LUND UNIVERSITY

Department of Economic History

Master Program in Economic Demography

Infant and Child Mortality in Ethiopia

The role of Socioeconomic, Demographic and Biological factors
In the previous five years period of 2000 and 2005

By

Desta Mekonnen

mas09da3@student.lu.se

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Supervisor: Tommy Bengtsson

ACRONYMS

CSA Central Statistics Agency

DHS Ethiopian Demographic and Health Survey

FMOH Federal Ministry of Health

HIV/AIDS Human Immuno-deficiency Virus/ Acquired Immuno-deficiency Syndrome

IBFAN International Baby Food Action Network

MDG Millennium Development Goals

MoFED Ministry of Finance and Economic Development

NFFS National Family and Fertility Survey

PHC Population and Housing Census

UNFPA United Nations Fund for Population Activities

UNICEF United Nations Children's Fund

WHO World Health Organization

Abstract

This paper examined and identifies the important determinants of infant and child mortality in Ethiopia. The 2000 and 2005 Demographic and Health Surveys (EDHS) data were used. Logistic regression method were used to determine the impact of bio-demographic (proximate) and socioeconomic determinants on infant and child mortality. The infant and child mortality reduced during the period 2000 and 2005. The results show that among bio-demographic factors marital status, birth order, type of birth and preceding birth interval are the important proximate determinants for both infant and child mortality. However, breast feeding has a significant impact on infant mortality. Among Socioeconomic determinants education, household size and sex of household are the most important determinants for both infant and child mortality. However, other socioeconomic variables diminished their impact and environmental factors lack their impact on infant and child mortality. Therefore policies should be revised and implement and health intervention program that focus on mothers and children health should be strong to achieve the Millennium Development Goals (MDGs) of infant and child mortality in the remaining years and in addition the policies should be focus on improving both mothers and fathers education and prolonged breast feeding should be encouraged.

Key words: Infant mortality, child mortality, bio-demographic factors, socioeconomic factors, Ethiopia.

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1. Introduction

Infant and child mortality is a factor that can be associated with the well-being of a population and taken as one of the development indicators of health and socioeconomic status and also indicates a life quality of a given population, as measured by life expectancy. That is why reduction of infant and child mortality is a worldwide target and one of the most important key indexes among Millennium Development Goals (MDGs). Hence its indication is a very important for evaluation and public health strategy. Thus it is an area that many researchers focus and that has attracted the attention of policy-makers and program implementers worldwide. One of the most important targets of Millennium Development Goals (MDGs) that introduced in 2000 at the United Nations Millennium Summit was reducing infant and under-five child mortality rates by two-thirds from the 1990 levels by 2015. In 2000 the Ethiopian government announce the intention by signed the millennium declaration committing to achieve the Millennium Development Goals (MDGs) by 2015, many of which overlap with the 2015 national policy goals, which introduced by the federal government in 1991 and a policy action has been continued, for instance, in 2004 the Ethiopian government prepared child survival strategy and implementation plan to reduce under-five mortality of 140/1000 live births to 67/1000 live births by 2015, this means a reduction of two-thirds of from the 1990 rates about 200/1000 live births or a 52 percent reduction from 2004 rate about 140/1000 live births (FMOH, 2005).

Ethiopia is the second largest country in Africa and the least developing country with high fertility and rapid population growth rates. The country's population is estimated nearly 79 million and a growth rate of 2.73 percent per year (MoFED, 2008). The Ethiopian population is a predominantly rural and young society and the majority of the population has traditionally been concentrated in the highlands, with nearly 85 percent of the population living in rural areas while the rest lives in urban areas. The population growth rates about 2.73 percent which is slightly greater than the sub-Saharan Africa countries an average growth of 2.5 percent. Urban populations growing nearly 2.3 percent per year while the rural population growing at about 4 percent. The age structures suggest nearly 45 percent of the populations are under age 15 and the percentages of the population above age 65 are only about 3.2 percent (Ringheim et al, 2009). Since the late 1950s the country economic performance indicates that the average GDP growth has reduced from 5 percent in the 1950s to less than one percent in the 1980s. Emerging from long civil war and several famine, Ethiopia replaced the Derg regime, which negatively affected the countries economy, with a federal structure of government, introducing a new national policy that address population growth and population dynamics and was implemented in 1993, which allowed Ethiopian to take off from this economic stagnation and to start a sustainable and enduring political, economic and social development. Economic growth during this period show that quit impressive that per capital GDP grew at average rates of 5.6 per annum (from 1991 to 2000) and the recent growth register showed that 10.7 percent per annum . Nonetheless, the economic performance has been fragile and uneven due to internal and external shocks including Ethio-Eritra war during the period 1998 to 2000.

Most of the scholars indicated that the decline of mortality especially infant and child mortality in Ethiopia. The critical forces behind for this decline of mortality are the downward of agriculture, the increase of urbanization and the launch of globalization which accelerate the economic performance of a country, had significantly negative impact on mortality particularly reduced infant and child mortality rates (Kenny, 2006). At the same time an improvement of health conditions indicators for measuring the economic performances at the national level of the country.

In Ethiopia, in coincide with the population growth, starting in the late 1950s onwards, crude death rates substantially declined, it reduced from 30 to 15 per 1000 people from 1960-2005 due to the introduction of basic health services, particularly in the rural areas and at the same time life expectancy (about 42 years) slightly lower as compared to sub-Saharan countries (about 45 years) (World Bank, 2004). The infant and child mortality in Ethiopia had shown a continuous decline since 1960 onwards with a more pronounced reduction in the recent decades. The trend of infant mortality rates has been about 200 per 1000 live births in 1960, 153 in 1970, 110 in 1984 (CSA, 1991, 1993), 97 per 1000 in 2000 and 77 per 1000 live births in 2005 , this means that infant mortality declined by 20.6 percent between 2000 and 2005 (DHS, 2005) and under-five mortality rate is more than 200 per 1000 live births and continued the reduction to 123 per 1000 live births in 2005 which is 25.1 percent lower than it was five years ago that is 167 deaths per 1000 live births in 2000 (DHS, 2000 and see appendix 2). In a great deal of this gains was achieved through the progressive implementation of Millennium Development Goals (MDGs) and Ethiopian health sector development program, has made a great strides to improve infant and child mortality. However, yet over all infant and under-five mortality rates remain very high; one in every 13 babies born in Ethiopia did not survive to celebrate its first birth day and one in every eight children died before its fifth birth day.

The current levels of under-five mortality still high as compared to the minimum Millennium Development Goals (MDGs) of 67 deaths per 1000 live births internationally adopted in the 1990 world summit for children. As indicated in the Figure 1 the trend of under-five mortality and the target of the Millennium Development Goals (MDGs) deviate slightly.

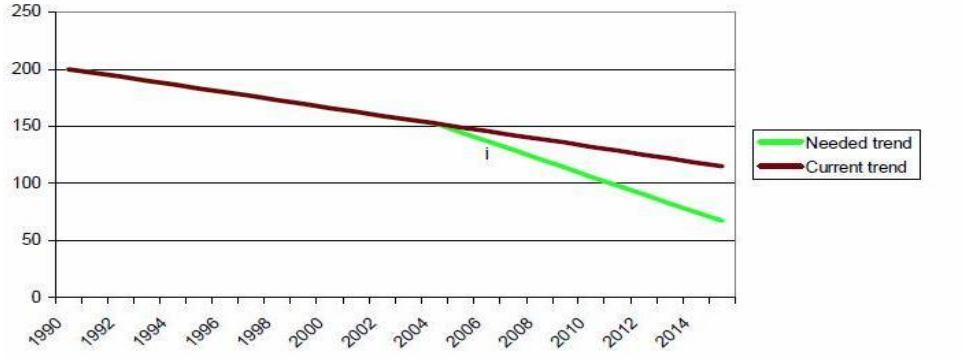
It is not well understandable why infant and child mortality rates are staying high and far from the desire in Ethiopia, despite the intervention target made. Researcher suggest that like other sub-Saharan region, the impact of HIV/AIDS epidemic (Rutstein, 2000), poverty, economic crises, political unrest and civil war contributed to the worsened of the levels of mortality particularly for infant and child mortality. It was noticed that for the decline of infant and child mortality achievement was through the intervention of disease oriented program, in recent decades the awareness of maternal, environmental, behavioral and socioeconomic factors were increased and recognized as additional important factors of infant and child mortality. At the same time the level of infant and child mortality rate are among a vital indicators used as a measurement for socio economic progress of the country.

Like other developing countries, significant differentials in mortality levels were observed among rural and urban residents of Ethiopia. For example, according to 2005 EDHS report infant, child and under-five mortality are lowest 66, 32 and 35 per 1000 live births in urban areas while 81, 40 and 41 per 1000 live births in rural areas, respectively. The urban-rural variation even more pronounced in child mortality. The regional variation in infant and child mortality also pronounced in Ethiopia. This variation is due to the unevenness of the distinct characteristics of basic health care and socioeconomic developments.

From the above discussion, a reduction of infant and child mortality is an important issue in Ethiopia. There has been a clear decrease in infant and child mortality between 2000 and 2005. This study investigate the causes for the reduction of infant and child mortality and identifies the more important factors associated with the decrease of infant and child mortality, since in recent decades demographic researchers indicate that, there is a strong relationship between infant and child mortality and socioeconomic and bio-demographic factors. It is important in order to revise, develop and implement effective national health strategy to achieve Millennium Development Goals (MDGs) by 2015. It also may important to develop and implement child

survival program to handle the differentials of infant and child mortality in Ethiopia. The analysis will be based on Mosley and Chen (1984) who consider socioeconomic and bio-demographic factors that affect infant and child mortality.
In this thesis I will use logistic regression analysis to analyze the determinants of infant and child mortality rates as well as I will compare the result of the estimate of the model between 2000 and 2005 and distinguish which factors are more pronouncedly contribute to the decline level of infant and child mortality. I will estimate the model using data from Ethiopia Demographic and Health surveys, 2000 and 2005.

Figure 1 Achieving MDG for child survival



Source: (FMOH, 2005)

1.1 Aim and scope

As discussed earlier, together with the decline of infant and child mortality, poverty is the fundamental problem in Ethiopia. Yet the overall estimation indicated that about 44 percent of the population lives under the poverty line, which is equivalent to US$ 0.45 or 3 birr per person a day (MoFED, 2005).

Since in recent decades demographic researchers indicated that, there is a strong relationship between infant and child mortality and socioeconomic and bio-demographic factors. When data from two Ethiopian Demographic and Health surveys (EDHS, 2000 and 2005) are compared between the period 2000 and 2005, the marked decline of infant and child mortality rates are observed in the two surveys (2000-2005).

The main aim of this study is to investigate the association between infant and child mortality and socioeconomic and bio-demographic factors in Ethiopia and distinguish which of these factors are more pronounced impact for the reduction of infant and child mortality during the period between 2000 and 2005 and identifies the most important factors so that, it indicates the government should give more attention on those key sectors that will have more impact on child survival to achieve the goal of Millennium Development Goals (MDGs) on infant and child mortality and to develop and implement appropriate intervention of health strategy to further reduction of infant and child mortality. According to Mosley and Chen (1984) factors associated with mortality categorized in to socioeconomic (exogenous) and biomedical (endogenous) or proximate determinants. Socioeconomic factors affect infant and child mortality indirectly because they operate through the proximate determinants while the proximate determinates directly affect infant and child mortality (Mosley and Chen, 1984). This study consider most of the variables belonging to both categories and used Mosley and Chen

(1984) child survival framework unless some problem of the data analysis and the data availability restricting to use the variables.

Mosley and Chen (1984) categorized socioeconomic determinants in to individual levels, household levels and community levels, that infant and child mortality could have reduced due to the change of those socioeconomic categories operating through proximate determinants, and proximate determinants categorized in to five generalized group such that Maternal factors, environmental contamination, nutrient deficiency, injury and personal illness, that the decrease of infant and child mortality may due to the change of these proximate determinants categories. DHS survey permit the analysis of this study since I can access all needed information on the reproduction history of womens or the status of all births that is obviously important for infant and child mortality analysis.

