of "unexplained" deaths had been provided for the development of these systems. Some of these systems are applied only in specific regions or countries and only 21% of them were consistent with the codes of ICD (Leisher, Teoh, Reinebrant, Allanson, Blencowe, Erwich, Froen, Gardosi, Gordijn, Gulmezoglu, Heazell, Korteweg, Lawn, McClure, Pattinson, Smith, Tuncalp, Wojcieszek & Flenady, 2016:2).

Of these multiple systems, a few had been applied in different settings depending on the availability of resources and relevant skills. Each system demonstrates its unique strength and limitations. However, what is common to many of them is the fact that coding of the stillbirth was based on clinical or pathological observations with the intention to determine the underlying causes or conditions that led to the event. To this effect, some studies assessed the comparative strength of each of these systems based on their ability to effectively classify stillbirths, ease of use, inter-observer agreement, and ability to retain information. For instance, Aminu et al. (2014:141) reviewed six stillbirth classification systems including Amended Aberdeen, Extended Wigglesworth, PSANZ-PDC, ReCoDe,

Tulip, and CODAC that were frequently used in different health facility settings. Accordingly, CODAC, PSANZ-PDC and ReCoDe had relatively better chance of accurately categorising stillbirth with some degree of ease (Aminu et al. 2014:141). Each system uses different criteria. For instance, Relevant Conditions at Death (ReCoDe) relies on descriptions as “what”, “when”, and “why” the clinical situation occurred whereas Cause of Death Associated Conditions (CODAC) seeks that the cause of perinatal death should be classified under categories including infection, neonatal, intrapartum, congenital anomaly, foetal, cord, placental, unknown, and termination (Jason & Robert, 2010:114 ; MBRRACE-UK, 2013:15).

This framework of action presented the above background descriptions on different systems of stillbirth classification to expand perspectives on the existing options and to ignite ongoing discussions at various levels within the Ethiopian health system as which system would be more appropriate. However, the researcher strongly argues that owing to lack of consistency across the different systems, limited feasibility of undertaking the required clinical and pathological assessments in public health facility and for reasons of international comparability many of these systems would not be easily applicable in the Ethiopian public health facilities in the foreseeable future. Therefore, the most appropriate medium- to long-term (3 to 7 years) option to standardise stillbirth classification in the health facilities would be adapting the International Classification of Diseases for Perinatal Mortality (ICD-PM) codes and reporting system.

WHO in collaboration with partners has developed a system to effectively classify the perinatal death using coding rules of the 10th revision of the International classification of diseases and related health problems (ICD-10). Moreover, this was done by closely modelling on the WHO application of ICD-10 to deaths during pregnancy, childbirth, and the puerperium: ICD-maternal mortality (ICD-MM), which aims to “facilitate the consistent collection, analysis and interpretation of information on maternal deaths” (Allanson, Tuncalp, Gardosi, Pattinson, Erwich, Flenady, Froen, Neilson, Chou, Mathai, Say & Gulmezoglu, 2016:79).

Subsequently, WHO released a detailed guideline on the ICD-PM approach to classify causes of death that would allow perinatal deaths to be captured in settings where investigations such as post-mortem or placental histology alongside deaths are not

feasible. This classification system considers the following steps in determining the timing and probable causes or conditions around perinatal death:

- Deaths are first grouped according to timing – whether the death occurred in the antepartum period (prior to the onset of labour), intrapartum or in the neonatal period.
- The main cause of perinatal death is assigned and grouped according to the new ICD-PM groupings.
- The main maternal condition at the time of perinatal death is assigned and grouped according to the new ICD-PM groupings (WHO 2016c:1).

Hoping the Ethiopian public health facilities would have applied the modified stillbirth recording system recommended as a short-term framework of action in this thesis, transitioning into the ICD-PM classification would be easier as the major categorisation of stillbirth in antepartum, intrapartum and neonatal segments are essentially similar.

The ICD-PM application requires grouping of the main conditions of foetus and neonates at death based on clinical and obstetric judgements under the three headings for timing of death classified antenatal (A), intrapartum (I) and neonatal (N). There are six groups of antepartum causes of death, designated by a leading “A”; seven groups of intrapartum causes of death, designated by a leading “I”; and 11 groups of neonatal causes of death, designated by a leading “N”. All the ICD-10 codes that can be assigned to the perinatal cause of death on a death certificate are represented in these new groupings. The ICD-10 codes have been reordered and clarified to better represent the pathologies at different times of perinatal death. However, codes that are not considered to be a cause of perinatal death in these sections have been excluded from the ICD-PM groupings (ibid).

Similarly, the five existing ICD-10 groups of maternal conditions in perinatal death have been rearranged into four groups to document the underlying situation simultaneously in order to triangulate the stillbirth calcification (ibid).

Therefore, the application of ICD-PM classification system presupposes that obstetric care providers in the health facilities should make accurate diagnosis of each fatal outcome of pregnancies. This should be based on their clinical and obstetric knowledge and skills, identify corresponding codes for the cause of foetal death and maternal

condition at the time of the event, and tally the specific cause and conditions in the matrix, maintaining the timing categories in appropriate cells of the summary matrix where the codes should be placed.

Adapting the ICD-PM approaches for stillbirth classification might require additional efforts and resources as indicated at the bottom of this section. However, this framework of actions is consistent with the various strategic initiatives and high impact priorities including quality, equity, excellence in service delivery that were stipulated in Ethiopia's health sector transformation plan. The recommendation to standardise the classification of stillbirth has relevance to the strategic initiative that calls for advancing the data collection, aggregation, reporting and analysis practice; promoting the culture of information use at place of generation; harnessing ICT; improving data visibility and access; and strengthening verification and feedback systems (FMOH, 2015a:12).

The following template presents the summary of the ICD-PM matrix combining key classification of stillbirth along with the timing of death and maternal conditions at the time of the foetal death.

