Factors determining neonatal mortality in Ethiopia and interventions to improve neonatal health

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Country: Ethiopia

Declaration:

Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.

The thesis **Factors determining neonatal mortality in Ethiopia and interventions to improve neonatal health** is my own work.

Signature _

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List of Abbreviations

ANC	Antenatal care
B-EmNOC	Basic emergency obstetric and newborn care
BMI	Body Mass Index
CBNC	Community Based Newborn Care
CMR	Child mortality rate
DHS	Demographic and Health Survey
DSS	Demographic Surveillance System
GDP	Gross Domestic Product
GII	Gender Inequality Index
HSDP	Health Sector Development program
iCCM	Integrated Community Case Management
IGME	Inter-agency Group for Child Mortality Estimation
IMNCI	Integrated Management of Newborn and Childhood illness
LBW	Low Birth Weight
MDG	Millennium Development Goals
NMR	Neonatal mortality rate
PNC	Postnatal care
SBA	Skilled Birth Attendant
SGA	Small for Gestational Age
SNNP	Southern nations, Nationalities and People
TBA	Traditional Birth attendant
TT	Tetanus Toxoid
U5MR	Under Five Mortality Rate
UN	United Nations
Unicef	United nations children's fund
WHO	World Health Organization

Abstract

Introduction: Ethiopia is in the top 10 of countries with the highest number neonatal mortality in the world and showed slow progress in decreasing neonatal mortality rate (NMR). Demographic and Health Survey of 2011 indicates an NMR of 37/1000 live births, which is similar to the rate in 2005. Because of this, it is important to study the determinants of neonatal mortality to guide health planning related to it.

Objective: To identify determinants of neonatal mortality, review interventions to improve neonatal health and describe neonatal health programs in Ethiopia, in order to recommend for improving neonatal health

Methods: This study used literature about neonatal mortality in Ethiopia. The conceptual framework of this study was adapted from the 1984 Mosley and Chen child survival conceptual framework.

Findings: Majority of neonatal deaths in Ethiopia is preventable. Three major causes contributed to neonatal mortality: intrapartum complications, preterm birth and infections. Five intermediate factors and socioeconomic factors are associated with neonatal mortality. Health services factors, cultural belief and practices and maternal nutrition were the important intermediate factors determining neonatal mortality. Similarly, poverty, low female literacy and access to road, gender inequality and wide practice of early marriage are the socioeconomic factors which determined neonatal mortality in Ethiopia.

Recommendations: Focusing on addressing in equalities of health care utilization, improving access and quality of care, and increasing awareness on newborn care is recommended to improve the newborn care. Further study is needed on acceptability of care.

Keywords: Neonatal mortality, determinates, Ethiopia, intervention, low income countries

Word count: 11, 921

Introduction

I am working as an instructor in the College of Health Sciences at one the University found in Ethiopia. As one of my responsibilities, I have to do research, read literatures and show students the current health problems in Ethiopia. In the past two decades the child mortality was decreased dramatically, and I observed, no decline neonatal mortality in the country.

I also have personal interest to work for improvement of child health. So the Demographic and Health Survey report of 2011 attracts my interest to study determinants of neonatal mortality and what should be to decrease it. So by doing this thesis, I can partly answer these critical question of improving health status.

In this study NMR is defined as the rate of death among newborn babies within the first 28 days of life per 1000 of live births. It is an indicator of quality of maternal and newborn health. Also, Neonatal mortality is the death of newborn babies from the death of birth to 28 days of life.

The primary objective of this thesis is to identify determinants of neonatal mortality and intervention to address it in Ethiopia. There are 8 chapters in this thesis. The first chapter discusses background information about Ethiopia in general and health and health related issues in Ethiopia. In the second chapter; statement of the problem, justification and objective as well as the method is included. The third chapter is about the situation of neonatal mortality in Ethiopia while the next chapter discusses the determinants of neonatal mortality. Then intervention to improve neonatal health discussed in chapter five and next to that policy and strategies addressing neonatal mortality in Ethiopia included.

Finally the findings are discussed and concluded. Then recommendation is made based on the finding of the study.

1. Background information
1.1. Population and geography

Ethiopia is a country located in East Africa. It is bordered by Sudan, South Sudan, Kenya, Somalia, Djibouti and Eritrea. The country administratively divided into nine regional states (Tigray, Afar, Amhara, Oromia, Somali, Benishangul-Gumuz, Southern Nations, Nationalities and Peoples (SNNP), Gambela and Harari) and two city councils (1).

Ethiopia is second most populous country in Africa next to Nigeria. The total population of the country is estimated to be 87 million in 2014 and more than 80 ethnic groups live in the country. The annual population growth rate is estimated to be 2.6 percent. The majority of Ethiopian populations are agrarian and 84% live in rural areas. In rural area the main source of income is farming. Some the population are pastoralist, who depend on livestock and move from place to place for searching for grass and water (1,2).

1.2. Health system and policy

Ethiopia's current health policy was developed during 1993 by the transitional government. The main focus of health policy is democratization, decentralization and equitable distribution of health service. It also gives emphasis to prevention of disease and promotion of health. To achieve the health goals, a 20 year strategic plan which is called Health Sector Development Program (HSDP) which has four phases of five year term plan was developed (3).

Regarding distribution of health facilities there are about 16,048 health posts, 3,335 Health Centres and 156 hospitals in the country during 2013. One hospital is serving about 156 thousand population, while one health centre is for 26,390 and a health post is for 5 thousand population (4).

Concerning human resource for health, there are about, 2, 668 physicians, 5,621 health officers, 5,776 midwives and 45, 509 nurses working in public health facilities in the country. Accordingly one physician serves about 32,000 people, one health officer for 15,000 people, one midwife 14,847, as well as about one nurse for 1884 people in the country during 2013. The distribution varies from region to region (4). World Health Organization (WHO) recommends 23 health professionals per 10,000 people to provide

basic health care package. But, the ration in Ethiopia is about described above is about 13 per 10,000 people (5,6).

Ethiopia health care delivery system is a three tiered system. The lower health care delivery care consists of a district hospital and primary health care unit which consists of Health centre and five health posts. Major activities at health post are promotive and preventive service. It also serves as linkage between community and health facilities. Two trained health extension workers, which are community health workers, work at health post. Health extension workers spend majority of their time on an outreach program to train household (3).

The second level of the care provides care for about 1 million people. It serves as referral level for primary level. Specialized hospital is the last level of care, it is supposed to serve five million people (3).

1.3. Causes of admission and death

Neonatal sepsis is on the major contributors of health problem under five year of age. It is the fourth leading cause of admission (5.6%) and the second leading cause of mortality (12.3%) in the 2013/14 years. Regarding the health problems among children under five years of age, is pneumonia is the major cause of morbidity (29.3%) and mortality (16.6%)(7).

1.4. Health care financing

According National Health Account report of 2014 about 67% of health expenditure is through government in Ethiopia (67%). But most the health care fund comes from donors. From the total health expenditure donors fund cover 50% health expenditure, 34% is from household and 16% is domestic fund. Half of reproductive care is financed by donors (47%) and 24.1% by government and 27% is from out of pocket. Financing of the child health program is different from this. The majority of child health care is financed by household (47.9%) followed by donors (27.1%) and government (24%) (8).

2. Statement of the problem, justification and objective
2.1. Problem statement

Neonatal mortality is death of newborn babies from the time of birth to 28 completed days of life. In 2013 about 2.8 million children are dying during neonatal period Worldwide (9). The majority (99%) of death is occurred in low and middle income countries. WHO showed about two-thirds of neonatal deaths occurs in Sub-Saharan African and Southeast Asian WHO regions. The highest number of mortality is happening South East Asia but NMR is higher in Sub-Saharan Africa (9,10).

Neonatal mortality accounts for 44% of under-five mortality in 2014. Average death during neonatal period is 30 times higher compared to the rest of five years childhood time. The mortality rate is higher even in the first 24 hours and quarter of neonatal deaths occurs in the first week of life after birth. Ten countries account for 67% of neonatal mortality globally. India accounts for 27% of death while Ethiopia accounts for 4% of global neonatal mortality (10).

Since the inception of Millennium Development Goal (MDG) in the year of 2000, NMR decreased by 37% globally. This is slow progress compared to the progress in child mortality rate (CMR), which is decreased by 59%. As a result of this fast decrease in child mortality, the share of neonatal deaths among under-five deaths increased from 36% to 43% in 2011(9). The rate decreasing NMR is slower in sub-Saharan Africa (by 27%), where the highest neonatal morality exists (11).

In Ethiopia, the rate of under-five mortality (U5MR) decreased by 47% from the year 2000 to 2011; i.e. from 123 to 88 per 1000 of live births. But NMR decreased only from 39/1000 live births to 37 per 1000 live births from 2005 to 2011. Because of this the share of neonatal mortality in under-five mortality has been increased from 25% to 44% (2).

Neonatal mortality has three main causes in low and middle income country. Complication of preterm, asphyxia and neonatal infection together contribute to 85% of newborn death. In 2013, 35% of the global neonatal deaths were caused by complications of preterm birth, 24% by intrapartum related complications and 25% by infection. The rest of death is caused by congenital malformations (12). Majority of these causes are preventable by

available health interventions and improving access to health care for women and neonates (13).

However, in Ethiopia studies which identify the determinants neonatal mortality in broad base are limited. Therefore, this study is intended to identify determinants of neonatal mortality from existing research as well as to review possible interventions available it in low income setting. Also to current program and health systems related to neonatal health were reviewed.

2.2. Justification of study

Neonatal health problems are usually seen as similar with an older child health problem. But, the causes of neonatal mortality and intervention to improve neonatal health are different from that of other under-five children. Neonatal survival is the most important indicator of improved health care during childbirth. Despite the difference the need of care and difference in the neonatal health problems, health programs for neonatal mortality is attached to maternal and child health programs. As a result, there is slow progress to decrease neonatal mortality in the majority of the countries with high mortality rate (9).