1.2 Research question

In this study I focus on socioeconomic, biological and demographic factors of infant and child mortality in Ethiopia. Also discuss and summarize the factors likely to explain the observed socioeconomic and bio-demographic differentials in infant and child mortality.

The main research questions are

- Could the decline of infant and child mortality in the period 2000 and 2005 in Ethiopia be due to the significant role of socioeconomic and bio-demographic determinants? And together with these question the study identifies the factors that are primary important determinants of infant and child mortality in Ethiopia. Since in the recent decades, it is established that, socioeconomic and bio-demographic determinants have a strong impact on the reduction of infant and child mortality and also investigate the regional variation of infant and child mortality, Since from the pervious researches unevenness of health facilities and services across the region and also the observed socioeconomic and bio-demographic differentials also explain infant and child mortality in Ethiopia.

The initial assumption of the study was all socioeconomic, biological and demographic factors are important for the case of Ethiopia. For this reason and based on the previous researches I have selected the theoretical model of Mosley and Chen (1984) which are in fact this frame work fit very well for the data I will used and also most previous research studies on infant and child mortality implicitly and explicitly used on the Mosley and Chen framework (1984) that distinguish between intermediate and socioeconomic factors. As I discussed above based on the previous researches and theoretical model, this study identifies the important determinants of infant and child mortality and seeks plausible answers for the above main research questions.

1.3 Outline of the study

Chapter two will discuss the background of Ethiopian situation and profiles in related to infant and child mortality followed by a theoretical frame work, literature review and hypothesis. The data and methodology part are presented in chapter three followed by statistical model in chapter four. The fifth chapter will present the empirical analysis and discussed in chapter six. Finally, the conclusion section will present in chapter seven.

2. Background

Ethiopia is a land locked country situated in horn of Africa, with boarders to Kenya, Sudan, Somalia, Djibouti and Eritrea. Ethiopia is the oldest independent countries of Africa and among ancient and historical countries of Africa. It is accredited as being the origin of mankind. Ethiopia has categorized one of the largest populated countries in the world and ranked 2nd largest country in sub-Saharan Africa countries.

Ethiopia is divided in two nine region state and two administrative cities, with large variation in term of economic performance and standard of living. Like other many countries the country has a multi ethnic group with great variety of language spoken. In 2005 the country had a population about 78 million, with 85 percent of the population resides in rural areas and the remaining 15 percent live in urban areas, making Ethiopia one of the worst urbanized countries in the world (EDHS, 2005).

The performance of the Ethiopian economy has been very fluctuated and volatile. In the 1980s the economic performance of Ethiopia is very poor relative to the current situation due to civil war, drought and economic mismanagement. During this period the GDP grew less than one percent. In 1990s after the Derg regime changed, the decline trend of real GDP growth and per capital growth has been reversed. In 2007 Ethiopia has recorded the fastest growth economy in Africa among countries whose economy largely depend on the agriculture sector, the GDP growth within an average of 10.5 percent which is slightly higher than the sub-Saharan Africa average GDP growth of 6.1 percent (IMF, 2007). However, due to the rapid growth of the population, per capital income are increased only from 100USD to 150 USD from the period 1990 and 2005. The population growth reached at the peak during 1990s and then slows down the growth rates. The slow improvement of economic performance link with the intervention of market based economic strategy and poverty related health program strategy. However, about 42 percent of Ethiopian GDP growth contributed by the agriculture sectors and 80 percent of the population depend on it for their livelihood (MoFED, 2006).

As mentioned above, the population growth rates rises about 2.2 percent in the 1960s to a peak of 3 percent in 1990s, then again the annual population growth rate declined from the mid 1990s onwards and in 2009 it recorded about 2.6 percent (World Bank, 2010). The population growth continues by the pace of the current growth rates, the Ethiopian population will double in 27 years (World Bank, 2007). According to CSA (2005) the age structure suggest that above 48 percent of the population less than 15 years of age and 49 percent of the population belong to the age group 15-64, large part of the population belonging to young age group resulting high dependency ratio and unemployment rates.

The Ethiopian fertility is still characterized by high fertility levels. Total fertility rates have been increased from about 5.2 children per women to 6.4 children per women in 1990 (Family and Fertility survey, 1990 and see appendix 1), although these have started to fall to 5.9 children per women in 2000 (EDHS, 2000). Since then, continue declining sharply to 5.4 children per women in 2005 (EDHS, 2005). This shows total fertility rates reduced by only one child during the period 1990 to 2005. However, a large gap in fertility between urban and rural areas and the richest quintile and the poorest quintile exist in Ethiopia due to large inequality socioeconomic status of the society linked with demographic characteristics. For instance, total fertility rate in the capital city (Addis Ababa) is 1.95 children per women, which has achieved below replacement levels due to behavioral change of the society such that improvement of education, better provision of family planning and high housing cost can be induced women to

postponed marriage and child births (Sibanda et al, 2004). On the other hand rural areas have been declining slowly, even if the gap between urban and rural areas has been increased since 1994. Now a day's rural total fertility rates remain high at 6.4 children per women and adolescent fertility rates high for rural women's. And total fertility rate is 3.9 children per women for the richest groups while 6.4 children per women for the poorest groups (World Bank, 2005).

As mentioned earlier, since 1960 Ethiopian mortality rates trend declined in a slow pace and also higher than in sub-Saharan average mortality rates. However, during the period 1980s and 1990s most sub-Saharan countries infant and under-five mortality rates stagnant and even few of them also shows an increased trend. Despite Ethiopia continue steadily decreasing trend, some reason for this mentioned are price stability and community health intervention and performed good as compared to other sub-Saharan countries and even currently near to catch up the sub-Saharan infant and under-five mortality rates.

Overall, yet Ethiopian infant and child mortality recorded as large, nevertheless less infant and child mortality as compared to countries with the same level of per capital incomes with Ethiopia.

Based on DHS and FMOH data, the cause of under-five mortality were categorized as follow: Pneumonia, neonatal conditions (e.g. Sepsis and asphyxia), malaria, diarrhea, measles, HIV/AIDS and others, responsible for 28, 25, 20, 20, 4, 1 and 2 percent of deaths (FMOH/WHO, 2004 and see appendix 3). However, immunization role for the child survival are very poor as compared to other countries in Africa and other world. In Ethiopia only 14.4 percent of children among 12-13 months old children have been fully immunized. From recent HIV/AIDS have contribute for the high infant and child mortality rates because of the rising number of infected mothers and pregnant womens, for example, in 2005 the HIV prevalence rates for pregnant womens are about 5.3 percent (Government of Ethiopia, 2007).

As mentioned above Ethiopia is one of the poorest countries in the world and evidence indicated that most social and human development indicators ranked the worsen compared to other world countries, for example the UN's human development in 2004, placing the country at 170th out of 177 countries and in 2010, placing 157 out of 169 countries. Despite the depth and severity of poverty also varied across the region in Ethiopia.

Together the level of depth and severity of poverty, substantial socioeconomic characteristics variation in infant and child mortality would be expected. There are also significant variations in infant and child mortality by demographic characteristics of both mothers and children, such as sex of child, mother's age, age at birth, birth order, length of previous birth interval and the size of the child at birth. The marked regional disparities in infant and under-five mortality rates reflected variations in urban-rural, educational and wealth level disparities. According to 2005 DHS survey, as shown the tables 1 and 2 below infant and child mortality largely varied by regional socioeconomic and demographic characteristics. It indicates also the living standard situation of the region. According to DHS (2005), the regional variation in under-five mortality rates varied from lowest record 72 deaths per 1000 live births in the capital city of Addis Ababa to highest 157 deaths per 1000 live births in Benishangul-Gumuz and followed by 156 deaths per 1000 live births in Gambela region. The disparities of child mortality also range from lowest 28 deaths per 1000 live births in Addis Ababa to the highest of 80 deaths per 1000 live births. Similarly, infant mortality varied from 45 to 94 deaths per 1000 live births in Addis Ababa and Amhara region, respectively. These wide disparities indicate that there exist wide

variations of health infrastructure and communication and diseases prevalence conditions within regions of Ethiopia.

The mother's levels of education also highly associated with infant and child mortality and play an important role for the decreases of infant and child mortality, since better educated mothers exposed to information about better socioeconomic factors and about children health situations to decrease mortality and increase the ability to use health care resources and facilities (Caldwell, 1979). In Ethiopia a significant disparities of infant and child mortality has been found with mother's education levels. Under-five mortality rates are 139 and 54 deaths per 1000 live births for children born to illiterate mothers and secondary and higher level of educations, respectively (DHS, 2005). Similarly, infant and child mortality rates are 16 and 42, and 18 and 62 deaths per 1000 live births for children born to mother's with no education and with secondary and above education levels, respectively. In general infant, child and under-five mortality rates for children born to mothers with no educations are over twice that of children born to mothers with secondary and more educational levels. There are also great variations in term of place of residences. However, it highly associated with socioeconomic condition, access of infrastructures and health care improvement. In the case of Ethiopia urban residence have a positive pronounced impact for child survival. According to DHS (2005) that indicated under-five, child and infant mortality rates are 98 and 135, 34 and 58, and 66 and 81 deaths per 1000 live births in urban and rural areas, respectively.

Wealth based variation also larger in Ethiopia; however, it is lower as compared to other countries with similar per capital income (World Bank, 2007). Under-five, child and infant mortality rates are 92 and 130, 34 and 54, and 60 and 80 in the lowest (poorest) and highest (richer) quintiles, respectively. In general more urban based and richer linked to a positive impact on reducing mortality rates. It is also important to notice that a great variation of infant, child and under-five mortality rates by demographic and environmental characteristics, which highly associated with greater inequality of socio economic, demographic and environmental factors with in the region. And also Ethiopia has different culture and ethnic groups lead to variation of cultural practice and health services across the region, therefore, this may be one reason for the variation of infant and child mortality rates (World Bank, 2007). Some of the demographic factors differentials are shown below in the table 3 and 4.

Table 1. Infant and childhood mortality by socioeconomic characteristics, Ethiopia 2000.

Socioeconomic characteristic	Infant mortality	Child mortality	Under-five mortality
Residence			
Urban	96.5	57.6	148.6
Rural	114.7	87.8	192.5
Region			
Tigray	103.6	73.0	169.0
Affar	129.2	114.9	229.3
Amhara	112.4	80.0	183.4
Oromiya	116.2	87.9	193.8
Somali	99.4	94.2	184.2
Benishangul-Gumuz	97.6	111.0	197.7
SNNP	113.4	88.2	191.5
Gambela	122.6	126.0	233.2
Harari	118.3	82.4	191.0
Addis Ababa	81.0	35.4	113.5
Dire Dawa	105.6	78.4	175.7
Mothers's education			
No education	119.1	89.0	197.4
Primary	85.0	67.9	147.1
Secondary and higher	63.5	27.4	89.2
Total	112.9	84.5	187.8

Source: EDHS 2000.

Table 2. Iinfant and childhood mortality by socioeconomic characteristics, Ethiopia 2005

Socioeconomic characteristic	Infant mortality	Child mortality	Under-five mortality
Residence			
Urban	66	34	98
Rural	81	58	135
Region			
Tigray	67	42	106
Affar	61	66	123
Amhara	94	66	154
Oromiya	76	51	122
Somali	57	39	93
Benishangul-Gumuz	84	80	157
SNNP	85	63	142
Gambela	92	70	156
Harari	66	40	103
Addis Ababa	45	28	72
Dire Dawa	71	70	136

Mothers's education			
No education	83	62	139
Primary	78	35	111
Secondary and higher	37	18	54
Wealth quintile			
Lowest	80	54	130
Second	86	64	144
Middle	86	63	144
Fourth	84	60	139
Highest	60	34	92
Total	80	56	132

Source: EDHS 2005

Table 3. Infant and childhood mortality by demographic characteristics, Ethiopia 2000

Demographic characteristic	Infant mortality	Child mortality	Under-five mortality
Sex of child			
Male	124.4	83.0	197.0
Female	100.6	86.1	178.0
Mothers's age at birth			
< 20	148.5	90.4	225.4
20-29	104.0	83.2	178.6
30-39	109.0	83.7	183.6
40-49	113.9	80.1	184.9
Birth order			
1	143.6	72.5	205.6
2-3	98.7	87.4	177.4
4-6	100.4	90.4	181.7
7+	126.4	79.8	196.1
Previous birth interval			
< 2 years	177.7	114.6	271.9
2 years	99.0	96.7	186.1
3 years	69.5	72.9	137.4
4 or more years	57.2	41.3	96.2
Total	112.9	84.5	187.8

Source: EDHS 2000.