	Maternal condition	M1: Complications of placenta, cord and membranes	M2: Maternal complications of pregnancy	M3: Other complications of labour and delivery	M4: Maternal medical and surgical conditions	M5: No maternal condition identified	Other	Total (%)
Perinatal cause of death								
Antepartum death (A)								
A1: Congenital malformations, deformations and chromosomal abnormalities								
A2: Infection								
A3: Antepartum hypoxia								
A4: Other specified antepartum disorder								
A5: Disorders related to fetal growth								
A6: Fetal death of unspecified cause								
Total (%)								
Intrapartum death (I)								
I1: Congenital malformations, deformations and chromosomal abnormalities								
I2: Birth trauma								
I3: Acute intrapartum event								
I4: Infection								
I5: Other specified intrapartum disorder								
I6: Disorders related to fetal growth								
I7: Intrapartum death of unspecified cause								
Total (%)								
Neonatal death (N)								
N1: Congenital malformations, deformations and chromosomal abnormalities								
N2: Disorders related to fetal growth								
N3: Birth trauma								
N4: Complications of intrapartum events								
N5: Convulsions and disorders of cerebral status								
N6: Infection								
N7: Respiratory and cardiovascular disorders								
N8: Other neonatal conditions								
N9: Low birth weight and prematurity								
N10: Miscellaneous								
N11: Neonatal death of unspecified cause								
Total (%)								

Figure 7.3 International classification of death: Perinatal mortality (ICD-PM)
(WHO, 2016c:1-75)

Furthermore, the following steps are recommended as a medium- and long-term process in adapting the ICD-PM classification system to effectively capture stillbirth data in the public health facilities:

- The FMOH and AARHB officially endorse the ICD-PM guide for application in the health facilities (the guide can be found through this link: <http://apps.who.int/iris/bitstream/10665/249515/1/9789241549752-eng.pdf>)
- Customise the ICM-PM guide to the health facility context in Ethiopia by reviewing the specific codes against appropriate clinical and obstetric diagnostic capabilities in the health facilities. This review can be undertaken through experts' consultations and national validation workshops.
- Integrate the adapted ICM-PM classification code and categories into the health facility maternity service recording and reporting tools.
- Provide training and orientation to obstetric care providers, health facility level data clerks and respective health facility leadership to familiarise them with the ICD-PM codes and applications.
- Enforce the utilisation of ICD-PM classification system through ongoing supervision and follow up thereby motivating the end users.
- Enhance the diagnostic skills of obstetric care providers through training, supportive supervisions, organising cases management sessions, regular live simulation/demonstrations and drills. It is also advisable to establish a few centres of excellence at selected public health centres and hospitals to promote high quality clinical, pathological and obstetric diagnostic skills and capabilities that will lead to accurate classification of stillbirth and immediate neonatal death as per the ICD-PM approaches which can be scaled up depending on resource availability.

7.3 SUGGESTED FRAMEWORK OF ACTION TO REMIND TIMELY APPLICATION OF STANDARD LABOUR MONITORING INTERVENTIONS IN HEALTH FACILITIES

As discussed in Chapter 5 of this thesis, for women receiving quality intrapartum care, as in many high-income countries, the proportion of intrapartum stillbirths is less than 10% of all stillbirths, indicating that a substantial proportion of intrapartum stillbirths are preventable with improved quality of intrapartum care (Darmstadt et al. 2009:6). To this effect, close monitoring and follow-up of women in active labour by skilled obstetric care providers is critical to determine the progress of labour and to facilitate successful childbirth or to manage any obstetrical emergencies timely. WHO encourages the use of partograph in all health facilities to monitor the progress of labour. Partograph is designed to allow for recordings at 15 minutes intervals and includes: foetal heart rate; maternal

temperature; pulse; blood pressure; details of vaginal examinations; strength of contractions; frequency of contractions in terms of the number in 10 min; fluid balance; urine analysis and drugs administered (Fraser & Cooper, 2009:102).

However, despite its wide acceptance and implementation globally, the use of partograph has not successfully improved birth outcomes in many settings because of several factors including incorrect or inconsistent use, time constraints, lack of knowledge of the partograph, limited motivation of health workers, and high caseload in some of the health facilities. While there is general agreement that the partograph use may not be clinically effective in reducing adverse health outcomes, there is currently no alternative to partograph for labour monitoring. Recent innovations in this area have focused on different presentations of partograph, such as Partopen and electronic partograph, without challenging its clinical foundations (Oladapo, Souza, Bohren, Tuncalp, Vogel, Fawole, Mugerwa & Gulmezoglu, 2015:48).

Currently, WHO has sponsored research projects including “Better Outcomes in Labour Difficulty” (BOLD); Simplified, Effective, Labour Monitoring-to-Action tool (SELMA) and Passport to Safer Birth to develop alternative labour management algorithms and innovative set of service prototypes and/or tools that would address the technical limitations facing the use of partograph in health facilities (Bohren, Oladapo, Tuncalp, Wendland, Vogel, Tikkanen, Fawole, Mugerwa, Souza, Bahl, Gulmezoglu & Group, 2015:2).

While the above potential innovations are hoped to improve birth outcomes in the health facilities in low and middle-income countries, it might take a few years before the tools and associated user guides become available and rolled out to end users. In the meantime, and in the absence of compelling alternative tools to facilitate labour monitoring, effective use of the WHO modified partograph in the health facilities would still be highly appropriate.

Pending the application of a more sensitive and interactive ICT-based solutions to monitor and manage labour in health facilities as recommended in Chapter 6 of this thesis, this framework of action emphasises on the following three concrete steps as short-term options to improve the process of labour monitoring.

7.3.1 Strengthen the analytical links between admission data and intrapartum monitoring data to make sound obstetric care decisions during childbirth

Obstetric care providers in each health facility have responsibility to treat each labouring mother as a unique individual with different and often acute needs. Based on the findings from this study, the loop between labour admission assessment results, subsequent labour monitoring and how these interventions determine the obstetric care decisions are not well connected. Moreover, tracing the status of the foetus and the mother based on critical obstetric and labour monitoring indicators would require sensitivity to each and the application of obstetric skills including sound technical competence and taking prompt decisions in the wake of any obstetric complications. Consistent with the gaps observed in this study, the following diagram shows these important milestones along the curve of obstetric care in the health facilities that need to be well connected and cross-referred to reduce intrapartum stillbirth.