So an understanding of the determinants of neonatal mortality is needed to design programs specific to neonatal mortality. Therefore, this review is done to provide evidence for policy makers and program managers. Existing literature which identified determinants of neonatal mortality and interventions to address are used in this study.

2.3. Objectives

2.3.1. General objective

- To identify determinants of neonatal mortality, review interventions and programs to address neonatal health in Ethiopia in order to recommend for improving of neonatal health.

2.3.2. Specific objectives

- To describe the epidemiological situation of neonatal mortality in Ethiopia
- To identify intermediate and socioeconomic determinants of neonatal mortality
- To review for interventions and best practice to decrease neonatal mortality
- To describe health programs related neonatal mortality in Ethiopia
- To recommend for policy making for the improvement newborn health and health care.

2.4. Method
2.4.1. Literature search strategy

The Literature searched includes research articles, reports, and government documents. Various electronic databases like PubMed, Medline and EMBASE were used to search of articles. In addition; WHO, Unicef, and Ethiopia Federal Ministry of Health websites were searched for reports and government documents. Literatures from open access sources are also included.

Combinations of searching key words indicated in the conceptual framework used to identify the studies. Some of key words are neonatal mortality, determinants; factors associated, Ethiopia, socioeconomic, causes of neonatal mortality, interventions, low and middle income countries, causes, maternal factors, socioeconomic, income, gender (Table 1).

To identify the determinants of neonatal mortality pre-reviewed and grey literature included. The search was restricted to conducted researches conducted in Ethiopia, written in English and published since 1990. To review the interventions, studies which focused on low and middle income country were used. Studies which evaluate the strategies for providing maternal and newborn care were included. For this; meta-analysis, systematic review and interventional studies were included.

First article were selected based on their titles. Full text article was then downloaded after abstract is reviewed. Most of the articles found were qualitative and cross sectional studies, conducted in specific areas.

The health policy and programs documents were selected purposely based whether they include newborn, child and maternal health programs. Beside this, national health policy, general strategic plan and yearly health indicator report were also retrieved. To describe the progress and direct causes of neonatal mortality, data from DHS and UN Inter-agency Group for Child Mortality Estimation (IGME) was used.

Table 1: Keywords and data bases used for searching by specific objectives

Objectives of the study	Key words used in combination or separately	Databases and websites searched
To describe the situation of neonatal mortality in Ethiopia	Causes, neonatal mortality, trends, Ethiopia, time of neonatal death	Federal Ministry of health, DHS, Unicef data base
To identify intermediate and socioeconomic determinants of neonatal mortality	Neonatal mortality, Ethiopia, Antenatal care, postnatal care, skilled birth attends, household/ traditional practice, household practice, environmental factors, low birth weight, preterm, neonatal factors, birth interval, water supply, sanitation socioeconomic, wealth quantile,	Pubmed, EMBASE, VU library, Google scholar Cochrane library, Countdown to 2015 website, the Lancet series, WHO reproductive health library
To review for interventions and best practice to decrease neonatal mortality	Interventions, evidence based, low income countries, middle income countries, neonatal mortality, maternal and newborn health services, community based strategies, quality improvement, developing countries	
To describe health programs related neonatal mortality in Ethiopia	Child Survival Strategy, Reproductive health strategy, Health sectors development plan, Health and health related indictors, National health account	Ministry of Health website,

2.4.2. Conceptual framework

The Mosley and Chen 1984 child survival conceptual framework, which is adapted neonatal situation, is used to guide the findings of this study. This framework is selected because of its relevance and its integrating both intermediate and socioeconomic factors (14).

According to the original framework proposed by Mosley and Chen, the socioeconomic determinants function through a common set of biological factors or intermediate factors to influence child survival. Accordingly, five intermediate factors were included. These are maternal factors, environmental contamination, nutritional deficiency, injury and personal illness control. Since some of these of factors are not specific to neonatal mortality, determinant specific to neonatal mortality was included after review of literature.

Five intermediate determinants factors are considered in this review. These are maternal factors, health service factor, neonatal factors, water and hygiene, and household practice for neonatal care. Neonatal factor includes; sex of child, birth order, birth interval, and birth weight were specifically included in to framework used in this study.

Furthermore, Mosley and Chen's personal illness control variable is changed to health service related factors related to included factors like accessibility, availability and quality maternal and newborn health service. Maternal factor include health status, age and nutritional status. And household practice is about newborn caring practices at home, traditional belief related and health seeking behaviour. In socioeconomic factors mother educational status, household and community level factors were included.

Direct causes of neonatal mortality are adapted from the Unicef conceptual framework for the causes of maternal and neonatal mortality (15). Four groups of direct causes have been identified. These are congenital malformation, intrapartum complications, preterm complications, and disease and infection.

The framework is used to describe the causes and determinants of neonatal mortality (Figure 1).
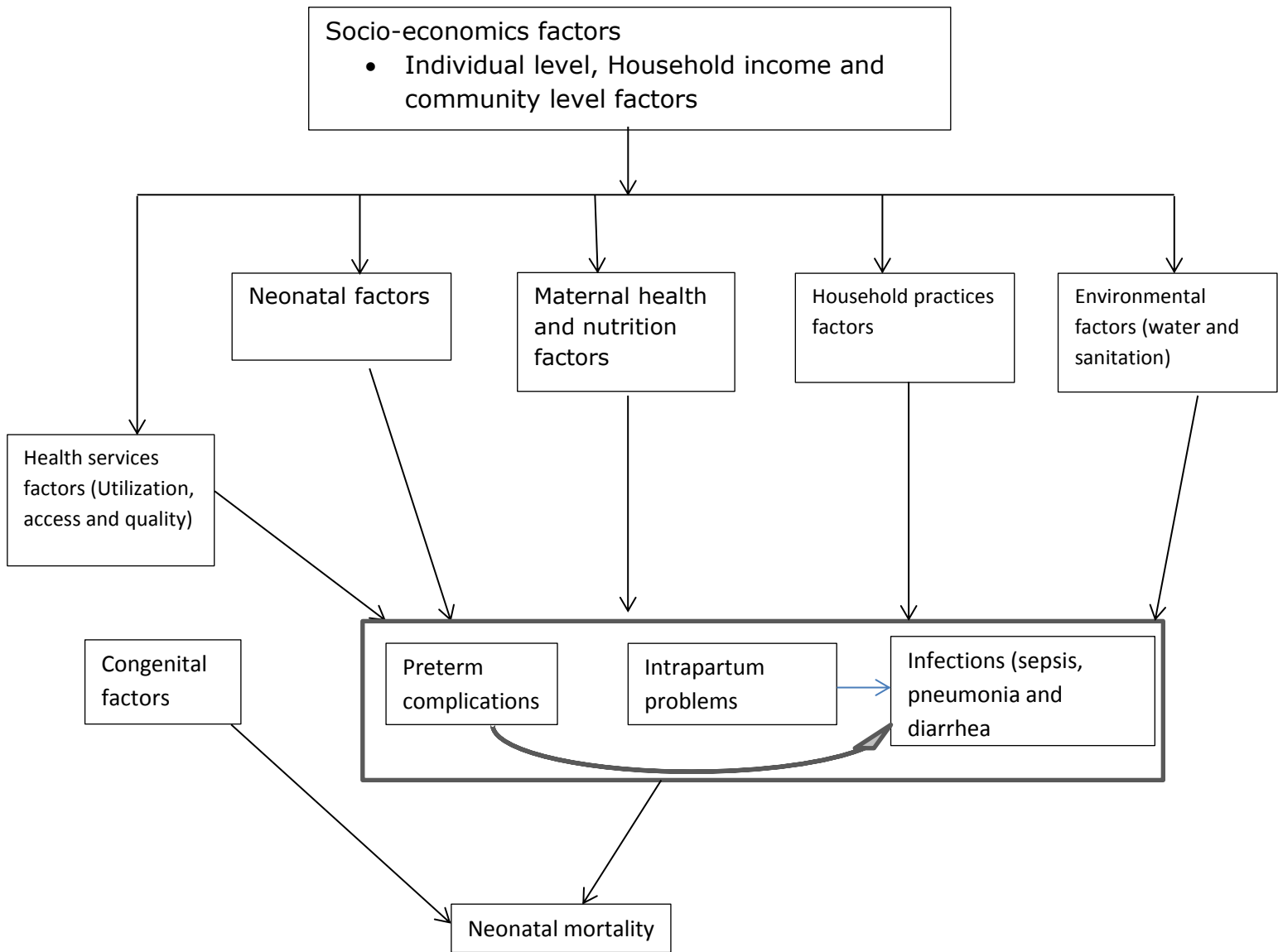
Figure 1: Conceptual framework for determinants of neonatal morality in Ethiopia

3. Neonatal mortality in Ethiopia

This chapter discusses the epidemiological situation and causes of neonatal mortality in Ethiopia. The rate progress in NMR is taken from Unicef estimation and DHS. Then it is compared with global and regional estimates.

3.1. Progress of neonatal mortality rate in Ethiopia

Ethiopia ranks 6th out of top ten countries with the highest number of neonatal deaths in 2010 (16). NMR was about 54/1000 of live birth in the year 1990. Then in 2005 and 2011, it was decreased to 39 and 37 per 1000 of live births (2). In 2013, it was estimated to be 27.5/1000 live births and ranged from 16 to 45 per 1000 of live births (Figure 2).