Table 4. Infant and childhood mortality by demographic characteristics, Ethiopia 2005

Demographic characteristic	Infant mortality	Child mortality	Under-five mortality
Child's sex			
Male	91	56	142
Female	70	56	122
Mothers's age at birth			
<20	106	62	161
20-29	75	54	124
30-39	72	56	124
40-49	96	63	153
Birth order			
1	97	50	142
2-3	71	53	120
4-6	76	57	128
7+	89	67	149
Previous birth interval2			
<2 years	134	85	208
2 years	62	53	112
3 years	51	43	92
4+ years	38	30	66
Total	80	56	132

Source: EDHS 2005.

2.1. Theoretical framework

Researchers used a number of different conceptual frameworks to analyze the impact of different factors on child survivals. Among these researchers Mosley and Chen (1984) and Schultz (1984), classified the determinants of infant and child mortality as exogenous (socioeconomic or extrinsic) such as cultural, socioeconomic, community and regional determinants and endogenous (bio-medical or intrinsic) such as maternal, environmental, nutrition, injuries and personal illness. Socioeconomic factors affect indirectly infant and child mortality, they operate through the proximate factors while proximate determinates affect infant and child mortality directly (Mosey and Chen, 1984; Schultz, 1984).

The study presented here, based on the conceptual framework of child survival for developing countries proposed by Mosley and Chen (1984) for the analysis of the impact socioeconomic factors and bio-demographic (bio-medical) factors on infant and child mortality. They identify clearly the proximate and socioeconomic determinants of infant and child mortality and they categorize fourteen proximate determinants of infant and child mortality in to five general groups. Mosley and Chen (1984) set the framework of child survival based on the assumption of all socioeconomic factors of child mortality necessarily operate through a common set of intermediate factors. The assumptions are:-

1. In an optimal setting, over 97 percent of children born can be expected to survive until the fifth birthday.

2. The proximate determinants through the socioeconomic factors operate to influence the infant and childe mortality.

3. Socioeconomic, biological and environmental factors are the driving force behind the reduction of infant and child mortality.

As mentioned above Mosley and Chen (1984) categorized a set of proximate determinants into five general groups that directly affect infant and child mortality. And socioeconomic factors affect infant and child mortality that must operate through these proximate determinates or indirectly affect infant and child mortality.

The five grouped proximate determinants that directly affect infant and child mortality are:-

1. Maternal factors: age, parity and birth intervals: - each of these factors has an impact on infant and child mortality through affecting maternal health. Synergism may also considered as maternal factors for example, birth interval categories (example short, medium, long) with mothers age categories (example five year age group).

2. Environmental contaminations: hygiene factors, water and sanitations: - each factor spread or transmits infectious disease to mothers or children.

3. Nutrient deficiency (calories, protein and micro nutrient deficiency):- the deficiency of nutrient decrease the probability of child survival and also an impact to the mothers through which affect infant and child mortality for instance, nutrition during pregnancy and lactation have an impact of new born children weight and quality of breast milk.

4. Injury: - this related to physical, burn and poisoning injury. Injuries have an impact on the infant and child mortality and more pronounced in the infanticide period.

5. Personal illness control (Immunization, bed net, malaria prophylaxis etc.):- this includes both traditional and modern preventative measures to avoid disease during pregnancy and child births and the quality of preventative measure are important. Personal illness control factors influence on pregnancy outcome and child survival through its affect on both mothers and children (Mosley and Chen, 1984 P 25-42).

On the other hand Mosley and Chen (1984) categorized the socioeconomic determinants of infant and child mortality in to individual, household and community level variables.

On the individual level fathers' and mothers' skills, health and time are the three main determinants of child survival. Parental skills have an important implication for child survivals that usually measured by fathers' and mothers' educational attainments. Mother's education may improve her productivity in child survival through influencing care seeking, morbidity and nutrition status while father's education particularly in urban areas strongly associated with the occupation and household income, household decision taking and for father's personal illness. However, the mothers' education level is the primary important determinant for child survivals. Due to strong biological association between the mothers and child during pregnancy and lactation, mother's educational levels influence her health, nutritional status, reproductivty

behaviors and knowledge of child care practice associated to contraception, nutrition, hygiene, preventative care and disease treatment that affect the health and survival of the child (Mosley and Chen, 1984).

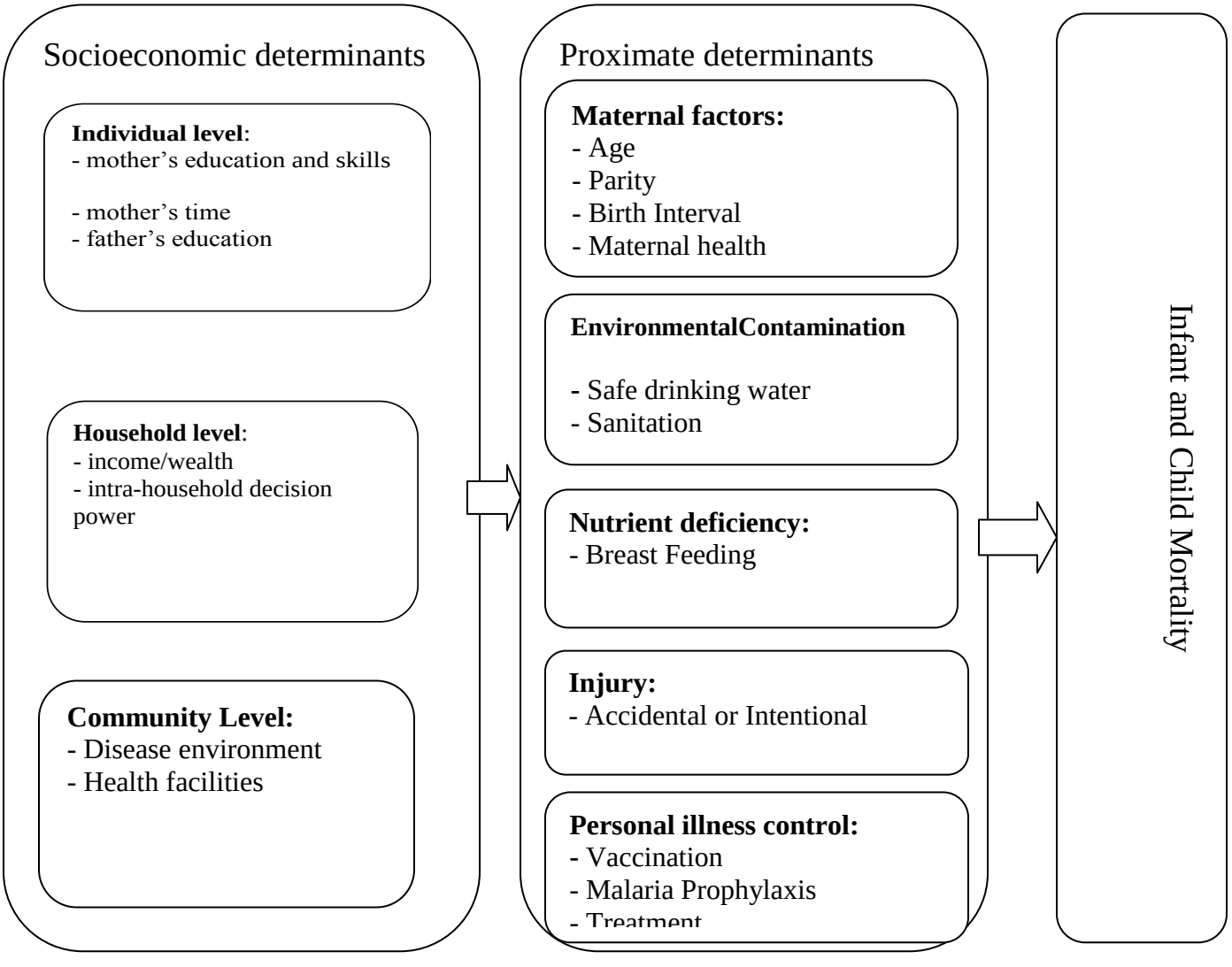
Finally mother's time also an impact for child survival such that time for health care and sickens care, food preparation, washing clothes, bathing the child and housing cleaning etc. A mother's time also linked to economical activities, particularly income generating activities that increasing child survival. In traditional society, the labor division by sex enable mother's to allocate much time for child care. However, in the majority of developing countries mother's time for children also depend on the economic situation of the household. For richer families it may be easier to allocate the needed time for child care, even if a mother's outside for work, their income enables to hire skilled or attentive nursemaid for the child while the poor household neglect the child by less skilled or non skilled sibling. As a result mother's time highly depends on the economic situation of the household, which influence infant and child mortality operate through the proximate determinants (Mosley and Chen, 1984).

Traditional/norms/attitudes are other important individual level variables in the socio-cultural dimension that shape and modify the individual's economic choice and health outcomes, which depend on the tradition and norms of the society. One of the important determinate in this category is power relation with the household that strongly linked to social norms. In most traditional society the mothers has fully responsible for childcare and therefore she may have little allocation of resources in related to the time use, expenditure allocation, nutrition choice, and health practices and also this power relation with household also affect fertility and reproduction choice. This harmful traditional choice influence highly child survival. Other cultural determinants are value of children, belief about disease causation, and food preference that influence infant and child mortality. Cultural differences between the society and regions have an impact for the child survival probability of male and female children (Mosley and Chen, 1984).

Household levels factors consider income/wealth/ effect on child survival that a variety of goods, services and assets influence child survival through operating the intermediate factors of child survival (Mosley and Chen, 1984). Similarly, community level factors also includes ecological setting (climate, soil, rainfall, temperature, altitude, and seasonality):- these variables particularly in rural society influence child and infant mortality and these variables can influence on the income generating work, use of medical facilities and the time of mothers for child care), political economy (infrastructure, political institution and health system variables) and availability of health service are crucial determinates for child survival (Mosley and Chen, 1984). In Ethiopia these difference resulting urban/rural differences in the infant and child mortality.

Figure 2 below summarize the adjusted Mosley and Chen (1984) framework, showing how the socioeconomic determinants operate through the proximate determinants that influence infant and child mortality.

Figure 2. Theoretical frame work



Source: Based on Mosley and Chen (1984) theoretical frame work.

2.2 Literature review

Several researchers investigate the factors associated with infant and child mortality by using Mosley and Chen (1984) analytical frame work of child survival. According to their analytical frame work as discussed earlier, 14 proximate determinates (Biomedical factors) were identified and categorized them into five general groups: maternal (fertility) factors, environmental-sanitation factors, availability of nutrient factors, injury and personal illness factors. However, injury and personal illness are not considered in this study.

According to Caldwell (1979) analysis found that infant and child mortality are highly associated mother's education that increases the awareness of how to care her children before birth and after birth and enables her to change feeding and child care practices by shaping and modifying the traditional familial relationships. Education plays an important role to improve knowledge of medical and health care, particularly mother's education enhance to improve

more effective preventative and health care practice, this increase her productivity and influence infant and child mortality.

Goro (2007) used data from 1993, 1998, and 2003 DHS surveys in Ghana to examine the determinants of infant and child mortality in three northern regions by using multivariate logistic regression model found that education of mothers, birth order of child and marital status of mothers are powerful significant determinants for infant mortality, while only mothers education have a significant impact for child mortality. Similarly, Twum-Baah et al (1994) indicated that children born to mothers with higher educational level associated with lower risk of infant and child mortality as compared to children born to mothers with primary education level or non-educated.