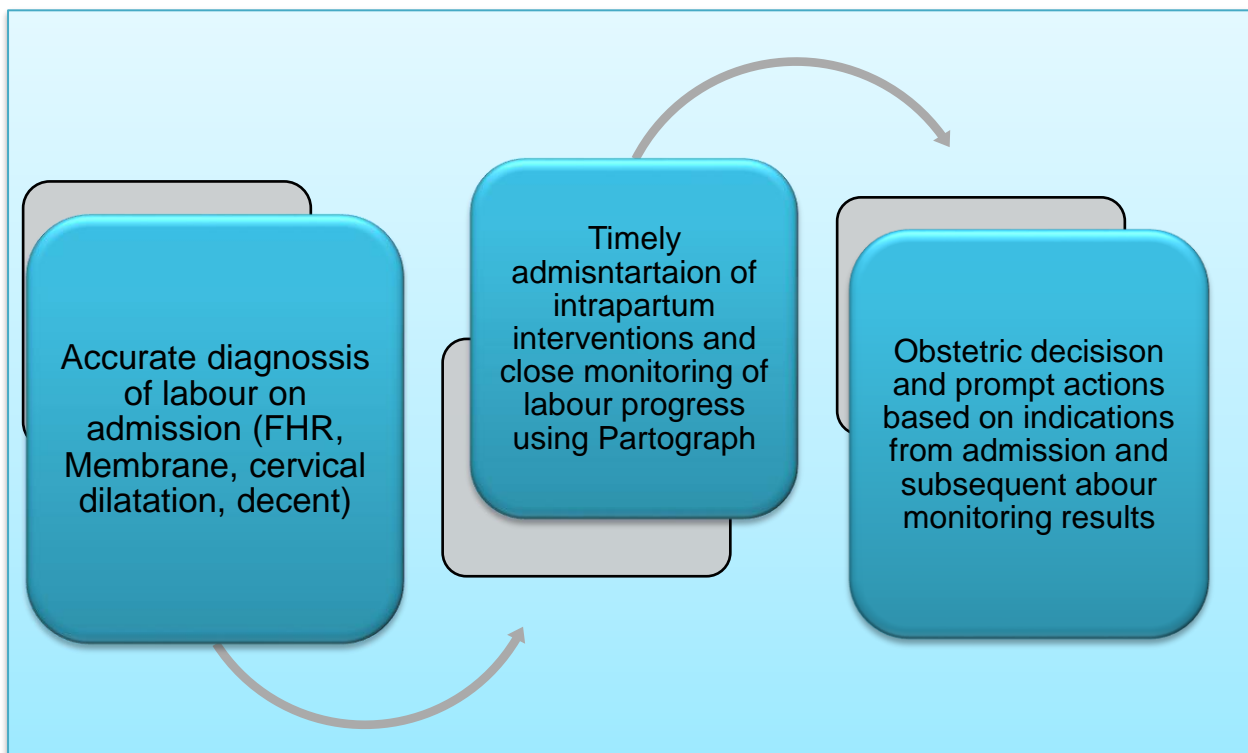


Figure 7.4 Key actions in the “admission–delivery” pathway for a successful birth outcome in public health facilities

Additionally, the following concrete steps are suggested as a framework of actions to strengthen the process of crosschecking intrapartum monitoring data to facilitate obstetric care decisions:

- Each case of labour admission should be clearly recorded against all critical indicators including FHR, status of membrane, duration of labour, status of cervical dilatation, and foetal descent.
- Once admitted to a labour ward, consistent follow-up and timely administration of intrapartum care interventions for each labouring woman should be enforced as a strict standard procedure. Sensitivity/responsiveness, competence to discern complications, and timeliness are critical virtues during this process. Evidence is scanty regarding gold-standards for intervals of each intrapartum care interventions during labour monitoring and some further argue that some of the conventionally agreed timings are less practical in short staffed and busy obstetric care facilities in resource-limited settings (Maaloe, Housseine, Van Roosmalen, Bygbjerg, Tersbol, Khamis, Nielsen & Meguid, 2017:4). However, this framework of action recommends the use of those conventionally agreed intervals for all critical labour monitoring indicators until more convincing and conclusive empirical evidence could be generated on the subject.
- Ongoing supportive supervision, retrospective case discussions, skills building through targeted trainings and orientation of relevant staff, regular obstetric team drills to simulate the linkages between admission data, intrapartum interventions and delivery outcomes are suggested to enhance the competence and motivation of obstetric care providers.
- Use of criteria-based audit to review the case-files of intrapartum stillbirth retrospectively and identify and discuss potential gaps in the obstetric care pathway to enhance service providers' skills without being judgmental (Mgaya, Litorp, Kidanto, Nystrom & Essen, 2016:343).

7.3.2 Consistent application of the WHO partograph for labour management in the health facilities

This current study revealed that the WHO partograph is being used inconsistently in the public health facilities of Addis Ababa. Previous assessments in the same settings also confirmed substandard use of partograph where only approximately 30% completion for FHR, 33% completion for cervical dilatation and 21% for uterine contraction while monitoring labour in public health facilities (Yisma et al., 2013:1). Given the fact that the partogram is currently in widespread use, and generally accepted, until stronger evidence

is available, the use of WHO modified partograph seems highly appropriate in the health facilities in resource-limited settings like Ethiopia (Lavender, Hart & Smyth, 2012:1).

Therefore, this framework of actions outlines the following steps to ensure correct and consistent use of the WHO modified partograph in the public health facilities of Addis Ababa. These suggested steps presuppose that the combination of factors such as skills, motivation, workload and lack of close monitoring/supervision can affect the accurate utilisation of partograph in the public health facilities; hence need to be duly addressed.

- Conduct a quick skills-audit among obstetric care providers in the public health facilities to check on their level of competence in measuring intrapartum monitoring indicators, recording the results on the WHO partograph, interpreting the findings and taking appropriate decisions.
- Based on the findings from these audits and consistent with the current obstetric care guidelines, design a hands-on, skills-building training manual to refresh the service providers on the subject. It is highly recommended that such a training should consider adult-centred and experiential learning approaches that consist of practical demonstrations and adult leaning techniques.
- Administer the skills trainings in a cascaded manner where training of trainers at Woreda/Sub-city level can roll out subsequent learning sessions in clustered facilities preferably inclusive of real case management during the sessions.
- Keep a poster of a correctly completed partograph (a copy included below) on the walls of the obstetric care providers' offices as a constant reminder to promote accurate application of partograph for labour management.
- Conduct a well-organised, focused, and regular supportive supervision to obstetric care providers from across the health system ladders including the sub-cities, regional health bureau and facility technical leadership
- Integrate the quality of intrapartum care service delivery including partograph use into service providers' job performance objectives. Accordingly, recognise best performing obstetric care providers through annual awards, public appreciations and certification to motivate committed staff and create a spirit of healthy competition among service providers. On the contrary, punish those who consistently fail to meet such expectations.

Name **Mrs. S** Gravida **3** Para **2+0** Hospital number **7886**
 Date of admission **12.5.2000** Time of admission **5:00 A.M.** Ruptured membranes **1** hours