In 1990, the NMR of Ethiopia was higher than average that sub-Saharan Africa (45/1000 of live births). But in 2013, it was lower than the average mortality in Sub-Saharan Africa and Southeast Asia (Figure 3). Since there is not vital registration system, NMR can be underestimated in Ethiopia. And study also found that, neonatal mortality is not report and it is taboo to notify. Even, mothers are not supposed to mourn and dead newborn are buried in the backyard (17).
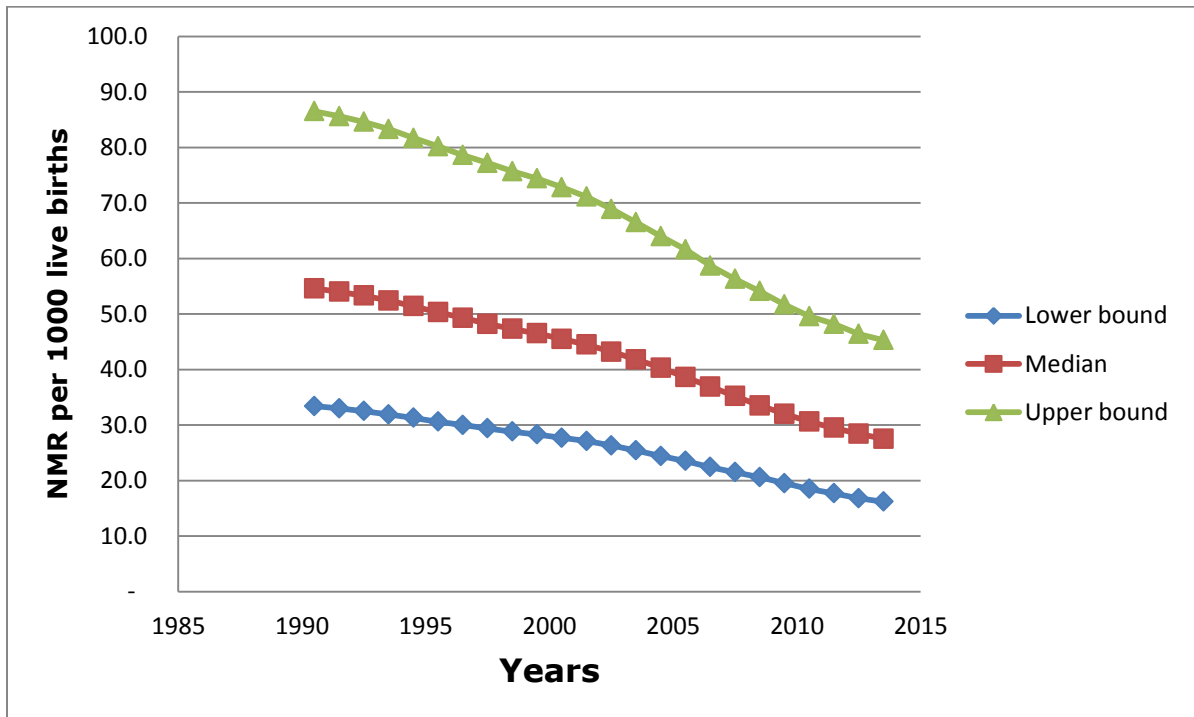
Figure 2: Progress in neonatal mortality in Ethiopia from1990 to 2013(18)

Figure 3 shows progress in NMR by WHO regions. Comparing NMR of Ethiopia, in 2013 the average mortality rate among newborn children in lower than the mortality in the average mortality rate in Sub-Saharan Africa and Southeast Asia
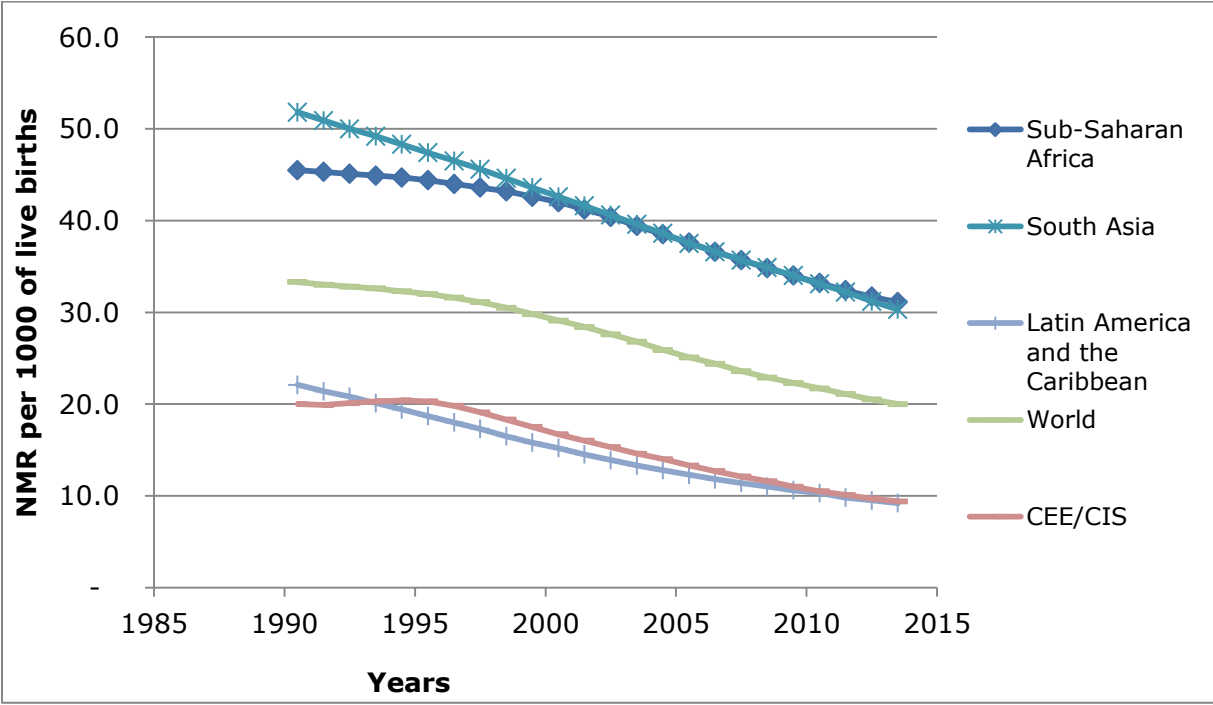
Figure 3: Global progress in neonatal mortality from 1990 to 2013 (18)

3.2. Neonatal mortality across the regions of Ethiopia

The NMR varies from region to region in Ethiopia. It ranges from 21/1000 births in Addis Ababa, to 62 per 1000 live births in Benishangul Gumuz in 2011. NMR rate is similar for most regions during 2005 and 2011 (Figure 4).
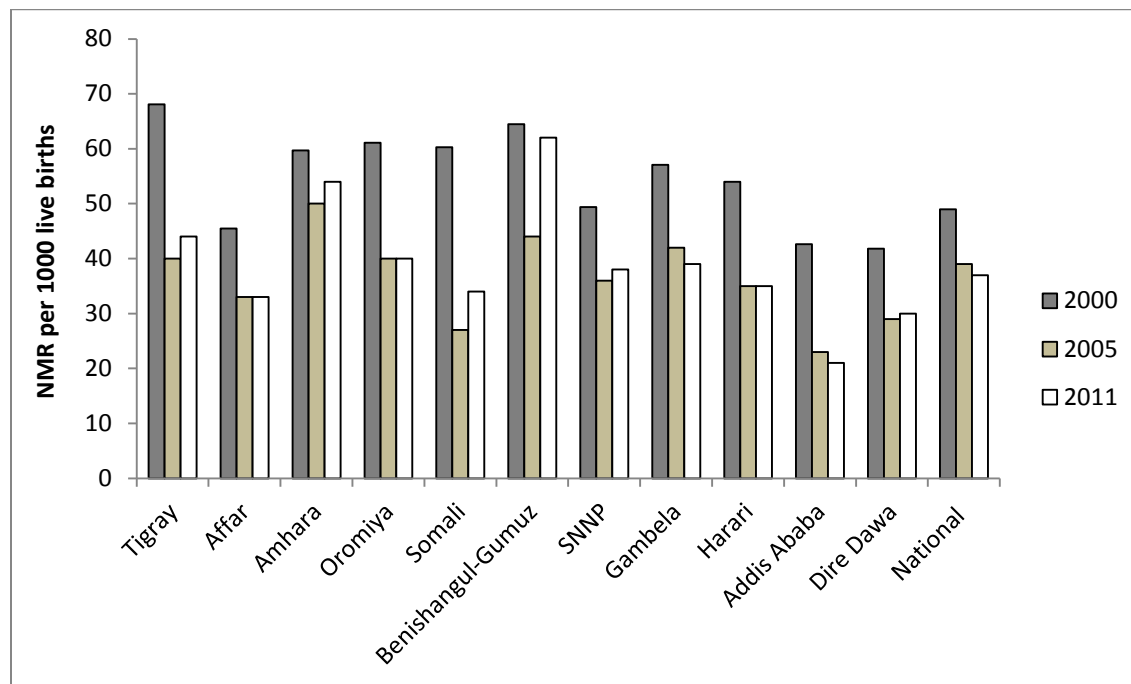
Figure 4: NMR in regions of Ethiopia from 2000 to 2011 (2)

3.3. Direct causes neonatal mortality in Ethiopia

In Ethiopia 86% of neonatal mortality occur from main three causes, infection [Sepsis (18%), Pneumonia (5.9%), tetanus (2.3%) and diarrhea (1.1%)], complication arise during intrapartum period (33.7%) and preterm (24.5%) (Figure 5). A cohort study, which followed pregnant mother until the 28 days after birth in Jimma Zone showed that about 93% of the neonatal death is caused by birth asphyxia (47.5%), neonatal infection (34.3%) and prematurity (11.1%) (19). Since there is no system to register vital occurrences like death, birth and other important events, this estimate should be interpreted with caution.