Kombo and Ginneken (2009) using the result of 2005-06 Zimbabwean DHS investigate the maternal, socioeconomic and sanitation factors on infant and child mortality by using Cox regression model. They found an evidence of birth order (6+) with short preceding interval significantly associated with high risk of infant and child mortality. Multiple births tend to increase infant and child mortality. On the other hand the expected U shape relation ship between birth order and infant and child mortality, and mothers age and infant and child mortality is not conformed in their analysis, that children who are first born and those born to mothers aged 40-49 years are found tend to decrease infant and child mortality. However socioeconomic determinants are rather small and insignificant effect on infant and child mortality. They suggest that the influence of birth order, preceding birth intervals, maternal age, type of birth and sanitation factors are more pronounced on infant mortality while weak effect on child mortality. Although as they discussed, the association of maternal, socioeconomic and sanitation factors with infant and child mortality weak as compared to 1994 and 1999 DHS surveys, which show those determinants are highly correlated and significant impact on infant and child mortality.

Kumar and Gemechis (2010) uses data from Ethiopia DHS survey (2005) and employs cross tabulation technique to examine the selected socioeconomic, bio-demographic and maternal health care factors that determine child mortality in Ethiopia. The result show that among socioeconomic variables birth interval with preceding birth and mothers education have significant impact to lowering the risk of child mortality. The result conformed that the child mortality risk associated with children of less than 2 years of birth interval with previous child was highest (15 percent) and lowest (4. 2 percent) for the children whose birth interval was 4+ years. On the other hand, they reported that children whose mother's educational level are significantly correlated to the low risk of child mortality relative to children born from illiterate mothers and fathers with primary educational level. Birth order and place of residence also an important determinates of child mortality in Ethiopia.

Wang (2003) using data from 2000 DHS in Ethiopia examine the effect of environmental factors on infant and child mortality by using three hazard models the Weibull, the Piece-wise Weibull and the Cox model to investigate three age-specific mortality rates: neonatal (under-one month), infant (under-one year) and under-five mortality by location (urban/rural), female education attainment, religion affiliation, and access to basic environmental services (water, sanitation and electricity). The key finding shows infant and child mortality are high for those children born in rural areas than urban areas. Also she found that poor environmental conditions are related to high risk of infant and child mortality. Safe water, sanitation and electricity not adequate in Ethiopia, only 20 percent of the total population mainly in urban areas have those

facilities. Improvements of these poor environmental factors lower infant and child mortality (Wang, 2003). Similarly in Malawi Espo (2002) indicate that there is a strong influence of source of drinking water and sanitation facilities on infant mortality.

In Ethiopia, Ezra and Gurum (2002) employees a logistic regression model to investigate the impact of birth interval on infant and child mortality in the context of communities characterized by high reproductivty, prolonged breast feeding practice and poor living conditions. They found that short birth interval (<18 months) significantly associated with infant and child mortality as compared to long birth interval (>24 months), this implies the influence of short birth interval are more pronounced on infant mortality while weaker impact on child mortality. Together with this main results of the analysis, they observed that children born to young mothers age (15-19) and oldest mothers age (35-49) have a significant effect on infant and child mortality as compared with children born to mothers in the age category (25-34). Education also has a significant determinant of infant and child mortality.

Mturi and Curtis (1995) used data from 1991/92 DHS in Tanzania to study the determinants of infant and child mortality by using hazard model found that short birth interval, adolescent pregnancy and previous child mortality associated with increased risk of infant and child mortality while no significant effect of socioeconomic status (i.e. maternal education, partner's education, urban/rural residence and presence of radio in the household) of the population on infant and child mortality. They conclude that demographic and biological factors such as short birth interval (less than 2 years), teenage pregnancies (<20 years) and previous child death were all have an impact on infant and child mortality and socioeconomic mortality differential are not significant (Mturi and Curtis, 1995).

Similarly in Kenya, Mustafa and Odimegwu (2008) using 2003 DHS data set for children by using logistic regression models. They examined socioeconomic determinants of infant mortality rate both urban and rural setting. They found similar result like in the case of Tanzania above that regional variation exist in infant and child mortality between the differences provinces of Kenya. Most of the socioeconomic factors are not associated with the risk of infant and child mortality while children born in the richest household has lower probability of infant mortality relative to children born in the poorest households. However ethnicity and breast feeding in both urban and rural areas have a significant influence on infant mortality and sex of the child in urban areas and birth order and birth interval in rural areas are important determinants for the risk of infant mortality. Although they found that the incidences of HIV/AIDS in both urban rural areas increase the risk of dying at infancy period.

On the other hand in Zimbabwe infant and child mortality differential exist between urban-rural residence due to regional differences in health infrastructure, and communication and disease prevalence conditions and also sanitation problem and low pipe water (poor of safe drink water) also highly affect infant and child mortality in Zimbabwe (Zimbabwe Central Statistical Office/ Macro International Inc, 2007).

Muntago (2004) used data from 2003 DHS in Kenya to investigate the impact of socioeconomic and environmental variables of infant and child mortality in urban areas of Kenya. The results show that the infant and child mortality were lower for those who were of birth order 2-3, birth interval more than 2 years, single births, living in wealthier households, had a access to drinking water and sanitation facilities, and users of low polluting fuels as their main source of cooking. However, maternal age, maternal education and gender of the child had no significant association with child mortality (Muntago, J, 2004). Other study in Kenya by Hill (2001) found that mother's educational levels and economic status have a significant impact on infant and child mortality while urban areas are associate with high risk of infant and child mortality than rural areas, however, controlling for HIV prevalence child mortality are lower in urban areas (Hill et al. 2001). Generally infant and child mortality in urban areas is lower than in rural areas.

Sahn and stifle (2003) used data from DHS for 24 African countries, found that the infant mortality in urban areas lower relative to in rural areas. Various factors contribute for this urban- rural variation such as better education, improvement of public and health infrastructures in urban than in rural areas. However, HIV/AIDS epidemic are partly responsible for the high risk of infant and child mortality in Africa, particularly in sub-Saharan countries.

Baker (1999) applying the Brass indirect estimation of the level of child mortality by using the data that was gathered by the Malawi Diffusion and Ideological change project (1998) from the three administrative region of Malawi: the north, canter and south to examine the pattern of regional variation of child mortality and selected maternal, socioeconomic and environmental factors. He found that the significant variation of child mortality between north and canter, between north and south but not between south and canter. Educational variations between those regions contribute for this regional variation of infant and child mortality. However, education associated with high child mortality variation if health service not readily available. On the other hand from the analysis sanitation and wealth index unexpectedly not contribute for the regional variation of child mortality in Malawi. However, the later result indicates that source of drink water and sanitation facilities highly correlated with the reduction of infant deaths. On the other hand Manda (1999) employs Cox regression to investigate the effect of birth interval, maternal age at birth, birth order and breast feeding by considering other relevant determinants on infant and child mortality. The result show that birth interval and maternal age significantly affect infant mortality, however, the impact much weaker on child mortality. Breast feeding status of the mothers does not change the influence of preceding birth interval length on infant child mortality risk while affect the succeeding birth interval effect on infant and child mortality in Malawi.

2.3 Hypothesis

Among sub-Saharan countries, Ethiopia is one of the country which experiencing substantial reduction of infant and child mortality. Thus, this reduction of infant and child mortality depends up on bio-demographic and socioeconomic factors. The proximate (bio-demographic) factors directly affect infant and child mortality. However, the effect of socioeconomic factors

on infant and child mortality is mainly through the proximate determinants (Mosley and Chen, 1984). Thus, in this section, according to the previous researches and theories the following hypothesis will be exploring and then this will indicates which factors are more associated with infant and child mortality in Ethiopia and seeks plausible answers for the research questions.

Socioeconomic factors:

1. The risk of infant and child mortality expected to be lower among children whose parents are secondary or more.
2. The risk of infant and child mortality is expected to be lower among children born in households that are less exposed to bacterial contamination. And the risk of infant and child mortality expected to be high for households with poor electricity, source of drink water and toilette facilities.
3. The risk of infant and child mortality are expected to be low among children whose residence are in urban areas than in rural areas.
4. The risk of infant and child mortality are expected to be lower among children born in house holds with some sort of equality between male and female.

Demographic factors and proximate determinants:

5. Closely spaced children are expected to have the highest risk of infant and child mortality.
6. The risks of infant and child mortality to be higher among first children born to mothers that were very young and children born at first and higher birth order.
7. The risk of Infant and child mortality expected to be high among children that are breastfed less than six months.
8. In the absence of discriminatory allocation of resources and health care, female children experiencing lower risk of infant and child mortality in comparison to male children.

In general, the descriptive analysis of the data will tell us the association and impact of biological, demographic and proximate determinants on infant and child mortality and the result of multivariate analysis will conform the above hypothesis premised or not.

3. Data and Methodology

As mentioned above the secondary data will be used for this study that obtained from 2000 and 2005 EDHS. The surveys were conducted by the Central Statistics Authority (CSA) with the financially supported by Essential Service for Health in Ethiopia (ESHE) project coordinating with USAID, UNFPA and The Federal Democratic Republic of Ethiopia. The data set consists of a national representative sample of household level data. The sample was selected in two stage, in the first 540 cluster (145 urban and 395 rural) in 2005 and 539 cluster (138 urban areas and 401 rural) in 2000 were selected from the list of enumeration areas from the 1994 population and housing census sample frame (EDHS, 2000, 2005). However, the 540 and 539

enumeration areas are not distributed proportional in the regions to the census population. Thus, the sample for the 2000 and 2005 Ethiopian DHS must be weighted to produce national estimates (EDHS, 2000 & 2005). The two surveys comprising women age 15-49 and men 15-59. In the 2000 Ethiopian demographic health survey 14,642 household were selected, 15,367 women and 2,605 men were interviewed. For 2005, approximately 14,500 households were selected, 14,070 women and 6,033men were interviewed. The objectives of collecting this DHS data are to analyze and monitor the population and health situation in Ethiopia and the Ethiopian DHS contain information on fertility, mortality, health issues, socioeconomic and environmental situations. The data for the two year enables to make comparison of the situation of infant and child mortality. I have access information about biological factors such that source of drink water, toilet facilities, family size, duration of breast feeding and etc, Demographic factors; such as age at first birth, birth order and etc, socioeconomic factors; such as mothers education level, fathers education level, fathers occupation, current marital status, region, residence, use of electricity and etc. The men's socioeconomic characteristics mainly concern income and educational level. In this study, the outcome variables that we are only interested are in infant and child (under-five) mortality which contains all children in the data set but to avoid right censoring case, a child survive at the time of interview and younger than five year old were excluded. In the analysis the censoring variable noted as 0 and the value 1 if otherwise. For the infant and child deaths the time variables created by the current age or the age at which the child died. In the study, four year rates, including birth that occurred in the past five year in the survey but excluding birth of child in the preceding one year, used in the study in order to assure statistical reliability and gives a proper picture of the impact of different variables on infant and child mortality. In the data all dummy variable will categorized in different group and the number of categories depends on the variable type and this enable comparison between different groups will be possible.

3.1 Model

For infant and child mortality that either the child die before celebrating the first birth day (the fifth birthday), or the child survives in the first year (the first five years), the dependent variables are binary, for which the response outcome for each subject is "died or alive", thus the logistic regression are employed to estimate the odd of a child dying before reaching the first year or the first fifth years due to the binary characteristics of these dependent variables, which are the most popular model for binary data analysis and investigate the significant socioeconomic and bio-demographic determinants of infant and child mortality. In this study the logistic regression have multiple independent variables, in which all are categorized in to k levels. The dependent variables are explained by the odd ratio of the explanatory variables. The logistic regression is similar to the ordinal least square regression, however, it violent the assumption of explanatory variables such that Heteroskedasticity, linearity and normality assumption of ordinary least square regression. Many researchers used logistic regression model to predict the probabilistic estimation that the child survival predicted by the maximum likely hood coefficients. The dependent variable noted 1 if the child dies before reaching certain

age and noted as 0 if otherwise. The data were adjusted for sampling weight using the weight command available (SVY command) in STATA 10.0.

The general form of logistic equation with several socioeconomic, biological, demographic and environmental variables.

$$\text{Logit}(P) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + ...+b_pX_p$$

P: - denote the probability of the risk of infant or child mortality and p is dichotomous that have a value 0 or 1
b_0... b_P: - is the coefficient of the independent variables.
X_1...X_p: - denote the socioeconomic, demographic, biological or environmental factors of infant or child mortality.