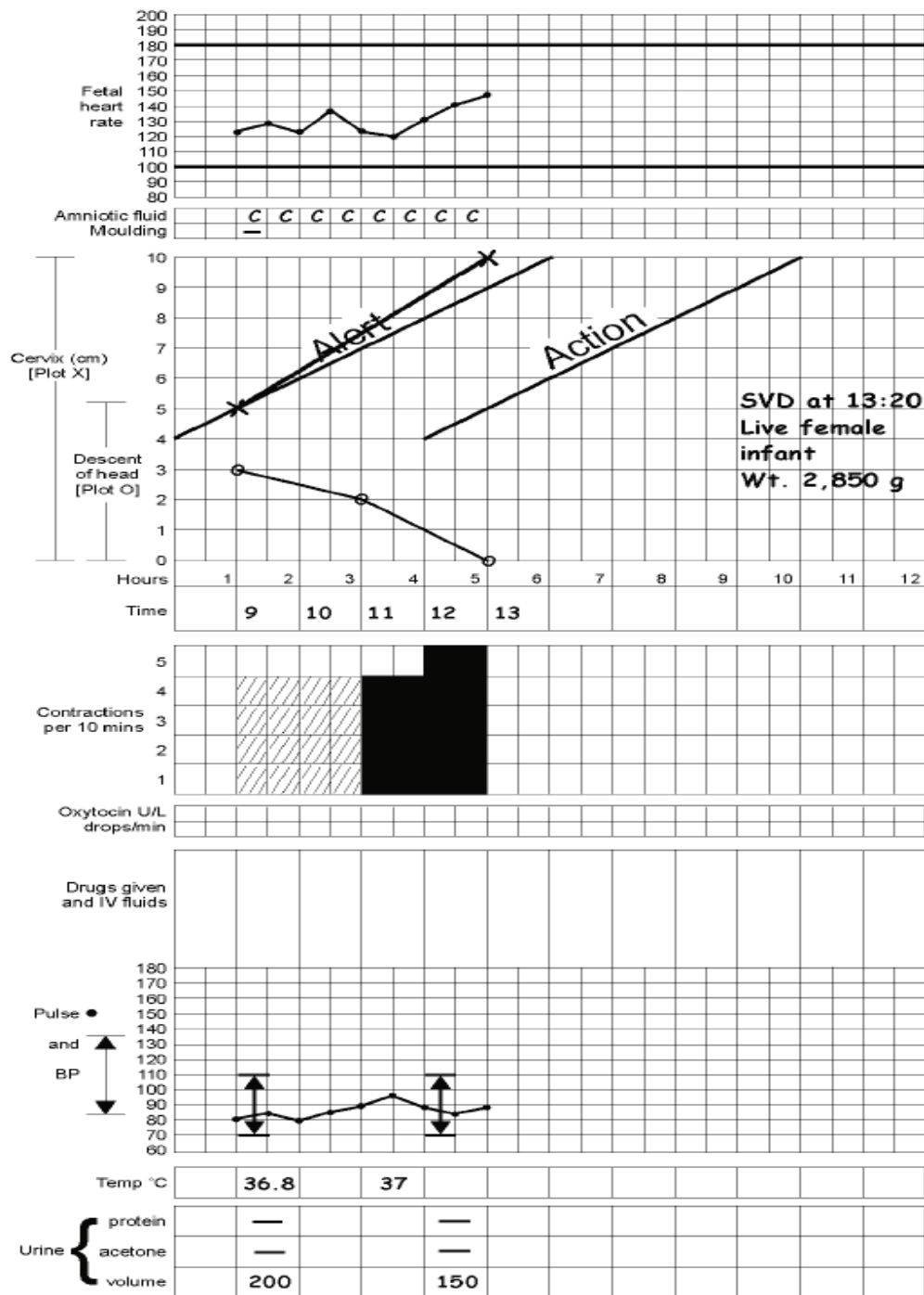


Figure 7.5 A sample of correctly completed partograph
 (WHO, 2017b:92)

7.3.3 Using a simple summary of labour monitoring indicators as “Cue to Action”




Based on the key recommendation presented in Chapter 6 of this thesis, making a spectrum of sensitive, accurate and timely clinical and obstetric assessments during

labour management and taking prompt actions that are consistent with obstetric care standards can reduce the burden of intrapartum stillbirth in the public health faculties of Addis Ababa. Many other actions including supportive supervisions, training of obstetric care providers, case discussions and obstetric drills have already been suggested as remedial actions to improve the skills gaps in obstetric case management. This section puts more emphasis on the importance of establishing a reminder system regarding the timing and intervals of administering intrapartum care interventions in the health facilities.

Cue-to-action is an important element in the pathway to changing health related behaviours. Any reminder that prompts the adoption of a desired behavioural actions can be considered as a cue to action (Glanz, Rimer & Viswanath, 2015:68). Furthermore, evidence shows that obstetric care providers' motivation and commitment to apply their technical skills and deliver responsive services can be impacted by introduction of reminder systems. For instance, a study in India indicated that introduction of a WHO's checklist-based childbirth safety programme led to a marked increase in the delivery of essential childbirth practices linked with improved maternal, foetal, and newborn outcomes. These checklists reminded obstetric care providers on essential steps of safe childbirth the application of which positively impacted their behaviours to deliver high-quality services (Spector, Agrawal, Kodkany, Lipsitz, Lashoher, Dziekan, Bahl, Merialdi, Mathai, Lemer & Gawande, 2012:e35151).

The quest for simple, practical and probably digital solutions to remind obstetric care providers to consistently and timely apply the evidence-based intrapartum interventions for women delivering in the health facilities remains an ongoing endeavour. It is hoped that some of the initiatives being pursued by WHO and other partners in the field including the SELMA study might introduce such simple tools including graphic algorithms, checklist, robust ICT platforms that can automatically send alerts to remind prompt actions during intrapartum care provision processes (Souza, et al., 2015:2). Pending the emergence of such breakthroughs with the reminder systems to improve the obstetric care delivery, this framework of actions suggests the following simple poster consisting of key intrapartum care indicators, recommended time intervals for administering the interventions and respective colour-coded interpretations of the measurements, ranging from normal to alert and action zones.

Table 7.1 Reminder on labour monitoring indicators and associated decisions (Poster)

Intrapartum Monitoring Indicator	Recommended interval of Measurement	Decision			If in the action zone
		Normal Zone	Alert zone – Actions	Action-Zone	
FHR	½ hourly	110 –160 bpm	111-120bpm	>160 bpm < 110 bpm	Immediate action as per the protocol
Foetal descent	4 hours (together with VE)	Consistent descent from 5/5 to 0/5	Slow descent	No descent of foetal head (5/5)	Immediate action as per the protocol
Cervical dilatation (from 4 cm – full dilatation)	4 hours	≥ 1 cm /hr	0.6–1 cm/hr	< 0.6 cm /hr	Immediate action as per the protocol
Uterine Contraction	½ hourly (active labour)	 ≥ 3 /10m & each last 40s	 ≥ 3 /10m & each last 20-40s	 ≤ 3 /10m & each last < 20s	Immediate action as per the protocol
Maternal BP	4 hours	SBP100-139 DBP60-89 (mmHg)	SBP140-159 DBP 90-109 (mmHg)	SBP ≥160 DBP ≥ 110 (mmHg)	Immediate action as per the protocol
Maternal Temperature	4 hours	37 °C	37.5 °C	≥38 °C on single reading	Immediate action as per the protocol
Maternal Pulse	½ hour	60–100 bpm	100-100 bpm	<110 bpm	Immediate action as per the protocol

(Adapted from Maaloe et al., 2017:4; Neal & Lowe 2012:319; NICE 2014:25; Northampton General Hospital 2011:11, WHO, 2017b:92).