Looking at trends of causes of neonatal deaths, deaths caused by pneumonia, neonatal tetanus and preterm decreased from the year 2000 to 2013. In contrast, deaths due to intrapartum complications and sepsis is increased during this period of year (figure 5).
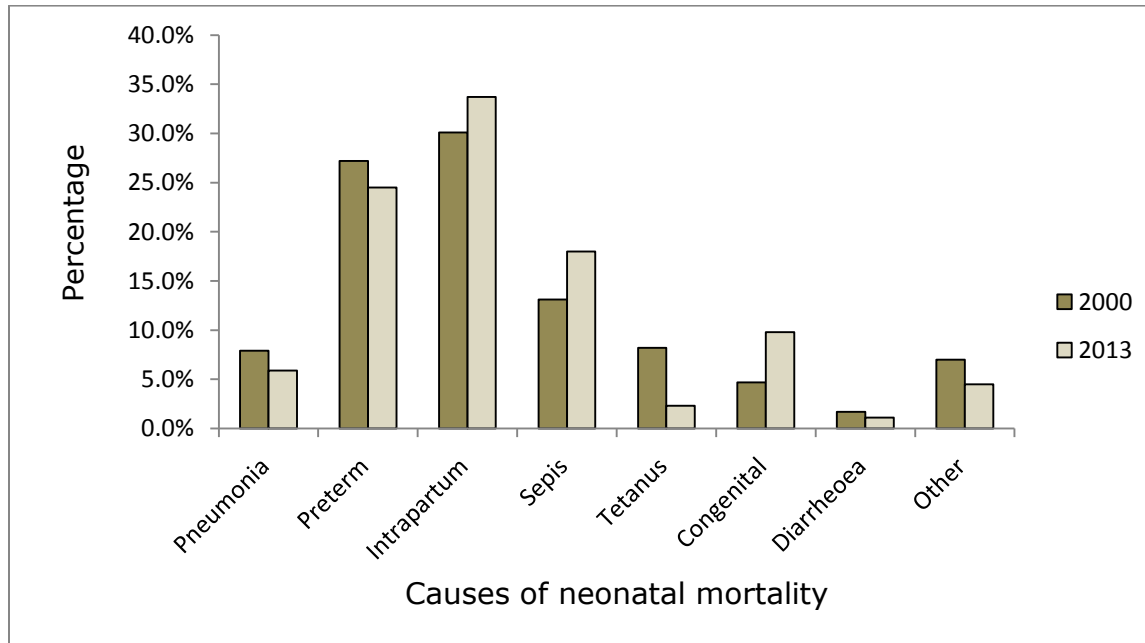
Figure 5: Causes of neonatal mortality in Ethiopia in 2000 and 2013 (18)

3.4. Time of death after birth

About 36% of neonatal deaths during neonatal period occur in the first 24 hours and 73% in the first week. The risk of death during both time period is higher in sub-Saharan Africa compared to other region of the World (20). Seventy percent of neonatal deaths occur in the first week of life in Ethiopia (19,21). The rate of mortality in the first 24 hours is very high Ethiopia. Study done at Buta Jira Demographic Surveillance Site (DSS) indicated, the mortality rate is 18 deaths per 1000 person-days during the first 24 hours. But the rate of death in 28 days is only 1.3 deaths per 1000 person days (22).

4. Determinants of neonatal mortality

This chapter discusses the determinants of neonatal mortality in Ethiopia. According the conceptual framework used in this study, socioeconomic determinants act through proximate determinants to influence neonatal mortality. Two categories of determinants discussed in this section: socioeconomic determinants and proximate determinants. Intermediate determinants will be discussed in the first part this section and the socioeconomic determinants are addressed in sub-chapter 5.2.

4.1. Intermediate determinants of neonatal mortality

Intermediate determinants are those factors which directly influences the direct causes of mortality and morbidity. Five intermediate factors are included in this study. These are; neonatal factors, mothers' health and nutrition, household practice, health care during pregnancy, child birth and postnatal period, and environmental factors (water and sanitation). The relationship between these determinants and neonatal mortality is discussed below.

4.1.1. Neonatal characteristics

Neonates are more susceptible to death compared to other age groups. This is possibly the immunity of the neonate not well developed. Neonates have 30 times higher chance of compared with children age 1-59 months (10). Susceptibility to death differ sex of child, birth size (birth weight), birth order and birth order.

Sex difference

Study found that male neonates have higher biological chance of death than female neonate (10). A study done in Ethiopia indicated, male newborn have 38% excessive risk of death compared to female. Another study also indicated, male neonates are at higher probability of death than female (21,22). This difference also observed in 2011 DHS report. According this report NMR is 51/1000 live birth among male while it is 34/1000 live births among female (2).

Birth weight

WHO defined birth weight as a weight of the newborn just after birth or within the first hour of birth. A neonate with normal birth weight has a weight of 2500 grams to 4000 grams. Birth weight less than 2500 gram is considered as Low Birth Weight (LBW). Mothers' response of birth size is used to estimate birth weight in places where the birth weight cannot be taken.

Neonate with small birth size were considered to have LBW (23). Globally, 14% of neonates have LBW. Children with LBW have 60 to 80% higher chance of death during neonatal period. LBW is mostly caused by intrauterine growth retardation and preterm birth (10).

Birth weight is estimated by mother's response on birth size in Ethiopia, since 86% of births takes place at home (23). Study showed neonates with small birth size are at higher chance of death in Ethiopia. A follow up study done in the Southwest Ethiopia reported higher risk of death among neonate with small birth size compared to those with normal birth size (19).

Birth order

Studies done in Ethiopia have contradicting findings on the association between birth order and neonatal mortality. Studies done through reanalysis of DHS 2011 found that, first birth order have 68% of excessive risk of mortality compared to second to fourth birth order (24). Also increase probability of mortality as documented among higher birth orders (five and above). Study done neonates 7 days of age indicated, higher likelihood for mortality among fifth and above birth orders compared other birth orders less than five (25).

A cohort study done in Southwest Ethiopia indicated, association both first and firth and above birth order are at risk of mortality compared to other birth orders (26). But another study, which combines DHS data from 2000, 2005 and 2011 concludes that birth order has no significant association with neonatal mortality (21).

Birth interval

Short and long birth interval has also showed to have an impact on neonatal mortality (27). Studies done in Ethiopia indicated birth interval less than 24 months higher likelihood for neonatal mortality (21,24). However, a study done in Southwest does not show a significant association between birth interval and neonatal mortality (26).

4.1.2. Maternal factors

In this section, maternal factors namely; maternal nutritional, tetanus vaccination and health status and age of mother were analysed as mothers' factors affecting neonatal mortality.

Maternal nutritional status

Globally, about 800 thousand neonatal deaths are attributed to mothers' under-nutrition. These because, undernutrition among mothers results intrauterine growth retardation which is a cause for small for gestational age (SGA) and LBW (28). Also, micronutrient deficiency contributes to intrauterine growth retardation (29). Analysis of DHS data indicates that neonates born from mothers who had anaemia during pregnancy are likely to have small birth size. But the study done in Ethiopia did not show an association between mother body mass index (BMI) and the birth occurrence of small birth size (30).

In Ethiopia there is a high rate of maternal under nutrition. During 2011, about 27% of women aged 15-49 years old have a BMI less than 18.5 which is the cut-off point for under nutrition among adult (31).

Mothers' health status

Health status of the mother affects survival neonates. Study done in Ethiopia indicated, NMR is 50 times higher among neonates lost their mother (421/10,000 child-days) compared those whose mother alive (81/10,000 child-days) (32). This contributes to high NMR since maternal mortality rate (MMR) was high in Ethiopia even though it is decreasing over time. In 2011, MMR was 676/100,000 of live births and decreased to 420/100,000 of live births in 2013 (31).

The effect of malaria infection on neonatal mortality has been also reported. Malaria during pregnancy causes anaemia, LBW, prematurity and stillbirth (33). Study done in 2003, multiple site in Ethiopia indicated, placental infestation with malaria related to LBW (3.2 (1.4–7.3)) and prematurity (2.7 (1.1–6.5)) (34).

Furthermore, sexually transmitted infection (syphilis, HIV, Gonorrhoea and chlamydia) of has an impact on premature birth, LBW and neonatal mortality (35). In addition, pregnancy induced hypertensive disorder also related with neonatal mortality (36). But our search does not yield study done studies from Ethiopia which showed association of above mentioned diseases and neonatal mortality.

Age of mother

Age of mother is another important contributing factor for the occurrence neonatal mortality. Neonate born from mother less than 18 year of age are at higher chance of mortality (11). Reanalysis of DHS data from 2000 to 2011 year showed 41% excessive death among neonates born from mothers aged less than 18 years compared to those aged 18 to 34 years of age. It is also indicated that, NMR is higher (61/1000 live births) among newborn from mother aged less than 20 years than the average NMR (37/1000 live births) in 2011 (2,21).

Median age at first marriage is 16.5 years among women in Ethiopia. During 2014, 17.3% of girls aged 15-19 years are got married (26). The rate of early marriage is highest in regions with the highest NMR. About 40% women in Amhara and 20% Benishagul Gumuz regional states are married at 15 year and, these two regions highest NMR compared to other region of Ethiopia (2).

Tetanus toxoid vaccination

Vaccinating mother against tetanus decreases the occurrence of neonatal tetanus. Ninety four percent of neonatal death will be averted by giving mother at least two doses of tetanus toxoid during pregnancy (11,13). Data have been indicated that the neonatal death due to tetanus is decreasing in Ethiopia. This is can be related with increased tetanus toxoid (TT) vaccination rate. The recent data from Ethiopia indicated that 48% of mothers take at least two doses TT which prevents the occurrence of neonatal tetanus (2).

4.1.3. Health care service factor

Health care before and during pregnancy, childbirth and the postnatal period also associated neonatal mortality. Availability and access of service during these periods attributed to lower NMR. Also, provision of high quality maternal and newborn care saves one million neonates worldwide (11). In the health care factors, the effect of access and utilization of antenatal care, skilled attendant birth attendant, and postnatal care on neonatal mortality is discussed.