3.2 Limitation of the data

As earlier mentioned, this study use the birth history data of the respondents (mothers) from Ethiopian DHS and the data are reported retrospectively. Therefore using this retrospective birth data may decrease the quality of the data that might to suffer from missing report due to the lack of memory of the respondent (mothers). From the experience of most studies that used DHS data, for longer recall period, the respondent might misreporting the important information, one of these are infant and child mortality. One of the most common errors is omission of reporting child death, particularly death at the infancy period. However, in this study, the missing report can be minimized by limiting births that occurred in the five years period prior to the surveys date to ensure that to provide better quality data.

The other problem of using retrospective data is that some variables are measured the current situation, in this case the current variables are taken as the proxy of for the past to investigate the relationship between infant and child mortality and variables. On the other hand this study also exclude infant and child death that child born to mothers under age 15 due to the sampling unit of DHS survey that include only respondents age of 15-49 years old. Generally omission of deaths and births, incompleteness of the date of births and deaths, age at death are also important errors that affect the trend of infant and child mortality and also might biased the analysis too. However in both EDHS, these problems are not significant (DHS, 2000 and 2005).

3.3 Variable description

3.3.1 Dependent variables

The depend variables are infant and child mortality, is the relative risk of dying in a specific age range of childhood and it is important to clear the difference of the depended variables according to the time that the deaths occurred, such that

Infant mortality is referred as the probability of dying between birth and the first birth day.

Child mortality is the probability of dying between the first and the fifth birth day.

As mentioned above the dependent variables are dichotomous, coded as 0 if death has not occurred and coded as 1 if death has occurred.

3.3.2 Independent variables

According to Mosley and Chen (1984) discussed earlier, the determinants of infant and child mortality categorized in to socioeconomic, demographic and biological variables. In this section I will discuss few of these determinants used for the analysis.

Education

The socioeconomic variables used in this study include parental educations levels, literacy, ype of place of residence (urban/rural) and household size.

Educations play an important role for the reduction of infant and child mortality, since better educated parents, particularly mothers education important for better use of the available information's crucial for child care and health situations and this could be beneficial for child care and child health, however, fathers education is important for the income generating purpose that highly influence infant and child mortality. In general educated mothers convert the traditional characteristics such as change feeding and child care practice, changes the preference of fertility that more focus on quality of children than quantity, increase her participation on family decision, exercise new ideas and manipulate modern world and etc (Caldwell, 1979). As a result expansion of education in a society also increases the income of the household and reduced poverty of the society. It is generally belief that low infant and child mortality related to high parental educational level and high literacy rate. In this study the education variable for both mothers and fathers are categorized in to three groups where 0) no education 2) primary education 3) secondary and higher education. Literacy (mother literacy) variable also categorized in to two where 0) can not read 1) can read.

Type of place of residence

Many researchers indicated that infant and child mortality in urban areas are smaller than the rural areas. This variation occurred due to unequal distribution of socioeconomic factors and health facilities, for example, in rural areas the distribution of health resources more likely limited than urban areas. Because of the lack of modernization and limited health facilities, rural areas are expected to have higher risk of infant and child mortality in case of Ethiopia. In this study, the urban-rural variable are created where 0) rural 1) urban.

Household size

The household size in this study is categorized in to three where 1) 1-5 household size 2) 6-10 household size 3) >10 house hold size. Concerning the household size the result found are expected much or less similar from the evidence of previous literatures. Small household size contribute a lot for the reduction of infant and child mortality due to the household able to afford better health facilities and nutrition, thus increase the probability of surviving children. Because of this large household size are expected to have higher infant and child mortality relative to small one.

Household environmental conditions

Source of drink water, floor material and toilet facility are among the environmental factors which highly affect infant and child mortality. As indicate by Mosley and Chen (1984) better water supply and the provision of sanitation facilities are important for child survival. In this study source of drink water and toilet facility categorized in to 0) other 1) pipe, 0) other 1) sand earth and 0) other 1) flush, respectively. Safe drink water and better toilet facility reduce the incidence of disease and infection which highly related to infant and child mortality. It is often believed that pipe water (safe drink water), floor with sand earth and flush toilet facilities better indicator to low infant and child mortality.

The bio-demographic factors included in this study are maternal age at first birth, mother age at first intercourse, sex of child, birth order, duration of breast feeding, preceding birth interval, and type of birth.

Birth interval (preceding birth interval)

The length of birth interval is one of the important bio-demographic factors that influence infant and child mortality. And it is a common problem in most developing countries. Mortality theories indicated that short birth interval associated with high risk of infant and child mortality due to physiological and nutrition depletion of the mothers which relate to premature child births and the mothers exposed to pregnancy complication (Boerma and Bicego, 1993). In general short birth interval raises the vulnerability of infectious and parasitic diseases and

exposing children to malnutrition. In this paper, the length of birth interval categorized in to five where 1) < 18 months 2) 18-23 months 3) 24-35 months 4) 36-47 months 5) >47 months. From the evidence of previous research, preceding birth intervals are expected short the risk of infant and child mortality is high.

Birth order, Mothers age at first birth and at first intercourse

The association between infant and child mortality with birth order seems like a U-shape. However, the relationship between infant and child mortality indicated by the researcher is mixed and not Cleary understood. In general the risks of infant and child mortality is higher for the first birth order and very young mothers age and steadily decline the consquetive birth orders and mothers age and then again start increasing. The cause for this high risk of infant and child mortality at the first birth order and at the younger age of mothers are associated with social and physiological and reproduction immaturity that many mothers born their first child at the adolescent age or before reaching reproduction age. On the other hand, repeated child birth and complication of pregnancy that is the deterioration of reproductive system might explain the high risk of infant and child mortality at older age (Sullivan, 1994). In this study birth order, mother age at first birth and intercourse categorized in to four, three and three groups respectively. Where 1) 1st birth 2) 2-3 birth order 3) 4-7 birth order 4) >=8 birth order and for mothers age 1) <15 years 2) 15-20 years 3) >20 years and 1) <15 years 2) 15-18 years 3) >18 years. In agreement to the previous literatures, the risk of infant and child deaths is expected to be higher for very young mothers and also for the first and higher order births.

Breastfeeding

Another important determinant for child survival is breastfeeding. Breastfeeding is almost prolonged and universal in developing countries. Breastfed child contribute a significant advantage for the reduction of infant and child mortality, for instance infant and child who are not breastfed are 14 times greater the risk of death from diarrhoea and 3 times higher the risk of death respiratory infectious diseases (IBFAN,1999). So breastfeeding is highly associated with lowering diarrhoea and infectious diseases and malnutrition which breastfeeding protect children dying against these diseases. This variable merged where 0) < 6 months 1) 6 months to above. Duration of breast feeding has a negative relationship with infant and child mortality.

The categories of other determinants of infant and child mortality included in this study are shown below in the table 5.

4. Statistical model

Based on the theoretical and previous literatures discussed previously, the model for the empirical analyses is classified to two parts. The models consist of most of the proximate (Bio-demographic) variables and socioeconomic variables for the year 2000 and 2005, separately.
The first model consists of proximate variables while the second model incorporates socioeconomic variables with proximate variables.

So the models in this study are

Model (1)

Child mortality = (Drink water, Toilet facility, Floor material, Child gender, Current marital status, Birth order, Breast feeding, Household size, Type of birth, Preceding birth interval, Age at first birth and Age at first intercourse).

Infant mortality = (Drink water, Toilet facility, Floor material, Child gender, Current marital status, Birth order, Breast feeding, Household size, Type of birth, Preceding birth interval, Age at first birth and Age at first intercourse).

Model (2)

Child mortality = (Drink water, Toilet facility, Floor material, Child gender, Current marital status, Birth order, Breast feeding, Household size, Type of birth, Preceding birth interval, Age at first birth, Age at first intercourse, Region, Residence, Mothers education, Fathers education, Literacy (Mothers), Religion, Sex of household head, wife beating justified, Electricity).

Infant mortality = (Drink water, Toilet facility, Floor material, Child gender, Current marital status, Birth order, Breast feeding, Household size, Type of birth, Preceding birth interval, Age at first birth, Age at first intercourse, Region, Residence, Mothers education, Fathers education, Literacy (Mothers), Religion, Sex of household head, wife beating justified, Electricity).

4.1 Descriptive statistics

This section present a discussion of few variables included in the study and a brief summarized table that include all explanatory variables.

The total number of live births considered for this study were 11,108 and 10,562 with 1,948 (17.54 percent) and 1,315 (12.45 percent) of under-five deaths occurred during the preceding five years of the study periods (1996-2000 and 2001 -2005), respectively. With regard to infant and child mortality, 1,499 (13.04 percent) and 1,019 (9.65) were died and 499 (5.17 percent)

and 299 (3.10 percent) deaths were occurred during the preceding five years of the study periods (1996-2000 and 2001 -2005), respectively.

There are considerable variations in the level of under-Five, child and infant deaths according to the socioeconomic and bio-demographic (proximate) determinants. About 90.00 and 90.56 percent of women interviewed are currently married in 2000 and 2005, respectively and 87.73 and 88.59, 86.97 and 85.8, and 87.99 and 89.40 of under-five, child and infant deaths are occurred for children born currently married women in the preceding five years of the study periods (1996-2000 and 2001 -2005), respectively.

On the other hand Out of the total number women interviewed in the household about 17.02 (in the year 2000) and 23.62 (in the year 2005), 10.35 (in the year 200) and 10.37 (in the year 2005), and 15.36(in the year 2000) and 16.18 (in the year 2005) percent deaths for children who live in the household that have safe drink waters, toilet facility (flush and pit latrine) and electricity, respectively. Variation of under-five, child and infant deaths for few variables explain below and the whole variations are presented in table 5 below. And also under-five mortality are used only for in table 5 but not included in the empirical analysis section.

In general from the evidence of previous literatures, under-five, child, and infant mortality are higher for children whose mothers and fathers have no education relative to for those children born to educated mothers and fathers. Out of the total number women interviewed in the household 81.24 and 76.19 percent were illiterate, 12.40 and 15.57 were primary educated, and 6.36 and 8.24 percent had at least secondary education. About 86.29 and 83.22, 87.58 and 88.18, and 85.85 and 91.84 percent of under-five, child and infant deaths in the preceding 2000 and 2005 periods, respectively, occurred for children whose mothers have no education. And the remaining deaths occurred for those children whose mothers have primary, secondary and above educational level.

On the other hand, mortality in Ethiopia have strikingly varies across place residences and regions due to the variation of the socioeconomic and bio-demographic characteristics of the residences and the regions.

With regard to age of mother's at first birth, previous literatures indicated that under-five, child and infant mortality are more likely higher for those children born at a very young and old mother's ages (Mosley and Chen, 1984 and Hobcraft, 1985). In this study, about 6.47, 7.41 and 6.76 (in the preceding five years period of 2000) and 10.1, 6.76 and 11.09 percent (in the preceding five years period of 2005) of under-five, child and infant, respectively, deaths occurred for those children born to mother aged below 15. About 56.62, 55.91 and 56.87 percent (in the preceding five years period of 2000) and 55.79, 53.38 and 59.09 percent (in the preceding five years period of 2005) of under-five, child and infant, respectively, deaths occurred for those children born to mothers aged 15-20. The reaming under-five, child and infant deaths occurred for those children born to mothers aged above 20.
The distributions of all the explanatory variables which are included in the analysis are summarized below in table 5 under their respective categories.

Table 5. Absolute and percent distributions of dependent and explanatory variables for the preceding five years period of 2000 and 2005.