It is being suggested that the above table should be printed as a medium sized poster (1m X 80cm) maintaining the colour codes. As cue to action tool, it is highly recommended that each poster should be posted on the walls visibly behind each maternity bed where women in the active labour are admitted and waiting for delivery. More importantly, placing a copy of the poster on a front and visible location on the walls of the midwifery

office could also maximise the effect of reminding health workers as what to look for while undertaking labour monitoring in their respective health facilities.

7.4 CONCLUSION

Several modifiable risk factors including maternal infection, low uptake of ANC, multiple pregnancy, poor diagnosis at admission to labour, substandard monitoring of labour and obstetric complications have contributed to the high burden of intrapartum stillbirth in the public health facilities of Addis Ababa. Based on the findings from this research and existed evidences, two important interventions have been presented in this chapter as a framework of action to address issues related to poor classification and sub-standrad intrapartum care practices. To this effect, a short-term effort to distinuised antepartum, intrapartum and immediate neonatal deaths as well as medium- and long-term process in adapting the ICD-PM classification system to effectively capture stillbirth data in the public health facilities have been suggested in this chapter. A colored poster consisting of sensitive indicators of labor monitoring has also been included as an actionable tool to improve the outcomes of labour.

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ANNEXURES

303	Age of the mother at the time of birth event in review	1. 15–49 2. Below 15 or above 49 99. Don't know	} →	Exclude the case
304	Admission record for the current labour management	1. Available 2. Not available 99. Don't know	} →	Exclude the case
305	Foetal heart beat on admission for labour management	1. Detected 2. Not detected 99. Don't know	} →	Exclude the case
306	Qualification of the person attended the birth (please refer to the facility HR record if not indicated in the card)	1. Midwife 2. Nurse 3. Medical doctor 4. Non-health professional 99. Don't know	} →	Exclude the case
307	Intrapartum care record or partograph	1. Available 2. Not available 99. Don't know	} →	Exclude the case

Section IV: Control Screening Questions (Inclusion/Exclusion criteria)

No.	Questions and filters	Coding categories	Skip to
400	Was the birth recorded on the facility's maternity care register	1. Yes 2. No 99. Don't know	} → Exclude the card

401	Was the outcome a live birth	1. Yes 2. No 99. Don't know	} —————→	Exclude the card
402	Did the mother receive at least one ANC in the same facility	1. Yes 2. No 99. Don't know	} —————→	Exclude the case
403	Card /registration number for the current maternity care	_____		
404	Age of the mother as at the birth event	1. 15–49 2. Below 15 or above 49 99. Don't know	} —————→	Exclude the case
405	Admission record for the current labour management	1. Available 2. Not available 99. Don't know	} —————→	Exclude the card
406	Qualification of the person attended the birth	1. Midwife 2. Nurse 3. Medical doctor 4. Non-health professional 99. Don't know	} —————→	Exclude the card
407	Intrapartum care record or partograph	1. Available 2. Not available 99. Don't know	} —————→	Exclude the card

Section V: Socio–Demographic characteristic of the mother (from the ANC Chart)

No.	Questions and filters	Coding categories	Skip to
500	Age of the mother at the time of current birth	1. _____ (Yrs) 99. Don't know	
501	Marital status of the mother at the time of the birth in review	1. Married 2. Divorced 3. Widowed 4. Separated 5. Never married	
502	Gravida	1. One 2. Two 3. Three 4. Four 5. Five and above	
503	Para	1. Zero 2. One 3. Two 4. Three 5. Four 6. Five and above	
504	Number of children alive	_____	

Section VI: Past Obstetric and Medical history of the mother during ANC

600	History of previous stillbirth?	1. Yes 2. No 99. Don't know	
601	History of three or more consecutive spontaneous abortions?	1. Yes 2. No 99. Don't know	
602	Birth weight of last baby less than 2500g?	1. Yes 2. No 99. Don't know	
603	Birth weight of last baby more than 4500g?	1. Yes 2. No 99. Don't know	
604	Was there hospital admission for hypertension or pre-eclampsia/eclampsia during the last Pregnancy?	1. Yes 2. No 99. Don't know	
605	Previous surgery on reproductive tract?	1. Yes 2. No 99. Don't know	

Section VII: General Medical Condition of the Mother during ANC

700	Maternal Medical history at the time of ANC visits for the pregnancy in review	Yes	No	Don't know
	Hypertension	1	2	99
	Diabetes	1	2	99
	Cardiac disease	1	2	99
	Renal diseases	1	2	99
	Any other severe diseases or medical conditions	1	2	99
	Others (specify) _____			
701	Sero-status for HIV infection	1. HIV positive 2. HIV negative 99. Don't know		
702	Mother received PMTCT services (ART)	1. Yes 2. No 99. Don't know		
703	Blood group and Rh	_____		

Skip to Q704

Section VIII: Current pregnancy related Information on the Mother and the Foetus

800	Current Pregnancy follow up card number	_____
801	Was the pregnancy in review multiple?	1. Yes 2. No 99. Don't know
802	Sero-status for syphilis	1. Positive 2. Negative 99. Don't know
803	Number of ANC visits during the pregnancy in review	1. Once 2. Twice 3. Three times 4. Four times and more 99. Don't know
804	Date of the first ANC visit for the pregnancy in review	_____ (DD/MM/YYYY)
805	Date of the last ANC visit for the pregnancy in review	_____ (DD/MM/YYYY)
806	Expected Date of delivery (EDD) for the pregnancy in review	_____ (DD/MM/YYYY)

Section IX: Condition of the foetus during last ANC visit of the pregnancy in review

900	Foetal Heart Rate (FHR) during the last visit of the birth in review	<ul style="list-style-type: none"> 1. Normal 2. Abnormal 99. Don't know
901	Foetal Presentation during the last ANC visit of the birth in review	<ul style="list-style-type: none"> 1. Vertex 2. Breech 3. Shoulder 99. Don't know

Section X: Admission and Intrapartum Care Intervention Data

1000	Date of birth event in review	_____ (DD/MM/YYYY)					
1001	Time of admission for labour management	_____ (Hr:Min)					
1002	Status of membrane on admission	<ul style="list-style-type: none"> 1. Intact 2. Ruptured 99. Don't Know 					
1003	Foetal Heart Rate on Admission	____ (normal range 110–160)					
1004	Cervical Dilatation on admission	_____ (cm)					
1005	Duration of labour on Admission	_____ (Hrs)					
1006	Foetal presentation on Admission	<ul style="list-style-type: none"> 1. Vertex 2. Breech 3. Shoulder 99. Don't know 					
1007	Type of timing of Intrapartum Intervention provided during the birth in review	Type of care given			Timing of care consistent		
		Yes	No	Don't Know	Yes	No	Not sure
	FHR – 15min	1	2	99	1	2	99
	Contraction observation – 1/2 hr	1	2	99	1	2	99
	Maternal pulse – 1 hr	1	2	99	1	2	99
	Maternal Blood Pressure (BP) – 4 hr	1	2	99	1	2	99
	Maternal temperature – 4 hr	1	2	99	1	2	99
	Vaginal Examination (VE) – 4 hr	1	2	99	1	2	99
	Oxytocin provided?	1	2	99	1	2	99
	Episiotomy conducted?	1	2	99	1	2	99
	Vacuum/Forceps delivery?	1	2	99	1	2	99
	Others (Specify) _____						