Antenatal care utilization

Antenatal care (ANC) is the first contact of health facility with pregnant women. During ANC health professional identify problems during pregnancy, provide vaccination and nutritional supplements, treats disease which adversely affects the neonate and mother. The components of services provided and information provided during ANC is essential in improving neonatal (37).

Studies done in Ethiopia showed contradicting result for association between ANC follow up and neonatal mortality. One study showed that neonates born from mothers without ANC follow up are more likely to die than those followed ANC (24). Also, another cohort study also document higher risk of death among neonates whose mother did no use ANC (19). But study done in Northwest Ethiopia doesn't show statistically significant association between ANC and neonatal mortality (38).

In Ethiopia, ANC utilization increased from 27% to 41% from the year 200 to 2014. But, in 2014 only 31% of mother received the recommended number visits (31).

Utilization of Skilled birth attendants

Utilization of skilled attendants (SBA) during child birth increases the survival of both neonates and mothers. Evidence from sub-Saharan Africa indicated that facility delivery reduces neonatal mortality by 29% in low and middle income countries (26). Skilled birth attendance is mostly provided in the health care facility. Studies done in Ethiopia indicated a lower risk of neonatal mortality by health institution delivery (19,21,25). But in Ethiopia only 16% of delivery is attended by skilled attendants during 2014 (31).

Study in Northwest Ethiopia does not show statistically significant association between use of skilled birth attendants and neonatal mortality (38). But this finding cannot undermine the importance of SBA for newborn health. The observed difference is because of factors considered in the study. The study done Northwest Ethiopia does not include factors like quality of care and household practice which also determine the occurrence neonatal mortality.

Postnatal care utilization

During postnatal care (PNC), health professionals counsel mother for breast feeding, assess and treat health problems of mothers. As a result of this, utilization of postnatal care have significant effect in decreasing neonatal mortality (37). In Ethiopia small utilization of postnatal is low. In 2014, only 13% of women received postnatal care after 2 days of delivery (31).

Access and quality of health care

Lack of access to health care, especially basic and emergency obstetric care is associated with neonatal mortality in Ethiopia. Study showed, living more than 80km away from health facility provide emergency obstetrics care has 14 time risk for neonatal mortality than living 10 km near to services (39).

Lack of competence on neonatal care was observed among health professional in place where health services are available. Study done in Addis Ababa indicated that, health professionals lack necessary competence for neonatal resuscitation. It also showed similar level of competency in the year 2008 and 2013, even after improvement for drug, supplies and referral system was made for health facilities (40). Study done among graduating midwife student from public universities indicated lack of competencies in neonatal care (41), which decreases quality of care provided in the future.

In addition to this, in urban places like Addis Ababa where about 80% of mother uses skilled birth attendants, problem in referral system and quality health care was reported. There is also communication problem among facilities and most of health professional never had refresh course on emergency obstetrics and newborn care (42).

4.1.4. Household newborn caring practice

There are different common caring practices related to neonates during and after birth in Ethiopia. These care practices are immediate bathing newborn, inappropriate cord care, discarding of colostrum milk and pre-lacteal feeding (giving foods before breast feeding).

Different newborn caring practices were reported in different studies done Ethiopia. Study done in Oromia, Amhara, Tigray, and Southern Nation, Nationalities and Peoples regions of Ethiopia indicated, wide practice of bathing during the first 24 hours after birth (74.7%), application of butter and other substances to the cord (19.9%), and discarding colostrum milk (44.5%) (43). Furthermore, qualitative study done by Mihretab et.al also reported practice of feeding immediately after birth (pre-lacteal feeding) and immediate bathing newborn (44).

But there are also practices acceptable home caring practices. The cross sectional study which covered four regions of Ethiopia documented wrap of baby with clothes (82.3%), exclusively breast feed (87.2%) and dry cord (62.5%) are practiced by majority of households (43).

But qualitative study from Southern Ethiopia indicated breast feeding initiation is delayed until the placenta is expelled. Also the child is not given breast milk until one day perceiving that, breast milk may not start to follow and colostrum should be discarded. It also found that, there is delay in wrapping of baby with warm clothes even among mothers who can explain the importance of thermal care. There is also immediate bathing, no or late skin to skin contact (45).

Furthermore, unhygienic care of umbilical cord is reported by qualitative studies. Application butter is the most commonly practiced. But other substance like petroleum gel and animal dung was applied to the cord. Mother or traditional birth attendants justify use this substance to facilitate healing (43,46).

Commonly, in Ethiopia mother and newborn should stay at home for 40 days. This is a belief designed by community, to facilitate the period of rest and repair for mother, to establish breastfeeding and to protect from evil spirit. During these 40 days women are not expected to assume the household as well as field works. This is likely to affect the health seeking behaviour of household in addition to lack of access to health facilities (47).

The cause of newborn illnesses is mostly related to evil spirits. There is a belief that newborn and mother should be protected from these evil spirts. Because of this, use traditional healers and religious leader is the first to be consulted in the case of illness (47).

Traditional norm on neonatal illness and mortality has also its place in contributing to the neonatal mortality. According to qualitative study done Molla et al., neonatal death is not considered as similar with adult death. It also indicated neonates considered as strange in household and their death is attributed to supernatural in most of cases. Even mothers are not expected to mourn for their dead newborn (17).

In addition traditional belief also shapes the decision making power of the women for health seeking behaviour of mothers. Studies have indicated, the community have set of symptoms which have to be taken to traditional healer, religious places and health facilities. The symptoms taken to health facilities are vomiting diarrhoea and weight loss. Other symptoms like difficult of breathing, skin infection and redness of eye are either not recognized or taken to traditional healers (48).

Other important determinant for neonatal survival is breast feeding practice of the mother. Especially, the effect of early initiation of breast feeding after delivery and exclusive breast feeding are well documented. Breast feeding within 24 hour after delivery decrease the risk of mortality by 44% among neonates, if it is combined with exclusive feeding (49).

Breast feeding is universal in Ethiopia. About 97.5% of mother breast feed their children. But during 2011, only 51.5% of mother breastfed within first hour after delivery and there are another 20% did not breast feed even in one day after delivery. Beside this, about 20% mother practiced pre-lacteal feeding (2).

4.1.5. Environmental factor (water, Sanitation and hygiene)

Clean birth practice reduces neonatal sepsis, tetanus and other infection affect neonates. Handwashing during delivery one the clean birth practice which decreases infections. A systematic review indicated that hand washing with soap can reduce overall neonatal mortality by 19%, neonatal tetanus by 49% and cord infection by 30% (50).

The effect of hand washing with soap is also indicated by intervention study done in Nepal. It documented NMR lower by 41% in intervention areas, compared to areas without intervention (51). Regarding the effect of water supply and sanitation, study indicated NMR is lower in area that have high quality water supply and sanitation (52).

In Ethiopia access to sanitation and water supply is limited. In 2014, about 57% of household has access to improved sources of water, in which 50% of urban household have access to pipped water sources while it is only 0.9% in rural areas. Regarding sanitation coverage only 4% of household have improved toilet facilities (31).

Studies have found that access to water and toilet facility decrease the risk of occurrence of diarrhoea. The difference in the quality of water has different effect on the diarrheal disease and mortality among children. High quality water has better effect then the low quality water (52).

In Ethiopia, studies done on neonatal health did not focus on the effect water, sanitation and hygiene on neonatal mortality and morbidity. But the effect of water, sanitation and hygiene cannot be ignored given its relationship with infections.

4.2. Socio-economic determinants

The next section discusses association between socio-economic determinants and neonatal mortality. These determinates act on intermediate determinants to cause neonatal mortality. The socio-economic determinates are categorized in to three. These are individual level factors (mother and father characteristics), household income and community level factors.

4.2.1. Individual level factors

The individual level factors mother and father characteristics: education, occupation and marital status. Study showed, NMR decrease as female literacy increases. In countries where female literacy is less than 51.1%, NMR is found to be greater than 30/1000 of live births (11).

DHS 2011 indicated decrease in NMR as mother educational level increase in Ethiopia. NMR is higher neonates born of mothers who have no formal education (46/1000 of live birth). It is 35/1000 live birth among those born from mother at least attended primary education, 31/1000 live birth among neonates born from mother attended secondary and 8/1000 live births above secondary respectively. Also, in Ethiopia only 50% women attended formal education, which is even lower among women rural area (2).

NMR has statistically significant difference among different educational levels of mothers. Neonates born from mother with no formal education have more likely to die compared to those born from mother having secondary school and above education. But, the risk is not statistically significant compared with primary school (21). But another study done in Jimma zone, Southwest Ethiopia, did not show statistically significant association between mother education and neonatal mortality (19). But these can be because of methodological difference between two studies. Study done in Jimma used small sample size.

Another mothers' characteristics is occupation. Study in hospital setting indicated high risk of neonatal death among neonate born from unemployed mother (25). But study done in Southwest Ethiopia at community level failed to show the association of neonatal mortality with mother employment (19).

Fathers' educational status and occupation is also included in study done in Ethiopia. The study done in Southwest Ethiopia does not observe the association of both occupation and educational status of father (19). Most of the studies included in this study do not include these factors.

4.2.2. Household income

NMR is high among households with lowest wealth index in Ethiopia. It is about 50/1,000 live births among household with lowest wealth index and about 37/1,000 among richest house. But, NMR has no significant difference between middle and richest categories of wealth index (2). It has been indicated the risk of neonatal mortality double among poor and poorest household compared to richest households (53). The gap of NMR between rich and poor households is increasing. From the year of 2000 to 2011, there is 1.5% increase gap of NMR (54).

It is also indicated health service related to newborn care utilized by rich household than poor. In the year of 2005 to 2011 utilization of skilled birth attendant is far higher among wealthiest household. In 2011, nearly half (46%) of wealthiest households are used the skilled birth attendants while it is only 2% among poorest household (2,55). Similarly, utilization of ANC is higher (77%) among rich household and only 23% poor household uses ANC. Also, 50% wealthy household use postnatal care while only 7% among poor households use it (31).