No	Variable		Total live birth		Under-five mortality		Child mortality		Infant mortality	
			2000	2005	2000	2005	2000	2005	2000	2005
1	Maternal highest educational level	No education (0)	81.24	76.19	1,681 86.29	1,095 83.27	437 87.58	261 88.18	1,244 85.85	834 81.84
		Primary (1)	12.40	15.57	200 10.27	172 13.08	54 10.82	26 8.78	146 10.08	146 14.33
		Secondary or higher (2)	6.36	8.24	67 3.44	48 3.65	8 1.60	9 3.04	59 4.07	39 3.83
2	Fathers highest educational level	No education (0)	65.83	59.08	1,369 70.64	888 67.79	376 75.65	217 73.31	993 68.91	671 66.17
		Primary (1)	21.50	25.94	403 20.79	315 24.05	93 18.71	62 20.95	310 21.51	253 24.95
		Secondary or higher	12.67	14.98	166 8.57	107 8.17	28 5.63	17 5.74	138 9.58	90 8.88
3	Mothers litracy	Can’t read (0)	80.59	80.47	1,674 85.93	1,131 86.01	430 86.17	259 87.50	1,244 85.85	872 85.57
		Can read (1)	19.41	19.53	274 14.07	184 13.99	69 13.83	37 12.50	205 14.15	147 14.43
4	Current marital status	Other (0)	10.00	9.44	239 12.27	150 11.41	65 13.03	42 14.19	174 12.01	108 10.60
		Married (1)	90.00	90.56	1,709 87.73	1,165 88.59	434 86.97	254 85.81	1,275 87.99	911 89.40
5	Wife beating justified	No (0)	34.66	35.16	623 32.00	463 35.21	164 32.87	104 35.14	459 31.70	359 35.23
		Yes (1)	65.34	64.84	1,324 68.00	852 64.79	335 67.13	192 64.86	989 68.30	660 64.77
6	Electricity	Yes (1)	15.36	16.18	244 12.53	133 10.11	62 12.42	29 9.80	182 12.56	104 10.21
		No (0)	84.64	83.82	1,704 87.47	1,182 89.89	437 87.58	267 90.20	1,267 87.44	915 89.79
7	Type of place of residence	Urban (1)	15.67	15.49	249 12.78	127 9.66	51 10.22	28 9.46	198 13.66	99 9.72
		Rural (0)	84.33	84.51	1,699 87.22	1,188 90.34	448 89.78	268 90.54	1,251 86.34	920 90.28

8	Province of residence (Region)	Tigray (1)	10.51	10.31	186 9.55	114 8.67	42 8.42	26 8.78	144 9.94	88 8.64
		Afar (2)	6.22	6.01	155 7.96	90 6.84	44 8.82	33 11.15	111 7.66	57 5.59
		Amhara (3)	15.08	14.81	298 15.30	240 18.25	74 14.83	59 19.93	224 15.46	181 17.76
		Oromia (4)	19.72	18.96	385 19.76	243 18.48	100 20.04	44 14.86	285 19.67	199 19.53
		Somali (5)	6.4	6.38	117 6.01	68 5.17	43 8.62	9 3.04	74 5.11	59 5.79
		Benshangul-Gumz (6)	7.14	6.89	145 7.44	102 7.76	45 9.02	30 10.14	100 6.90	72 7.07
		SNNP (7)	14.37	17.14	288 14.78	256 19.47	64 12.83	51 17.23	224 15.46	205 20.12
		Gambela (12)	5.37	5.43	117 6.01	69 5.25	29 5.81	13 4.39	88 6.07	56 5.50
		Harari (13)	5.23	4.94	82 4.21	51 3.88	14 2.81	13 4.39	68 4.69	38 3.73
		Addis Ababa (14)	4.68	5.00	69 3.54	37 2.81	12 2.40	6 2.03	57 3.93	31 3.04
		Dire Dawa (15)	5.28	4.13	106 5.44	45 3.42	32 6.41	12 4.05	74 5.11	33 3.24
9	Age at 1st intercourse	<15 years (0)	27.90	31.72	572 29.36	464 35.29	148 29.66	92 31.08	424 29.26	372 36.51
		15-18 years (1)	51.44	44.69	994 51.03	581 44.18	251 50.30	134 45.27	743 51.28	447 43.87
		>18 years (2)	20.66	23.59	382 19.61	270 20.53	100 20.04	70 23.65	282 19.46	200 19.63
10	Age at first birth	<15 (1)	6.25	9.04	126 6.47	133 10.11	37 7.41	20 6.76	89 6.14	113 11.09
		15-20 (2)	56.70	56.24	1,103 56.62	760 57.79	279 55.91	158 53.38	824 56.87	602 59.08
		>20 (3)	37.05	34.72	719 36.91	422 32.09	183 36.67	118 39.86	536 36.99	304 29.83
11	Sex of household	Female (0)	15.85	13.97	344 17.66	186 14.14	112 22.44	53 17.91	232 16.01	133 13.05
		Male (1)	84.15	86.03	1,604 82.34	1,129 85.86	387 77.56	243 82.09	1,217 83.99	886 86.95

12	Child gender	Male (0)	51.26	51	1,082 55.54	737 56.05	261 52.30	152 51.35	821 56.66	585 57.41
		Female (1)	48.74	49	866 44.46	578 43.95	238 47.70	144 48.65	628 43.34	434 42.59
13	Type of birth	Multiple (1)	2.47	1.93	159 8.16	78 5.93	19 3.81	10 3.38	140 9.66	68 6.67
		Single (0)	97.53	98.07	1,789 91.84	1,237 94.07	480 96.19	286 96.62	1,309 90.34	951 93.33
14	Source of drink water	Pipe (1)	17.02	23.62	263 13.50	224 17.03	58 11.62	58 19.59	205 14.15	166 16.29
		Others (0)	82.98	76.33	1,685 86.50	1,091 82.97	441 88.38	238 80.41	1,244 85.85	853 83.71
15	Toilet facilities	Has toilet facilty (1)	10.35	10.37	159 8.16	92 7.00	44 8.82	18 6.08	132 9.11	74 7.26
		No facility (0)	89.65	89.63	1,789 91.84	1,223 93.00	455 91.18	278 93.92	1,317 90.89	945 92.74
16	Floor material	Earth sand (1)	62.49	69.45	1,281 65.76	947 72.02	337 67.54	215 72.64	944 65.15	732 71.84
		Other (0)	37.51	30.55	667 34.24	368 27.98	162 32.46	81 27.36	505 34.85	287 28.16
17	Household size	1-5 (1)	44.43	44.30	1,096 56.26	737 56.05	272 54.51	155 52.36	824 56.87	582 57.11
		6-10 (2)	51.46	52.26	808 41.48	555 42.21	218 43.69	138 46.62	590 40.72	417 40.92
		>10 (3)	4.11	3.44	44 2.26	23 1.75	9 1.80	3 1.01	35 2.42	20 1.96
18	Religion	Orthodox (0)	42.55	41.19	776 39.84	533 40.53	176 35.27	113 38.18	600 41.41	420 41.22
		Moselim (1)	40.03	37.81	848 43.53	518 39.39	243 48.70	127 42.91	605 41.75	391 38.37
		Protesetant (2)	13.18	17.54	240 12.32	230 17.49	50 10.02	45 15.20	190 13.11	185 18.16
		Other (3)	4.24	3.45	84 4.31	34 2.59	30 6.01	11 3.72	54 3.73	23 2.26
19	Birth order	1st birth order (1)	19.92	23.77	433 22.23	311 23.65	83 16.63	56 18.92	350 24.15	255 25.02

		2-3 birth order (2)	30.32	29.86	526 27.00	358 27.22	139 27.86	85 28.72	387 26.71	273 26.79
		4-7 birth order (3)	37.31	35.62	710 36.45	469 35.67	215 43.09	114 38.51	495 34.16	355 34.84
		>7 birth order (4)	12.41	10.75	279 14.32	177 13.46	62 12.42	41 13.85	217 14.98	136 13.35
20	Breast feeding	<6 months (0)	12.88	9.46	1,220 62.63	776 59.01	12 2.40	9 3.04	1,208 83.37	767 75.27
		6 months or above year (1)	87.12	90.54	728 37.37	539 40.99	487 97.60	287 96.96	241 16.63	252 24.73
21	Previous birth interval	<18 months (1)	8.53	8.81	301 15.45	274 20.84	54 10.82	54 18.24	247 17.05	220 21.59
		18-23 months (2)	11.05	11.32	285 14.63	197 14.98	85 17.03	46 15.54	200 13.80	151 14.82
		24-35 months (3)	28.23	26.27	519 26.64	302 22.97	145 29.06	79 26.69	374 25.81	223 21.88
		36-47 months (4)	17.64	15.97	244 12.53	142 10.80	84 16.83	38 12.84	160 11.04	104 10.21
		>47 months (5)	34.56	37.62	599 30.75	400 30.42	131 26.25	79 26.69	468 32.30	321 31.50

5. Empirical Analysis

This section presents the statistical results of the logistic regression models which were analysed using STATA. As mentioned earlier the main objective of this study is to investigate the impact of socioeconomic and bio-demographic (proximate) determinants on the risk of child and infant mortality of children born in the previous five years period of 2000 and 2005, but not include children born in the past one year, before the survey. The first model for child and infant mortality only includes the bio-demographic determinants for 2000 and 2005 separately. This establish the significant proximate determinates of child and infant mortality. The second model of child and infant mortality models adds control of socioeconomic variables for 2000 and 2005 separately. The regression results for all models are shown in table 6 to 9 followed by the brief discussion of the results

5.1 Infant mortality

For the previous five year period before 2000

In the infant mortality model that control the proximate determinants as shown in table 6a, source of drink water, toilet facility, current marital status, breastfeeding, preceding birth interval, type of birth, household size and birth order are important determinants of infant mortality in the previous five year, before 2000.

As shown in the table 6a below the availability of source drink water and toilet facility were negatively associated with infant mortality rates, that children born in to households with the availability of safe drink water and toilet facility (flush and latrine pit) were about 43 and 64 percent, respectively, less likely to die at infant age.

The risks of infant mortality among children whose mothers are currently married relative to children whose mothers not currently married (others category) are decreased by about 28 percent. Breast feeding is a power full factors that decrease infant mortality in the case of Ethiopia , the result indicates children who were breast fed for more than 6 months are lower the risk of dyeing at the infant age periods by approximately 100 percent relative to children who were breast fed for less than 6 months. This explains in the case of Ethiopia, breast feeding is prolonged practice and a strong and important factor for child survival.
The preceding birth intervals associated with the lower risk of infant mortality, however, only children born for a long birth interval (36-47 months and above 47 months) have significant risk of low level of infant mortality, implies that children born after 36-47 and above 47 months of the previous births reduced the risk of dyeing before celebrating the first year of age by 45 and 64 percent, respectively, relative to those children born less than 18 months of the previous births. According to the type of birth variable, the occurrence of multiple births increase infant mortality, that the risk of dyeing at the infant age due to multiple births is more than four times higher than single birth.

The effect of children with two to three birth orders have significantly lower the risk of infant mortality relative to children with the first birth order. The relative risk is 0.49, which implies reduced the risk of infant mortality by about 51 percent. The relative risk of children with four to seven birth orders is 0.84, however, children with above 7 birth order positively associated with the risk of infant mortality, that children with above 7 birth order increase infant mortality by 26 percent compared to the first birth order but both four to seven and above seven birth order categories were insignificant.

With regard to the household size, children born in large household size significantly associated with decreasing the risk of infant mortality relative to small household size category (1-5 household sizes), which is unexpected result. The odd ratio indicated that children born 6-10 and greater than 10 household size have lower the risk of infant mortality by about 54 and 46

percent, respectively, relative to children born 1-5 household sizes. This striking result indicates the need of further investigation.

On the other hand female children and male children have approximately equal chance of dyeing before reaching one year of age. This result opposed the expectation with respect to the previous literatures that male children have higher risk of infant mortality than female children. The positive relationship between Mothers age at first birth and infant mortality which is unexpected relative to the previous researches, though relative to children whose mothers age at first birth less than 15, infant mortality whose mothers age at first birth 15-20 and greater than 20 were increased by 35 and 9 percent, respectively. Age at first intercourse has also negatively correlated with infant mortality that children born whose mothers age at first intercourse were greater than 18 reduced the risk of infant mortality by 11 percent relative to children born whose mothers age at first intercourse were less than 15. Among the household characteristic variables, floor with earth sand increased the risk of infant mortality by 8 percent relative to floor with out earth sand (other category), which is unexpected compared to the evidences of the previous researches. However all child gender, age at first birth, age at first intercourse and floor variables do not have any significant impact on the risk of infant mortality.