1008 Was there any Obstetric Complications?				
		Yes	No	Don't know
Eclampsia	1	2	99	
APH	1	2	99	
PPH		2	99	
Obstructed/Prolonged labour	1	2	99	
Ruptured Uterus	1	2	99	
Others (specify) _____				
Time of the birth completed	_____ (Hr : Min)			

1009

ANNEXURE 2: FACILITY CONSENT FORM FOR DATA COLLECTION

Greetings! My name is _____, and I am assigned as a data collector by student Alemayehu Gebremariam who is working on his thesis for the D Litt et Phil in Health Studies at the University of South Africa (UNISA). His research seeks to understand the trends, magnitude, determinant and factors associated with intrapartum stillbirth in the public health facilities of Addis Ababa. Your facility has been selected as one of the sites to collect data on antenatal and intrapartum care through review of maternity service records that have been documented in the past five years and based on the study's inclusion criteria. The study protocol declares that all information obtained through this inquiry will be handled confidentially. Ethical clearance has been obtained from Unisa's Institutional Review Board (IRB) and authorization has also been secured from the Addis Ababa Regional Health Bureau (AARHB) to undertake this chart review (please show the letters).

Furthermore, it is anticipated that findings from this study will contribute towards improving the quality of intrapartum care through policy advocacy and development of appropriate quality improvement tools. We would like to thank you in advance for your willingness to allow the chart review for ANC and intrapartum care services offered by your esteemed facility during the course of the last five years. Your permission to give access to the charts is voluntary, and you are not obliged to allow the data collection process if you do not want to. However, I want to assure you that all the data collected from your facility will remain confidential and there will not be any negative consequences to your facility. Please could you kindly confirm your permission for the data collection (Please circle the response)?

1. Yes (provide the consent form)
2. No (thank the official and leave the facility)

I read the aforementioned information and procedures to the head or his/her representative of the facility. I asked if the official had any questions and tried to address all of them to the best of my capacity. Finally, I handed over the consent form to the official for his decision.

Name of data
collector

Date permission
obtained

Date the data
collection began _____
(DD/MM/YYYY)

Date the
data _____
collection (DD/MM/YYYY)
ended

Signature _____

ANNEXURE 3: ETHICAL CLEARANCE FROM UNISA



**UNIVERSITY OF SOUTH AFRICA
Health Studies Higher Degrees Committee
College of Human Sciences
ETHICAL CLEARANCE CERTIFICATE**

REC-012714-039

HS HDC/421/2015

Date: 17 June 2015 Student No: 5766-159-6
Project Title: Trends and determinants of intrapartum still births in Public health Facilities of Addis Ababa, Ethiopia.
Researcher: Alemayehu Gebremariam Agena
Degree: D Litt et Phil Code: DPCHS04
Supervisor: Prof LM Modiba
Qualification: D Cur
Joint Supervisor: -

DECISION OF COMMITTEE

Approved Conditionally Approved

for Prof L Roets
CHAIRPERSON: HEALTH STUDIES HIGHER DEGREES COMMITTEE
L.L. Roets (par)

Prof MM Moleki
Prof MM Moleki
ACADEMIC CHAIRPERSON: DEPARTMENT OF HEALTH STUDIES



PLEASE QUOTE THE PROJECT NUMBER IN ALL ENQUIRES

**ANNEXURE 4: ETHICAL CLEARANCE AND SAMPLE SUPPORT LETTERS FROM
ADDIS ABABA REGIONAL HEALTH BUREAU (AARHB) AND SUB-CITIES**

Reference A.A.T/445/22

Date 6/7/2018

To Yekatit 12 hospital medical college
Zewditu memorial hospital
Ghandi memorial hospital
Yeka subcity health office
Kolfe subcity health office
Gulele subcity health office
Nifassilk subcity health office
Bole subcity health office
Addis ketema subcity health office
Kirkos subcity health office
Ledeta subcity health office


Addis Ababa

Subject: Request to access Health Facilities to conduct approved research

This letter is to support **Alemayehu Gebremariyam** to conduct research, which is entitled as "TRENDS AND DETERMINANTS OF INTRAPARTUM STILL BIRTH IN PUBLIC HEALTH FACILITIES OF ADDIS ABABA ". The study proposal was duly reviewed and approved by Addis Ababa Health Bureau IRB, and the principal investigator is informed with a copy of this letter to report any changes in the study procedures and submit an activity progress report to the Ethical Committee as required.


Therefore we request the mentioned HEALTH FACILITIES and staffs to provide support to the Principal investigator.

With Regards


Eyobed Kaleb
Ethical Clearance committee

Cc **Alemayehu Gebremariyam**
Addis Ababa
To Ethical Clearance Committee
Addis Ababa

Reference: A.A.T/445/227
Date: 6/27/2015


Addis Ababa Health Bureau

To Yekatit 12 hospital medical college
Zewditu memorial hospital
Chandi memorial hospital
Yeka subcity health office
Kofle subcity health office
Gulele subcity health office
Nifassilk subcity health office
Bole subcity health office
Addis ketema subcity health office
Kirkos subcity health office
Ledeta subcity health office


Addis Ababa

Subject: Request to access Health Facilities to conduct approved research

This letter is to support Alemayehu Gebremariyam to conduct research, which is entitled as "TRENDS AND DETERMINANTS OF INTRAPARTUM STILL BIRTH IN PUBLIC HEALTH FACILITIES OF ADDIS ABABA". The study proposal was duly reviewed and approved by Addis Ababa Health Bureau IRB, and the principal investigator is informed with a copy of this letter to report any changes in the study procedures and submit an activity progress report to the Ethical Committee as required.

Therefore we request the mentioned HEALTH FACILITIES and staffs to provide support to the Principal investigator.