4.2.3. Community level variables

As community level factors, geographic variation (urban-rural and regional variation), access road, gender in equalities and early marriage were discussed.

Geographic variation

NMR is similar among urban and rural residence during 2011 in Ethiopia. But, utilization of skilled birth attendant is 43.1% in urban and only 3.7% in rural (2). However, statistically significant variation in neonatal morality was observed among the regions of Ethiopia. Benishangul, Tigray and Amhara regional states have high NMR, while Addis Ababa city has the lowest rate in the country (21,56).

Access to road

Road coverage is important for the household to access basic health care during illness and connection with information, better job and education. Road access found to be associated with neonatal mortality in Ethiopia. Yaya et al. indicated neonatal mortality is 2 time higher among households which are 6 km far away from road compared with those with five kilometer road access (53). But in Ethiopia there is limited road access especially in rural areas.

Gender Inequalities

Gender inequality is a societal factor related neonatal mortality. It does not directly contribute to mortality, but through maternal health and women economic power. In countries where gender inequalities exist, there is a high rate of under nutrition among women. Also there is high rate of domestic violence, low education attainment among women, less access health service and less control on economy (57).

Gender inequality index (GII) is one way of measuring inequalities. Ethiopia has high GII (0.547) and domestic violence rate (58). Domestic violence, which is mostly resulted from gender inequality affects pregnancy outcome. Study done in Ethiopia found that there increased risk of LBW and preterm birth among women exposed to domestic violence (59).

Early marriage

As indicated above in section 5.1.2, neonatal born from mother aged less than 18 years old at higher risk death. Delivery before this age is because of early marriage. Ethiopia is one of the countries with wide practice of early marriage. Early marriage is results lower school attainment among women with lower educational status. It is highly practiced rural residents than urban. Two regions, Amhara and Benishangul regional states, are where nearly half women marry before age of 18 year (60).

5. Best practices and interventions of decreasing neonatal mortality

Cost-effective interventions exist to reduce neonatal mortality in low resource settings. The interventions should cover the life course from pre-conception, through pregnancy, childbirth and postnatal period. It is should be in all level of care (61). Study indicated universal coverage of health services during pregnancy, labour and postnatal period could avert 41 to 72% of neonatal mortality (37).

Interventions before pregnancy are; delaying age at first pregnancy, optimizing interval between pregnancies, meeting the unmate need for family planning and improving nutritional status of the girls. During antenatal period; maternal immunization, treatment and screening for sexual transmitted disease, malaria prevention and treatment, maternal nutritional enrichment and detection of intrauterine growth retardation (13,37).

Interventions during labour include; obstetric care, skilled birth attendance, and management of pre-term labour and post term pregnancies. Emergency obstetrics care is one of the interventions which can reduce the neonatal mortality by 40%. Skilled care with without emergency facilities reduces neonatal mortality by 25% only (13).

This intervention should be provided through continuum of care across the level of care. It has been recommended packages of service should be provided through community, outreach and facility level to achieve high coverage of this interventions (62). To increase access and coverage of intervention different care modalities and intervention were used in low and middle income countries. In the following subsection, delivery strategies and platform used to provide these services and their effect on decreasing neonatal mortality is discussed.

5.1. Community based strategies

Different community based strategies are available to provide newborn care at the community level. These strategies are effective in countries where access and utilization of health care is low (37). Evidence from systematic review indicated that interventions at community level decreases NMR by 26%. Interventions provided at community level consists of behavioural change communication, provision treatment and care and increasing health seeking behaviour (13,63).

These are; community based newborn care, participatory women's group, involvement of male partner, home visit, community based case management, and training of traditional birth attendants. The effect this strategies on neonatal mortality will be discussed.

5.1.1. Community based newborn care

Community based newborn care (CBNC) is a strategy through which intervention related newborn care is provided at the community level. It consist of identification of pregnancy, provision of home based antenatal care, postnatal care and treatment of referral for newborn care Interventional study done in Bangladesh found that CBNC decreased 34% reduction in NMR (64). Meta-analysis focused on interventional studies done in India also showed 26% decreased neonatal mortality by CBNC. In India, CBNC included home visit during pregnancy, delivery and postnatal as well as treatment for sick neonates through community health workers (65).

CBNC was piloted also in different zones of Ethiopia. According the ministry of Health the program has aim to link between health post and health centre. It also addresses intervention before and during pregnancy and postnatal period. It consists of prenatal and postnatal contact of mother, case identification, care and treatment and completion of full course of antibiotics (66). This strategy is can be useful in rural Ethiopia.

5.1.2. Participatory Women's group

Women's group is participatory leaning activity for pregnant women that involve identification and prioritization of health problems during pregnancy, plan and implement the solution with locally available solutions. It is intended to increase appropriate health seeking behaviour, improve home based prevention and practices. Meta-analysis indicated 20% reduction in NMR in place were women group was used (67).

Women's group has also found to be effective in Nepal. In intervention study which compares the effect of women's group with no intervention showed that 30% reduction in neonatal mortality. It also indicated increase in utilization ANC and hygienic care (68). Study done in Bangladesh also found lower NMR in place where women's group was implemented. It is indicated participatory women's group improve in home based newborn care like infection, newborn thermal care and breast feeding practices (69).

Use of women group was started in Ethiopia as women Health Development Army. They are responsible to identify health problems, and designed solution it. Although there is no study which showed the effectiveness of the program, ministry of health claims the success in Tigray region in terms of increased utilization of skilled birth attendants. But this group generally focused on overall health problem of the community rather than maternal and newborn health (70).

5.1.3. Training of traditional birth attendants in newborn care

Traditional birth attendants are responsible to attend birth and care for new in place where use of skilled birth attendants is low. Training of the traditional birth attendants was effective to decrease neonatal mortality (71). Meta-analysis indicated inconclusive result on the effect of training of TBA on the neonatal mortality. It is reported small decreased in neonatal mortality, but no significant effect on maternal mortality (72,73).

Changing the role of tradition attendant from handling of delivery to promotion for use skilled attendants was found to effective. In Malawi changing the role TBA has increased utilization of skilled birth attendants (74).

5.1.4. Home visit for maternal and neonatal care

Home visit during pregnancy, delivery and postnatal is another effective community based care strategy to provide newborn care. In 2009, WHO recommend home visit for neonates immediately after birth when possible. During home visit community health workers identify health problem of the mother and newborn. If the problem exists, they refer the nearest appropriate health facility (75).

Home visit also facilitates continuum of care from health facility to community and visa versa. It also improves healthy behaviour practices like breast feeding, hygienic neonatal care, delayed bathing and skin-to-skin contact (62). It also indicated for postnatal home visit around time of birth, the visit during the first two days after delivery more effective than the later days (65).

Systematic review indicated that, home visit by community health worker decreases neonatal health by 24%. It also increase utilization of ANC, tetanus toxoid immunization, early initiation of breast feeding within one hour and clean cord care (76).

5.1.5. Integrated Community case management (iCCM)

Community case management (iCCM) is one the community based intervention used to treat common childhood illness at the community level by community health workers. It was mostly used for treatment of malaria, diarrhoea and pneumonia for children aged 2-59 months of age. It is used reach underserved community segments by increasing access to treatment through Community Health Workers (77).

Inclusion of the case of neonatal sepsis and pneumonia in the iCCM is also effective to decrease neonatal mortality. Meta-analysis found that community level treatment of pneumonia decreases the neonatal mortality by 44% (78). An interventional study done in India for 10 years on home based treatment of neonatal sepsis, care for preterm and LBW found effective decreased in neonatal mortality. Community health workers are trained to provide home based care which both prevention and treatment. Ten years result of the study indicated the reduction mortality is due to treatment of cases like pneumonia and sepsis (79).

Use of community health workers is also effective. Studies have indicated that community health worker can diagnose possible bacterial infection among newborn babies with high sensitivity (tends to include false positive) and low specificity (80).

5.1.6. Male partner involvement

Male partner involvement is strategy in which women are accompanied by their partner during ANC, delivery and postnatal care. Different strategies are taken in different counties to increase the involvement of male partner. It is recommended to increase utilization of maternal and newborn health service (81). A study found that male involvement in ANC increases the use skilled birth attendance at birth, use early postnatal care and improve mother knowledge. But there no conclusive evidence that the male involvement improve pregnancy outcome and neonatal mortality (82).

5.2. Improving quality of maternal and newborn of care

Quality improvement at different level of care is showed to be effective to increase utilization of maternal and neonatal health service. It also showed to show decreased NMR. Women who perceive lack of quality health care can avoid using health facility (83).

Improving quality of care is important at community level. This consists of giving training of traditional birth attendant and community health worker are effective to decrease neonatal mortality. To increase access, community level generation of fund for transport is found to be effective (84,85).

Different quality improvement methods found to be effective to increase maternal and neonatal care. This are in-service training, specialty team and support for mother during pregnancy and labour, and professional feedback, stress management training and multi-disciplinary meeting (85). But the effect of in service training on the reduction of neonatal mortality is not conclusive. Cochrane review indicated in service training can improve performance on neonatal resuscitation and decrease unnecessary resuscitation. But there is no conclusive result whether it decrease neonatal mortality or not (86).

5.3. Method to improve access to health care

Increasing access to essential health service especially for time around child birth is very essential to decrease newborn mortality. To increase access to care, training of additional human resources, facilitating transportation service and maternity waiting home are methods that tried before. In Malawi these method are applied to increase access to care. for instances, training of non-physician clinicians, provision of motorcycle ambulance were used to increase access (74).

In addition, reducing or removing user fee from maternal and neonatal health care, voucher system for access to care for pregnant mother also used to increase access. Beside this, designing transport schemes to facilitate referral for women with complication also intervention to remove barrier to access (71).