Model (2) in table 6b also show the result of infant mortality by taking account both proximate and socioeconomic variables. The full model (2) shows that among the proximate determinants access to safe drink water, floor with earth sand and toilet facility are a negatively related to infant mortality which are the expected direction, however, any of these variables do not have a significant impact on infant mortality. The negative relationship of children born in households with access safe drink water and availability of toilet facility are not change but insignificant due to the presence of socioeconomic variables. The positive relationship of infant mortality and children born in households with, floor with earth sand continue, but insignificant in both models. Among the biological factors (proximate determinates) mothers age at first birth positively correlated to infant mortality. Infant mortality in 15-20 age of mothers at first birth 26 percent higher than less than 15 age of mothers at first birth while infant mortality in greater than 20 age of mothers at first birth decreased by 2 percent relative to less than 15 age of mothers at first birth.

Similarly, like model (1) in table 6a in this extended model, children born with 15-18 age of mothers at first intercourse were increased infant mortality by 7 percent while children born with greater than 18 age of mothers at first intercourse reduced infant mortality by 7 percent as compared to children born with less than 15 age of mothers at first intercourse, however, mothers age at first birth and at first intercourse variables do not have any significant impact on infant mortality.

The result of table 6b, also show that the impact of socioeconomic variables on infant mortality.

Place of residence negatively correlated with infant mortality that children born in urban areas reduced infant mortality by 17 percent relative to children born in rural areas. Literacy of mothers is negatively related to infant mortality that children whose mothers are literate

reduced the risk of infant mortality by 7 percent as compared to children born to illiterate mothers.

With regard to wife beating justified variable, the risk of infant mortality is reduced by 12 percent for children whose mothers are not justified wife beating by her husband as compared to for children whose mothers justified wife beating.

Children born in household's that use electricity have lower risk of infant mortality relative to children born in the households that don not use electricity, which using electricity reduced the risk of infant mortality by about 32 percent. However, according to the result of the model (2) in table 6b, place of residence, wife beating justified and use of electricity do not have any significant impact on infant mortality.

Table 6b, showed that the result of model (2) by adding socioeconomic control variables in model (1), that among proximate determinates marital status, birth order, breast feeding, household size, type of birth and preceding birth interval are the most significant important factors for the infant mortality.

According to table 6b, current marital status variable is negatively correlated with infant mortality, which is expected according to the previous literatures, implies the risk of infant mortality reduced by 40 percent among children whose mothers are currently married relative to children whose mothers are not currently married (other category). The presence of socioeconomic factors in model (2) increased the reduction of the risk of infant mortality by about 12 percent from the result of marital status variable in model (1).

With regard to birth order, children born in 2-3 and 4-7 birth order are negatively related with infant mortality, which reduced by about 52 and 25 percent of the risk of dyeing of children before reaching one year of age relative to the first birth order while children born in greater than 7 birth order are positively correlated with infant mortality that increase by 8 percent relative to the first birth order. When comparing this result with model (1), the reduction of the risk of infant mortality increased by 1 and 9 percent for 2-3 and 4-7 birth order, respectively, but the addition of socioeconomic variable in the model increase the risk of infant mortality by 18 percent for children greater than 7 birth order. However in both models children in 2-3 birth order is only important significant impact in the risk of infant mortality. In both models also similar result is obtained for breast feeding variable, that significantly lower the risk of infant mortality.

The effect of household size on infant mortality also similar to the result of model (1) that reduced the risk of infant mortality as the household size increases, which is unexpected. The odd of multiple birth of child at the infant period were about 4.28 times greater than from single ton birth, Which significantly increase the risk of infant mortality of multiple birth of children by about 13 percent due the presence of socioeconomic variables as compared to model (1).

According to preceding birth interval, the risk of infant mortality is reduced significantly by 44, 55 and 58 percent for children born 24-35, 36-47 and greater than 47 months the previous births, respectively, relative to children born less than 18 months of the previous births. The presence of socioeconomic factors increases the reduction of the risk of infant mortality by 7, 7, and 4 percent, respectively. However, in this model child born in 18-23 months preceding birth insignificant impact on infant mortality, which is about 14 percent, reduced the risk of infant mortality.

As for education variables, mother's education and father's education negatively associated with the risk of infant mortality, indeed the result support the previous literatures of a negative association. Child born to mothers who completed primary and secondary or above educational levels reduced the risk of infant mortality by 70 and 42 percent, respectively, while primary and secondary or above fathers educational level decreased the risk of infant mortality by 75 and 55 percent, respectively, relative to children born to mothers and fathers with no education, respectively. All categories of education except primary education level of mothers were significant impact on infant mortality. As shown from the result education are among the most crucial socioeconomic variables for reducing the risk of infant mortality and the impact of mothers education were more pronounced than fathers education on infant mortality, which is found by the most previous researchers.

The risk of infant mortality is experienced higher in male household headed as compared to female household headed that increase by about 43 percent. This is expected and supported by previous researches.

Ethiopian experienced the steady reduction of infant mortality; however, together with this decline there exist a large regional disparity in infant mortality in the country. And this large regional variation are explained by the variation of socioeconomic and health infrastructure in the country. The results in table 6b show that with the exception of Somalia and Benshangul-Gumz in all other regions there exists a reduction of the risk of infant mortality relative to Tigray region. The highest reduction of infant mortality exist in Dire Dawa Administrative city, which reduced the risk of infant mortality by about 82 percent followed by Addis Ababa administrative city which reduced by about 75 percent and the lowest reduction exist in Harari followed by Amhara and Afar regions, which reduced the risk of infant mortality by 13, 14 and 29 percent, respectively, relative to the Tigray region. However, the risk of infant mortality increased in Benshangul-Gumz and Somalia by about 5 and 45 percent, respectively, relative to Tigray region. Despite these regional variations only in Oromia, Somalia and Gambela have a significant impact on infant mortality.

The other variable that affects infant mortality is religion. The influence of religion on infant mortality may arise due to socioeconomic and bio-demographic condition such as traditional belief and practice related to childbirths, infant feeding and healthcare. The result from table 6b shows that the relationship between religion and infant mortality is negative relative to orthodox followers. The risk of infant mortality reduced by 15, 33 and 40 percent for Muslim,

protestant and other category, respectively, relative to the orthodox religion. However, only the effect of protestant followers has a significant impact on infant mortality.

For the previous five years period before 2005

The regression analysis in table 7a below shows the effect of proximate determinants on infant mortality for the previous five years period, before the year 2005.

In this model, except floor material variable all variables that were included in the model were important significant determinants of infant mortality. According to the regression results, the proximate determinants in the form of household environmental factors such as availability safe drink water (pipe) and sanitation (toilet facility) have a strong negative effect on infant mortality, that the availability of safe drink water (pipe) and toilet facility (flush and latrine pit) reduced the risk of infant mortality by 34 percent relative to other categories (without safe drink water and with out the availability of toilet facility). However, the reduction of the risk of infant mortality decreased as compared to the effect of on infant mortality in the previous five years period before 2000, which reduced by 43 (availability of safe drink water) and 64 percent (availability of toilet facility).

Regarding the bio-demographic variables, except household size and type of birth all variables have significant effects on reducing the risk of infant mortality, of course few categories of the variables are not significant.

According to the result in model (1) table 7a, female children reduced infant mortality by about 3 percent relative to male children, which increased the reduction by 30 percent in the previous five years period before 2005 as compared to the previous five year period before 2000. Although children born to currently married women were 30 percent less likely to die before celebrating the first year birth day relative to children born to non married (other category) women. It increased by only 2 percent relative to the previous five years period before 2000.

Birth order highly correlated to infant mortality in this previous five years period as compared to the previous five yeasr period of 2000. Children born in 2-3, 4-7 and higher than 7 birth order are 62, 44 and 23 percent, respectively, less likely to die before reaching one year of age relative to the first birth order. However higher than 7 birth order do not have a significant effect on infant mortality. The risk of infant mortality reduced by 99 percent for those children that breast fed for more than 6 months. It is a crucial factor in both preceding five years periods of 2000 and 2005.

Children born to mothers aged at firs birth 15-20 and higher than 20 were 35 and 52 percent, respectively, less likely to die before at the infant period relative to children born less than 15 ages of mothers at first birth. This variable does not has significant impact in the previous five years period before 2000, which is more pronounced impact on infant mortality in this recent five years period interval. Regarding Household size, similarly to the previous preceding period

of 2000 result, here also found that the risk of infant mortality reduced as the household size increased. Children born to 6-10 and higher than 10 household sizes reduced the risk of infant mortality by 58 and 84 percent, respectively, which is unexpected according to the evidence of the previous researches. The odd ratio of multiple births of children was 10.78 times higher than the odd of single birth of child, which is supported by the evidence of previous researches. Multiple births have pronounced impact on infant mortality in this preceding five years period as compared to the five years period interval before 2000.

The increased preceding birth intervals are associated to the decreases in the risk of infant mortality. Children with 18-23, 24-35, 36-47 and above 47 months lower infant mortality by 34, 54, 66 and 79 percent, respectively, relative to less than 18 months preceding birth interval. And the impact of proceeding birth interval on infant mortality higher and more significant as compared to the previous five years period of 2000. Children born with 36-47 and more than 47 months reduced infant mortality by 45 and 54 percent, respectively, and children born with 18-23 and 24-37 months preceding birth interval have insignificant impact on infant mortality in the previous five years period of 2000 while all preceding birth interval categories in the previous five years period of 2005 have a significant impact on reducing infant mortality.

According to mothers age at first intercourse variable, greater than 18 years of mothers age at first intercourse has a significant impact on reducing infant mortality, that children born to mothers whose age at first intercourse more than 18 years were 32 percent less likely to die before reaching at the age of one while in the preceding five years period of 2000, this variables does not a significant impact on infant mortality.

Model (2) in table 7b below shows the impact of proximate determinants on infant mortality by including socioeconomic variables. The addition of socioeconomic variables in the model changes the impact of environmental factors on infant mortality. The availability of toilet facility and floor with sand earth are positively associated and insignificant effect on infant mortality, which is unexpected. Although the availability of safe drink water negatively correlated with infant mortality but has insignificant impact.

The variables concerned with other proximate determinants, the result in table 7b shows approximately similar results as before indicated in regression results before adding socioeconomic variables.

Female children reduced the risk of infant mortality by 29 percent relative to the male children. Children born to currently married women were 33 percent less likely to die before the age of one. Birth order of children negatively correlated with infant mortality. children born in 2-3 birth order 63 percent less likely to die before reaching at age one relative to the first born children. However 4-7 and higher than 7 birth order of child do not have any significant impact on infant mortality.

Regarding breast feeding variable, the highly negative association with infant mortality also confirmed in this model. The relationship between age of mothers at firs birth and infant

mortality is expected, that 15-20 and greater than 20 mother's age at first birth reduced infant mortality by 36 and 51 percent, respectively, relative to less than 15 months mother's age at first birth. The unexpected increasing infant mortality with increasing the household size also confirmed in this regression result. Multiple child birth faces high risk of infant death relative to single child birth.

The effect of preceding birth interval has a significant negative correlation with infant mortality, implies an increase preceding birth interval related with decreased infant mortality, except the last category of birth interval, which reduced infant mortality by 58 percent. Children born 18-23, 24-35 and 36-47 months after the previous birth reduced infant mortality by 61, 66 and 80 percent, respectively, relative to child born after less than 18 months of the previous births. Mother's age at first intercourse also reduced infant mortality by 11 and 30 percent for 15-18 and more than 18 years of age at first intercourse, respectively, relative to mother's age less than 15 year at first intercourse but only mothers more than 18 years age at first intercourse has a significant impact on infant mortality.

The contribution of proximate determinants continue for the decrease of infant mortality in this five years preceding period and the contribution is higher as compared to the previous five years period of 2000. The majority of the contribution coming from child gender, birth order, age at first birth, preceding birth interval and age at first intercourse. However, the contribution of marital status reduced by 7 percent, the increasing effect of household size and type of birth on infant mortality also increased in this previous five years period as compared to the previous five years period of 2000.
Among socioeconomic factors, type of residence (urban-rural), mothers literacy, sex of household head, wife beating justification and use of electricity do not have any significant effect on infant mortality.