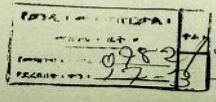
With Regards
SAH
Eyobed Kaleb
Ethical Clearance committee




Cc Alemayehu Gebremariyam
Addis Ababa
To Ethical Clearance Committee
Addis Ababa

*To Whom it may concern
Please to support the study*

*Dr. Eyobed Kaleb
Member*



Reference: A.A.T/445/227
Date: 6/27/2015


Addis Ababa Health Bureau

To Yekatit 12 hospital medical college
Zewditu memorial hospital
Chandi memorial hospital
Yeka subcity health office
Kofle subcity health office
Gulele subcity health office
Nifassilk subcity health office
Bole subcity health office
Addis ketema subcity health office
Kirkos subcity health office
Ledeta subcity health office


Addis Ababa

Subject: Request to access Health Facilities to conduct approved research

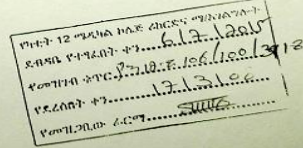
This letter is to support Alemayehu Gebremariyam to conduct research, which is entitled as "TRENDS AND DETERMINANTS OF INTRAPARTUM STILL BIRTH IN PUBLIC HEALTH FACILITIES OF ADDIS ABABA". The study proposal was duly reviewed and approved by Addis Ababa Health Bureau IRB, and the principal investigator is informed with a copy of this letter to report any changes in the study procedures and submit an activity progress report to the Ethical Committee as required.

Therefore we request the mentioned HEALTH FACILITIES and staffs to provide support to the Principal investigator.

With Regards
SAH
Eyobed Kaleb
Ethical Clearance committee



Cc Alemayehu Gebremariyam
Addis Ababa
To Ethical Clearance Committee
Addis Ababa



ANNEXURE 5: INTEGRATED MATERNITY CARE CARED (FMOH)

Federal Ministry of Health
Integrated Antenatal, Labor, Delivery, Newborn and Postnatal Care Card

Date: _____ ANC Reg.No: _____ Medical Record Number (MRN): _____
 Name of Client: _____ Name of Facility _____
 Woreda: _____ Kebele: _____ House No: _____
 Age (Years) _____ LMP _____ EDD ____/____/____
 Gravida _____ Para _____ Number of children alive _____ Marital Status _____

INSTRUCTIONS to Fill Classifying form: Answer all of the following questions by placing a cross mark in the corresponding box.

OBSTETRIC HISTORY	No	Yes
1. Previous stillbirth or neonatal loss?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2. History of 3 or more consecutive spontaneous abortions?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3. Birth weight of last baby < 2500g?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4. Birth weight of last baby > 4500g?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5. Last pregnancy: hospital admission for hypertension or pre-eclampsia/eclampsia?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
6. Previous surgery on reproductive tract?(Myomectomy, removal of septum, fistula repair, cone biopsy, CS, repaired rapture, cervical circlage)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
CURRENT PREGNANCY	No	Yes
7. Diagnosed or suspected multiple pregnancy?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8. Age less than 16 years?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9. Age more than 40 years?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10. Isoimmunization Rh (-) in current or in previous pregnancy?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11. Vaginal bleeding?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12. Pelvic mass?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13. Diastolic blood pressure 90mm Hg or more at booking?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
GENERAL MEDICAL	No	Yes
14. Diabetes mellitus?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
15. Renal disease?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
16. Cardiac disease?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
17. Chronic Hypertension	<input type="checkbox"/>	<input checked="" type="checkbox"/>
18. Known 'substance' abuse (including heavy alcohol drinking, Smoking)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
19. Any other severe medical disease or condition TB, HIV, Ca, DVT..?	<input type="checkbox"/>	<input checked="" type="checkbox"/>

A "Yes" to any ONE of the above questions (i.e ONE shaded box marked with a cross) means that the woman is not eligible for the basic component of the new antenatal care mode and require more close follow up or referral to specialty care. If she needs more frequent ANC visits use and attach additional recording sheets

II. Initial Evaluation plus Promotive and Preventive Care				
General Exam	Gyn Exam	Counseling /Testing, HIV + Care and follow up		
General _____	Vulvar Ulcer <input type="checkbox"/> Y <input type="checkbox"/> N	Danger signs in pregnancy & deliver <input type="checkbox"/> Y <input type="checkbox"/> N	Confidentiality Code _____	PARTNER
Pallor <input type="checkbox"/> Y <input type="checkbox"/> N	Vaginal discharge <input type="checkbox"/> Y <input type="checkbox"/> N	Birth Preparedness <input type="checkbox"/> Y <input type="checkbox"/> N	HIV test result <input type="checkbox"/> Y <input type="checkbox"/> NR	Partner Confidentiality Code _____
Jaundice <input type="checkbox"/> Y <input type="checkbox"/> N	Pelvic Mass <input type="checkbox"/> Y <input type="checkbox"/> N	MOTHER	HIV test result Received with Post test counseling <input type="checkbox"/> Y <input type="checkbox"/> N	Partner tested <input type="checkbox"/> Y <input type="checkbox"/> N
Chest Abn. <input type="checkbox"/> Y <input type="checkbox"/> N	Uterine Size (Wks) <input type="checkbox"/> Y <input type="checkbox"/> N	HIV pretest Counseling Offered <input type="checkbox"/> Y <input type="checkbox"/> N	Referred for care, treatment and support	Partner HIV Test result <input type="checkbox"/> R <input type="checkbox"/> NR
Hert abnormality <input type="checkbox"/> Y <input type="checkbox"/> N	Cervical Lesion <input type="checkbox"/> Y <input type="checkbox"/> N	HIV test accepted <input type="checkbox"/> Y <input type="checkbox"/> N	Counseled on Infant feeding <input type="checkbox"/> Y <input type="checkbox"/> N	Partner referre. for Chronic care <input type="checkbox"/> Y <input type="checkbox"/> N

III. Present Pregnancy: Follow Up				
	1 st visit (better before 16 wks)	2 nd visit (better 24-28 wks)	3 rd visit (better 30-32 wks)	4 th visit (better 36-40 wks)
Date of visit				
Gestation age (LMP)				
BP				
Weight (kg)				
Fallor				
Uterine height (Wks)				
Fetal heart beat				
Presentation				
Urine test for infection				
Urine test for protein				
Rapid syphilis test				
Hemoglobin				
Blood group and Rh				
TT (dose)				
Iron/Folic Acid				
Mebendazole				
Use of ITN				
ARV Px (type)				
Remarks				

	First visit	Second visit	Third visit	Fourth visit
Danger signs identified and Investigation	_____	_____	_____	_____
Action, Advice, Counseling	_____	_____	_____	_____
Appointment for next follow - up	_____	_____	_____	_____
Name and Sign of Health care Provider	_____	_____	_____	_____

Name	Gruvida	Para	MRN
Date of admission	Time of admission	Ruptured membranes	hours

	200													
	190													
	180													
	170													
	160													
Fetal heart rate	150													
	140													
	130													
	120													
	110													
	100													
	90													
	80													
	Amniotic fluid													
	Moulding													