5.4. Intervention for small and ill newborn babies

Small and preterm babies need special attention to survive. Proven high-tech intervention mostly found in high income countries. These technologies are not affordable in low income countries. Now days there are proven non-sophisticated and cost-effective interventions. One of these interventions is kangaroo mother care, which is skin to skin contact, breast feeding support and early discharge from the hospital care for small (LBW) newborns (13).

Meta-analysis has indicated Kangaroo mother care decrease neonatal mortality by 50% in low and middle income countries (87). Study done in Ethiopia also indicated mortality rate is lower for LBW babies received kangaroo mother care than those received conventional method of care (88). It also leads to 27% increase in the rate of breast feeding

6. Policies and strategies on neonatal mortality in Ethiopia
6.1. Policy and strategy milestones to neonatal health

Ethiopian current health policy was endorsed 1993 which laid down a foundation for the improvement of health service. The main focus is democratization, decentralization and equitable distribution of health care services. The policy also gives emphasis to less privileged population like rural community, women and children, and promotion of health and prevention of diseases. The health policy was guided by 20 year health sector development program, which is divided into five year term. Health sector development programs (HSDP) included many child survival programs (3).

The first HSDP identified essential health service package in which child health was one of the package. But, it does not include priority areas of child health including neonatal health. The second HSDP had particular focus on toward health problems objective for the reduction of infant mortality, but there is no specific focused on neonatal mortality. It is in 2004 when the national child survival strategy was developed to guide achievement MDG 4, reduction of neonatal mortality addressed. Implementation of this strategy was included HSDP III for implementation which starts in the year 2005 (89).

Child survival strategy identified newborn focuses on three main causes of neonatal mortality which are responsible high proportion of death in Ethiopia. It has addressed both the promotion/prevention and clinical care for neonatal health problems. Key intervention was focused antenatal care, TT immunization, skilled delivery, clean delivery, and prevention of hypothermia, early and exclusive breast feeding and Hygiene/sanitation/safe water were identified as intervention for child survival. Care also for newborn with health problem like resuscitation, management of hypothermia, antibiotics for sepsis was included in the strategy. These interventions were addressed at community, family and health facility level. In addition the strategy include care for small and preterm newborn (90).

Then in 2005, the national reproductive strategy was developed as part of HSDP III. This strategy highlights the importance of skilled birth attendance and emergency obstetric care. Also it address increasing utilization of family planning (91).

Furthermore, in 2005 the health extension program was launched primary level care for community level health services. In this program, two health extension workers are deployed to every kebeles, (the lowest administrative level in Ethiopia) provide majorly health promotion and preventive activities, and some basic curative activities. They work on to increase of antenatal care, hygiene and sanitation practice and institutional delivery. Basic interventions which reduce neonatal mortality were included in the family health package of health extension program (89).

But, Ethiopia left to scale up the program. Study which compared five countries with high neonatal mortality, in terms of their readiness to scale up neonatal specific heath program and policies indicated, Ethiopia did not achieved 50% of the benchmarks designed to implement neonatal specific program (92).

6.2. Service delivery

Regarding service delivery neonatal health services provided at community, primary and referral level of care. Community level service is provided by health extension worker, whose primary purpose is promotion and prevention of health problems. Health extension worker also attend deliveries, provide immunization and make referral (89).

Health centres provide basic curative care and supervise the health posts. Hospitals provide majorly curative and therapeutic care (89). But from the available health centres, on 56% of them provide basic emergency obstetrics care (B-EmNOC) and 73% provides integrated management of newborn and child common illness (IMNCI). Only 57% of available hospitals provide comprehensive emergency obstetrics service (4). The INMCI included the first week of life and clinical guide for neonatal care (4).

With the help of health extension program integrated community case management (iCCM) for common childhood illness (for children 2-59 months) is implemented since 2010 in Ethiopia. In the iCCM the health extension workers can assess, classify and refer the child to the health centres. It is also piloted for community based newborn care to include the treatment and referral of neonatal sepsis and pneumonia (93).

6.3. Financing for essential interventions

The current health expenditure is 16% from the total GDP which equals the pledged health care expenditure of Abuja declaration by Africa leaders. But the currently percapita health expenditure is about 41 USD, which is half the recommended 86 USD to provide the minimum health care package (8).

User fee was removed from maternal, newborn and child health in Ethiopia. But, study done in 2008 indicates that 65% charge user fee certain aspect of care including drugs and supplies (94). National health account indicated that, the rate of out-of-pocket payment is about 27% for reproductive health services, and 47.9% for child health services (8).

6.4. Health care workforce

WHO recommends at least 23 health professional (physician, Nurses and Midwifes) per 10, 000 of population to provide minimum coverage of key health services identified in MDG (6). According to the recent data of health and health related indicators, one physician service about 32,000 people and one midwife serves 14,847 people while one nurse serves about 1,884 people at national level. But there is huge variation across the regions. The biggest regions (Oromia, SNNP and Amhara region) with two third of countries population more affected by human resources (4).

There are also 39 thousand health extension workers for about 1 to 5000 people. The health extension is considered as one of the success story for health work force in Ethiopia. They provide some essential intervention like family planning, antenatal care, postnatal care and delivery care (89). But according to WHO definition health extension worker are not considered as skilled birth attendants.

7. Discussion

In this chapter the interventions to improve newborn health care by addressing the determinants will be discussed. The chapter is organized depending on the objectives and conceptual framework of this study.

7.1. Analysis on direct causes of neonatal mortality

Neonatal death is majorly occurred in the first week of life and the first 24 hours is the time when most of death occurs. Three major causes, intrapartum complications, preterm complications and infection, contribute to more than 85% of newborn death in Ethiopia. Providing effective care can prevent majority of these deaths.

Community level treatment which is integrated case management (iCCM), can be used to treat uncomplicated cases infections, and refer the complicated ones. Health extension workers can be used to provide care. It was used for illness among children aged 2-59 moths in Ethiopia and can be used in rural part of the country. But it may not bring the required result, if the next level of care, the health centre, is not available or does not have the capacity to provide the required service. Health centres should be equipped with necessary materials and skilled professional to handle the referral cases. Staff of the health centres should also supervise the community care.

Many cases of neonatal death within 24 hours and first week can be prevented by increasing access and utilization health care during delivery and postnatal care. Skilled birth attendance is important in the first 24 hours because, they are supposed to provide clean delivery, manage complications and provide essential neonatal care. Furthermore, increasing postnatal care utilization during the first three days can help to identify and treat the health problem occurring in the first week of life. For the mothers who prefer to give birth at home, home visit during delivery and postnatal period can prevent many deaths. Increasing skilled birth attendance and postnatal care is targeted by the strategic plan of the Ethiopian government. But, coverage of the services is still low.

7.2. Analysis of intermediate determinants

LBW is one of the neonatal factors determine the NMR. This review indicated neonate born having small birth size have higher chance of death. This underlines the importance of prevents the occurrence of LWB, identifying and treating neonate with small birth size. But, it is difficult to identify neonates with LBW in Ethiopia, since births are attended taken place at home by untrained attendants.

The effect of a shorter birth interval on neonatal mortality is also observed in this review; a birth interval less than 24 months is a risk for neonatal mortality. Shorter birth intervals are associated with LBW and preterm birth. This indicates the need to optimize birth interval at least up to 24 months and above. As a result of the high rate of unmet need for family planning in Ethiopia, birth intervals are short.

Studies have also indicated birth order also determines NMR in Ethiopia. The first, and fifth and above births are at higher risk for mortality. The risk of the first birth order is may be related the high occurrence of pregnancy complication among mothers who give birth for first time. But it can be also, related to the age of mother at first birth. High rate of early marriage in Ethiopia likely contributes higher risk of death the first birth order. The risk related to the fifth and above birth order related to also maternal health. Mother who gave multiple births likely to be malnourished and the chance for the baby to be preterm and LBW is high.

The second important group of intermediate determinants are factors related to (the health of) the mother. Mothers' health and nutritional status are key factors to newborn health. Study done in Ethiopia does show significant association between BMI of mother and neonatal death. But the role of mothers' nutrition on neonatal mortality is not ignored considering its association with preterm birth, LBW and SGA. So, focus should be given to girls' nutrition and mothers' nutritional status during pregnancy.

Age of the mother is another important factor contributing to neonatal mortality. There is an association between giving birth at age less than 18 years and neonatal mortality. NMR is also higher for mother less than 20 years age. In Ethiopia about one fourth of women married at age less than 18 years. This underlines the importance of increasing the age of the mother at first birth.

Furthermore, Survival of the mother is essential for survival of neonates. A study found that neonates whose mother died are more than 50 times more likely to die. Thus, preventing and treating health problems and conditions during pregnancy and delivery can improve neonatal health in two ways. It saves both mother and neonate.

In addition to health status and age, tetanus toxoid vaccination utilization among mothers prevents neonatal tetanus. Also contribution of neonatal tetanus to neonatal mortality is decrease. But only about 48% mothers are vaccinated against tetanus. Increasing TT vaccination coverage can further decrease the incidence. This can be also achieved through increasing ANC coverage and ensuring that all mothers attending ANC are vaccinated.

ANC is an important health service to identify health problems during pregnancy and helps for birth preparation. However, studies done in Ethiopia have inconclusive results on the association of ANC and neonatal mortality. The difference in studies may be due to difference design. Another problem is studies trying to find evidence for the effectiveness of ANC, that usually ANC coverage is used as indicator, whilst the quality of care provided in ANC clinics is not assessed. However, the importance of ANC in improving neonatal health care cannot be denied but quality of ANC should be improved. During ANC different health problems can be identified and treated.

Moreover, skilled birth attendance is a key factors determining neonatal mortality. Studies indicated that neonates born in health facility have lower chance of death compared with home delivery. This is because, during facility birth, health professionals provide essential newborn care. It is also possibly during facility birth, mother get counselled newborn care practice. Removing barrier to care and increasing awareness by improving quality can increase utilization of care.