	10												
	9												
	8												
	7												
	6												
	5												
	4												
	3												
	2												
	1												
	0												
Cervix (cm) [Plot X]													
Descent of head [Plot O]													
Hours		1	2	3	4	5	6	7	8	9	10	11	12
Time													

	5												
	4												
	3												
	2												
	1												
Contractions Per 10 mins													

Oxytocin U/L drops/min													
------------------------	--	--	--	--	--	--	--	--	--	--	--	--	--

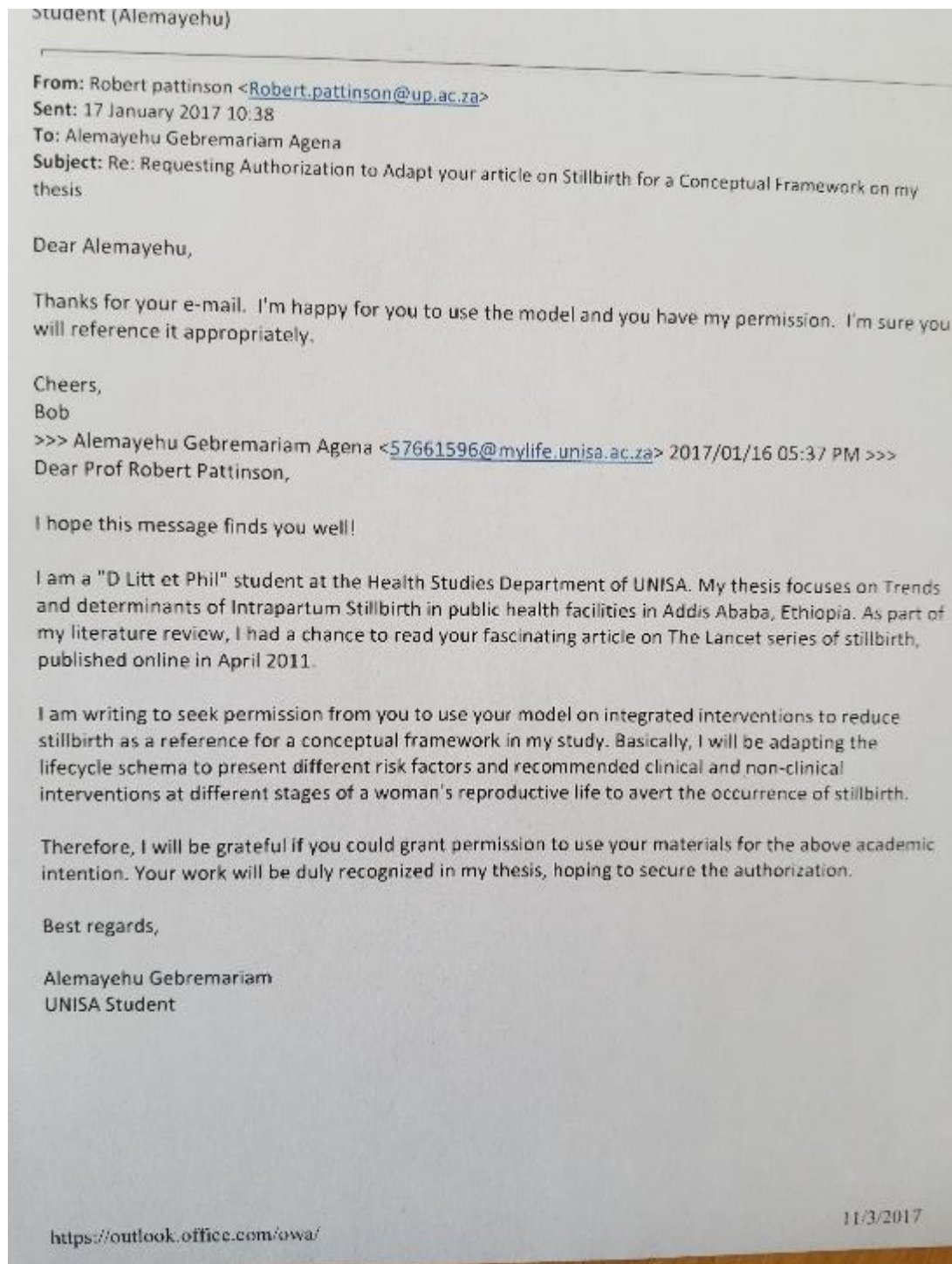
Drugs given and IV fluids													
---------------------------	--	--	--	--	--	--	--	--	--	--	--	--	--

	180												
	170												
	160												
	150												
	140												
	130												
	120												
	110												
	100												
	90												
	80												
	70												
	60												
Pulse ● and BP													

Temp °C													
---------	--	--	--	--	--	--	--	--	--	--	--	--	--

Urine	Protein												
	acetone												
	volume												

ANNEXURE 6: AUTHOR PERMISSION TO ADAPT THE CONCEPTUAL FRAMEWORK



ANNEXURE 7: PROFESSIONAL EDITING AND PROOFREADING CERTIFICATE

EDITING AND PROOFREADING CERTIFICATE

7542 Galangal Street

Lotus Gardens

Pretoria

0008

12 December 2017

TO WHOM IT MAY CONCERN

This letter serves to confirm that I have edited and proofread Mr Alemayehu Gebremariam Agena's thesis entitled, "**TRENDS AND DETERMINANTS OF INTRAPARTUM STILLBIRTH IN THE PUBLIC HEALTH FACILITIES OF ADDIS ABABA, ETHIOPIA.**"

I found the work easy and intriguing to read. Much of my editing basically dealt with obstructionist technical aspects of language which could have otherwise compromised smooth reading as well as the sense of the information being conveyed. I hope that the work will be found to be of an acceptable standard. I am a member of Professional Editors Guild.

Hereunder are my particulars:

Jack Chokwe (Mr)

Contact numbers: 072 214 5489

jmb@executivemail.co.za

Professional
EDITORS
Guild

ANNEXURE 8: ATTESTATION OF STATISTICIAN

Mr. Fistum Abebe
Statistician
Freelance Consultant
Tel - +251911649202
Addis Ababa, Ethiopia

TO WHOM IT MAY CONCERN

I am a statistician by profession and would like to attest th fact that all statistical analysis for the quantitative data of a study titled " Trends and Determinnnts of Intrapartum Stillbrith in the Public Health Facilities of Addis Ababa, Ethiopia" which was conducetd by Mr. Alemayehu Gebremariam Agena for his PhD thesis was undertaken by me in close clobartion with him during the period Sept 19 -30, 2016.

Sincerely,



Fitsum Abebe

Statistician and Freelance Consultant

e-mail - fitsumnabebe@yahoo.com

Tel - +251911649202