Furthermore, utilization of postnatal care, immediately after birth, is important service neonatal health. Evidence has indicated use of postnatal care decrease the neonatal health. This is important because during postnatal visit, health problems of the neonate are identified and treated. But it is difficult to increase postnatal care in Ethiopia. Culturally mother and newborn should stay at home for 40 days after birth. Health facilities far away from household further which prevents mothers from utilization.

However, utilization of ANC, skilled birth attendance and postnatal care is low in Ethiopia. This can be because of lack of access; services are not available in existing facilities or low health seeking behaviour. Our assessment on health service delivery indicates that, basic and comprehensive emergency obstetrics and newborn care is not available in all health care facilities. The ratio of facility and health professional to population is also less than the required standard. Furthermore, there is lack geographic and financial barrier which affects access to care. A study has indicated that, user fees are charged to maternal and health service while it supposed to be free. Beside this, the transportation cost to access the may be not affordable rural and poor community and in some places there may no road access. Acceptability of care provided can be problem which is not focused by studies in Ethiopia.

Also, utilization service is low among poor household, rural resident and mother with low educational status. Health facilities are also concentrated in urban area where more wealthy and educated individuals reside. This indicated services are not available for population with more health care needs. So, correcting this inequity is the role of government to ensure the services are available.

Studies done in Ethiopia identified different neonatal caring practices during birth and postpartum period which adversely affects the newborn care. These caring practices are taken place at home and cause infection, hypothermia and malnutrition. The traditional belief attached to postnatal period and neonates hinders the use of health service. So, understanding this traditional beliefs and practice is important to design appropriate care modalities.

Interventions for intermediate factors should address improving maternal health, increasing utilization of essential health care and discouraging harmful caring practices.

Different strategies used to decrease neonatal mortality in low income countries identified in this review. One of these strategies is community based newborn care which includes identification of pregnancy and follow up to neonatal period. The strategy use home visit, behavioural change communication, as well as treatment and referral for identified health problems. This is specifically can be used in rural areas where health

facilities are not available. This strategy showed to be effective Nepal and India, where it is used.

It can also be used in Ethiopia. Since there is established community health care program through health extension worker, it ca easily integrated health systems. But, it needs supervision and training of community level worker. Also care should be taken on implementation, because it may overload the health extension workers.

Organising participatory women's groups, which include pregnant mothers, can be used in Ethiopia. This is useful especially to change the household practice since it enhances learning from each other. Participatory women's group found to be effectively decreased NMR in Nepal and Bangladesh.

Besides increasing utilization of care, increasing availability should be considered. Training of additional health professionals and correcting misdistribution available one should be considered. This review described lack of skilled health professional like midwives and physicians as well as available health professionals are concentrated in urban areas. Quality of training for professionals should be improved, to create competent health professionals. Studies have found that, midwives lack necessary competency for newborn resuscitation and most of newly graduating midwifery students have no required competencies on obstetrics care (41).

In the review, the study which includes the effect of environmental factors is not found. But, this does not deny importance water, sanitation and hygiene on neonatal mortality. It is established that, environmental factors improves health. Child survival strategy of Ethiopia also included water, sanitation and hygiene as one the strategy to prevent neonatal mortality. But further study is needed on its contribution on neonatal mortality.

Based on analysis from the literature review, health care during pregnancy, delivery and postnatal period are mainly determining neonatal mortality in Ethiopia. There is interrelationship between the maternal health, nutritional status and neonatal factors. Also health care availability is related to neonatal care practice. The intermediate determinants factors together affect direct causes, which are infections and neonatal conditions. So addressing these factors have paramount importance in dealing with neonatal health programs.

For improving access, utilisation and quality of newborn health care communities and health facilities should be linked. The presence of health extension workers gives the opportunity to make this linkage.

7.3. Analysis of socioeconomic factors

Socioeconomic factors like educational status of mother, household wealth quintile, gender inequalities and access to road have high impact on neonatal mortality.

Education is a key for improvement of health and it one the basic determinant for neonatal mortality. Our review indicated; NMR decreases as educational status of mother increase. However, studies have enough evidence on the effect of primary education of mother. But this cannot deny the importance of primary education. Because, educated mothers are more likely to practice healthy behaviour like using ANC, skilled birth attendance, postnatal care and seek health care during the illness of their newborns. Educating women can improve health status of neonates. But, only half (51%) of women ever attend school in Ethiopia. To achieve the health goals, giving information on healthy practices should be considered.

Studies have conflicting results on the relation between mothers' occupation and neonatal mortality. Occupation of the mother, of course, also depends on the educational status. So, further study is needed on the effect of mothers' occupation on neonatal mortality.

In this review we found that household income is association with neonatal mortality. In Ethiopia higher NMR is documented in poorest wealth quintile household. This is not surprising finding since the household income is related with almost all of the intermediate determinants. Data also indicate there is no difference in neonatal mortality among richest and middle wealth quintile household. This indicates the poorest households are left behind.

Variation in NMR is also observed among regions, Amhara and Benishangul regional states have highest rate of NMR. These variations among regional status may be because of wide cultural practice which adversely affects the neonatal health. In this two regions there wider practice of early marriage. Especially in Amhara region nearly 50% women forced to be married before 18 years of age. In Benishangul Gumuz region there is a custom that a women give birth in bush alone. It is may be also associated with lack of

access to health care. Also, it is one the region in Ethiopia with infrastructure is less developed.

Reports in Ethiopia showed similar NMR in urban and rural area. But, NMR in Addis Ababa, the capital city, is the lowest in the country. So this may be because of the sample size, since, the proportion of population live urban area is only 16%. It is maybe because of lack of quality in health care available in urban areas. The finding of this review indicates lack quality in health facilities, problem in referral and lack of communications between health facilities. Also, as indicated above, rural areas have low utilization maternal and newborn health care and health facilities are less available for them.

It is clear that, improving socioeconomic status of the society improves health status. But, improving health status of the community also improves the socioeconomic status like income. To fulfil the health need of low people with low socioeconomic status health program should ensure equitable distribution of health care.

Although the Ethiopian health policy is designed to focus on low socioeconomic groups, services are mainly used by those with high socioeconomic status. This can be partly because lack of awareness. But it can be also because of the financial burden of health care on households. This study described health service, child health services, also majorly financed household and then by donor. This needs designing of sustainable financial mechanism of health services which decrease donor dependency and decreases financial burden on household related to health service use.

Achieving gender equality improves health status of the women and their newborn. In Ethiopia, women are less educated and exposed to domestic violence. Early marriage is still widely practices and deeply rooted in the society. So, working to empower women through education and access to resources has paramount result. In addition involving male partner in to maternal and newborn care is found to increase use service. It can be useful where male control most of resource and makes decision for household.

Strategies towards improving neonatal health in Ethiopia are mainly focused on the provision of maternal and newborn services health services, rather than on influencing socioeconomic and cultural factors. This contributes to continued occurrence of the problem since the underlying problems are not

solved. So there a need to work to improve socioeconomic factors through multi-sectoral collaboration.

7.4. Strengths and limitation

This review has strength by shows the determinants of neonatal mortality and it gives the summary of the problem on the topic. It also identified the interventions for the determinants which can be used by policy makers.

It also has certain limitations. Most of the studies used in this review are cross sectional and, for that reason, cannot show causal associations. Most studies only showed determinant of the demand side and very few studies show supply side determinants. Furthermore, this review cannot show the whole picture of neonatal mortality in Ethiopia, since it is limited to the studies done before in small areas.

Reflection on conceptual framework

The conceptual framework helped to systematically analyse the determinants of neonatal mortality. But it does not show the interrelationship of the factors. So, if this relationships among factors is corrected it may be used by other research to analysis the determinants of neonatal health problems.

8. Conclusion and recommendations
8.1. Conclusion

Most of neonatal deaths are preventable in Ethiopia. Preventing and providing treatment for the major cause; intrapartum problems, preterm complications and infection; can avert most of the deaths.

Low utilization maternal and newborn service like ANC, skilled birth attendants and postnatal care as well as lack of access to quality health services is the most prominent factors determining neonatal mortality in Ethiopia. Household practices and beliefs related to neonates and postpartum period contributes to neonatal mortality and hinders utilization of health care during postnatal period. Furthermore, high rate of undernutrition among mothers has its part in determining neonatal mortality by increasing LBW and preterm birth. Additionally, low women literacy, wide spread of poverty and presence of gender inequalities are the basic factors which contribute to neonatal mortality in Ethiopia.

Interventions are available to improve neonatal health in low resource settings. Most interventions focus the intermediate factors and direct causes. The most prominent interventions are community based newborn care, community case management, women's group and improving quality of care.

These removing user fee, preparing transportation facilities, and community based fund for transport can remove financial and geographic barriers of accessing care.

8.2. Recommendations

Based on the finding of this study the following recommendation is forwarded for different bodies

The ministry of health and Regional Health Bureau should:

- Increase access and utilization of health care during pregnancy, delivery and postnatal period especially for poor and rural communities through constructing additional health facilities and deploying human resources.
- Improve the quality of care available care designing standard for quality improvement methods and improving the competencies of health care professional during pre-service education.
- Discouraging harmful neonatal caring practice increasing awareness of the community health extension program and mass medias
- Scaling up of current community based programs that are piloted may decrease many neonatal deaths.

Health facilities should:

- Health facilities should work to continuously improve of quality of care related maternal and newborn health care by designing the care which are culturally acceptable to the community through community involvement.

Primary level health care

- Strengthen community and home based care of newborn through health extension workers by including the neonatal care into the health extension program and proving training for health extension worker on essential newborn care.

For further researchers

- Further research on acceptability of care provided by health facilities

For Government of Ethiopia

- The government of Ethiopia should give focus to; women empowerment, education and improvement of income

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