With regard to educational variables, surprisingly children born to mothers have completed primary education level is 3.49 times higher infant mortality than children born to mothers with no education, which is unexpected. This unexpected result might be related to other factors of infant mortality such that unavailability of health infrastructure and other socioeconomic and biological factors. The effect of mothers secondary school levels on infant mortality rather weak, which increased by only one percent relative to illiterate mothers. However, father's education level negatively associated with infant mortality that children born to fathers with primary and secondary educational level reduced infant mortality by 24 and 30 percent, respectively, but only fathers with primary education has a significant impact. On the other hand the effect of paternal and maternal education level has been found to be more significant and important in the previous five years period of 2000 as compared to 2005.

With regarding to regional variation, out of 10 regions in 8 of them there exists an increase of infant mortality relative to Tigray region. The highest increase infant mortality exists in SNNP, which increase by 81 percent followed by Somalia (79 percent) and Afar (75 percent), this high regional variation in these five years period might be due to the decreased of the Tigray region infant mortality in related to socioeconomic and bio-demographic impact. However, the two

administrative city, Addis Ababa and Dire Dawa negatively correlated with infant mortality, which reduced by 40 and 10 percent, respectively, relative to Tigray region. All regions except SNNP show insignificant impact on infant mortality.

Lower infant mortality experienced in Muslim, protestant and other religion followers; however Muslim and other religions significantly reduced infant mortality by 35 and 67 percent, respectively, which have been insignificant impact on the previous five years period of 2000. Protestant followers has insignificant effect on infant mortality but significant in the previous five years period of 2000.

Table1 6a. Model (1):- Impact of proximate determinants on infant mortality for the previous five years period of 2000.

Variable	Catagory	Odds Ratio	Std.Err		P-Value	[95%Conf.Interval]	
Drink water	Other (0)	Reference					
	Pipe (1)	0,57**	0,10	-3,28	0,00	0,40	0,80
Toilate	No toilet facilty (0)	Reference					
	Has toilet facilty (1)	0,36***	0,07	-5,02	0,00	0,24	0,53
Floor	Other (0)	Reference					
	Earth Sand (1)	1,08	0,12	0,72	0,47	0,88	1,33
Child gender	Male (0)	Reference					
	Female (1)	1,00	0,10	0,02	0,99	0,82	1,22
Marital status	Other (0)	Reference					
	Married (1)	0,72*	0,12	-2,04	0,04	0,53	0,99
Birth order	1st birth order (1)	Reference					
	2-3 birth order (2)	0,49***	0,10	-3,51	0,00	0,33	0,73
	4-7 birth order (3)	0,84	0,17	-0,88	0,38	0,57	1,24
	>7 birth order (4)	1,26	0,30	0,97	0,33	0,79	2,01
Breast feeding	<6 months (0)	Reference					
	6 months- 1 year (1)	0,003***	0,00	-49,06	0,00	0,00	0,00
Age at first birth	<15 (1)	Reference					
	15-20 (2)	1,35	0,32	1,26	0,21	0,85	2,14
	>20 (3)	1,09	0,27	0,35	0,73	0,67	1,78
Household size	1-5 (1)						
	6-10 (2)	0,46***	0,05	-6,67	0,00	0,37	0,58
	>10 (3)	0,29***	0,09	-4,07	0,00	0,16	0,53
Type of birth	Single	Reference					

	Multiple	4,13***	1,06	5,53	0,00	2,50	6,82
Preceding birth interval	<18 months (1)	Reference					
	18-23 months (2)	0,89	0,18	-0,58	0,56	0,60	1,33
	24-35 months (3)	0,73	0,13	-1,74	0,08	0,52	1,04
	36-47 months (4)	0,55**	0,11	-2,95	0,00	0,37	0,82
	>47 months (5)	0,46***	0,10	-3,61	0,00	0,30	0,70
Age at first intercourse	<15 years (0)	Reference					
	15-18 years (1)	1,00	0,13		1,00	0,78	1,28
	>18 years (2)	0,89	0,15	-0,66	0,51	0,64	1,25
	Pseudo R2	=	0.6220				
	legend:	* p<0.05	**p<0.01;		*** p<0.001		

Table 6b. Model (2):- Impact of proximate and socioeconomic determinants on infant mortality for the previous five years period of 2000

Variable	Catagory	Odds Ratio	Std.Err	p-Value	[95%Conf.	Interval]
Drink water	Other (0)	Reference				
	Pipe (1)	0,87	0,18	0,51	0,58	1,31
Toilate	No toilet facilty (0)	Reference				
	Has toilet facilty (1)	0,11	0,14	0,08	0,01	1,33
Floor	Other (0)	Reference				
	Earth Sand (1)	1,10	0,14	0,44	0,86	1,41
Child gender	Male (0)	Reference				
	Female (1)	1,00	0,10	0,98	0,81	1,22
Marital status	Other (0)	Reference				
	Married (1)	0,60***	0,12	0,01	0,42	0,88
Birth order	1st birth order (1)	Reference				
	2-3 birth order (2)	0,48***	0,10	0,00	0,32	0,72
	4-7 birth order (3)	0,75	0,16	0,16	0,50	1,12

	>7 birth order (4)	1,08	0,27	0,76	0,66	1,76
Breast feeding	<6 months (0)			Reference		
	6 months- 1 year (1)	0,003***	0,00	0,00	0,00	0,00
Age at first birth	<15 (1)			Reference		
	15-20 (2)	1,26	0,30	0,32	0,79	2,01
	>20 (3)	0,98	0,25	0,92	0,60	1,60
Household size	1-5 (1)			Reference		
	6-10 (2)	0,47***	0,06	0,00	0,37	0,60
	>10 (3)	0,26**	0,08	0,00	0,14	0,48
Type of birth	Single (0)			Reference		
	Multiple (1)	4,28***	1,13	0,00	2,56	7,17
Preceding birth interval	<18 months (1)			Reference		
	18-23 months (2)	0,86	0,18	0,47	0,57	1,30
	24-35 months (3)	0,66*	0,12	0,02	0,46	0,94
	36-47 months (4)	0,48***	0,10	0,00	0,32	0,72
	>47 months (5)	0,42***	0,09	0,00	0,27	0,65
Age at first intercourse	<15 years (0)			Reference		
	15-18 years (1)	1,07	0,15	0,62	0,82	1,40
	>18 years (2)	0,93	0,17	0,65	0,64	1,32
Region	Tigray (1)			Reference		
	Afar (2)	0,71	0,21	0,24	0,40	1,26
	Amhara (3)	0,86	0,19	0,51	0,56	1,33
	Oromia (4)	0,64*	0,14	0,05	0,42	1,00
	Somali (5)	2,45**	0,77	0,01	1,32	4,53
	Benshangul-Gumz (6)	1,05	0,29	0,86	0,61	1,80
	SNNP (7)	0,62	0,15	0,06	0,38	1,01
	Gambela (12)	0,40**	0,12	0,00	0,23	0,71
	Harari (13)	0,87	0,28	0,68	0,46	1,65
	Addis Ababa (14)	0,25	0,33	0,29	0,02	3,26
	Dire Dawa	0,18	0,24	0,19	0,01	2,36

	(15)					
Residenc	Rural (0)	Reference				
	Urban (1)	0,83	0,21	0,45	0,50	1,35
Mothers education	No education (0)	Reference				
	Primary (1)	0,70	0,17	0,15	0,43	1,14
	Secondary or higher (2)	0,42*	0,15	0,01	0,21	0,83
Fathers education	No education (0)					
	Primary (1)	0,75*	0,11	0,04	0,57	0,99
	Secondary or higher	0,55**	0,12	0,01	0,35	0,84
Litracy (moather)	Can't read (0)	Reference				
	Can read (1)	0,93	0,22	0,76	0,58	1,49
Religion	Orthodox (0)	Reference				
	Moselim (1)	0,85	0,12	0,28	0,64	1,14
	Protesetant (2)	0,67*	0,13	0,05	0,45	1,00
	Other (3)	0,60	0,18	0,08	0,33	1,06
Sex of household head	Female (0)	Reference				
	Male (1)	1,43*	0,24	0,03	1,03	1,98
Wifebeating justified	Yes (0)	Reference				
	No (1)	0,88	0,10	0,25	0,70	1,10
Electricity	No (0)	Reference				
	Yes (1)	0,68	0,16	0,10	0,43	1,08
	Pseudo R2	=	0.6349			
	legend:	* p<0.05	**p<0.01;	*** p<0.001		

Table1 7a. Model (1):- Impact of proximate determinants on infant mortality for the previous five years period of 2005.

Variable	Catagory	Odds Ratio	Std.Err	P-Value	[95%Conf.Interval]	
Drink water	Other (0)			Reference		
	Pipe (1)	0,66**	0,10	0,00	0,50	0,87
Toilate	No toilet facilty (0)			Reference		
	Has toilet facilty (1)	0,66*	0,13	0,02	0,42	0,94
Floor	Other (0)			Reference		
	Earth Sand (1)	0,97	0,11	0,76	0,77	1,21
Child gender	Male (0)			Reference		
	Female (1)	0,70***	0,07	0,00	0,58	0,86
Marital status	Other (0)			Reference		
	Married (1)	0,70*	0,12	0,03	0,51	0,97
Birth order	1st birth order (1)			Reference		
	2-3 birth order (2)	0,38***	0,08	0,00	0,25	0,57
	4-7 birth order (3)	0,56**	0,12	0,01	0,37	0,87
	>7 birth order (4)	0,77	0,20	0,31	0,47	1,27
Breast feeding	<6 months (0)			Reference		
	6 months- 1 year (1)	0,01***	0,00	0,00	0,01	0,01
Age at first birth	<15 (1)			Reference		
	15-20 (2)	0,65*	0,12	0,02	0,46	0,92
	>20 (3)	0,48***	0,10	0,00	0,32	0,72
Household size	1-5 (1)					
	6-10 (2)	0,42***	0,05	0,00	0,34	0,54
	>10 (3)	0,16***	0,05	0,00	0,08	0,31
Type of birth	Single			Reference		
	Multiple	10,78***	2,51	0,00	6,83	17,02
Preceding birth interval	<18 months (1)			Reference		
	18-23 months (2)	0,66*	0,13	0,03	0,45	0,96

	24-35 months (3)	0,41***	0,07	0,00	0,30	0,57
	36-47 months (4)	0,34***	0,07	0,00	0,23	0,50
	>47 months (5)	0,21***	0,05	0,00	0,14	0,32
Age at first intercourse	<15 years (0)	Reference				
	15-18 years (1)	0,86	0,11	0,22	0,67	1,09
	>18 years (2)	0,68*	0,11	0,02	0,49	0,94
	Pseudo R2	=	0.5334			
	legend:	* p<0.05	**p<0.01;	*** p<0.001		

Table 7b. Model (2):- Impact of proximate and socioeconomic determinants on infant mortality for the previous five years period of 2005.

Variable	Catagory	Odds Ratio	Std.Err	p-Value	[95%Conf.	Interval]
Drink water	Other (0)	Reference				
	Pipe (1)	0,77	0,13	0,11	0,56	1,06
Toilate	No toilet facilty (0)	Reference				
	Has toilet facilty (1)	1,31	0,64	0,59	0,50	3,42
Floor	Other (0)	Reference				
	Earth Sand (1)	1,03	0,13	0,83	0,80	1,33
Child gender	Male (0)	Reference				
	Female (1)	0,71***	0,07	0,00	0,58	0,87
Marital status	Other (0)	Reference				
	Married (1)	0,67*	0,14	0,05	0,45	1,00
Birth order	1st birth order (1)	Reference				
	2-3 birth order (2)	0,37**	0,08	0,00	0,24	0,57

	4-7 birth order (3)	0,56*	0,13	0,01	0,36	0,88
	>7 birth order (4)	0,85	0,22	0,53	0,50	1,42
Breast feeding	<6 months (0)			Reference		
	6 months- 1 year (1)	0,01***	0,00	0,00	0,00	0,01
Age at first birth	<15 (1)			Reference		
	15-20 (2)	0,64*	0,12	0,02	0,44	0,92
	>20 (3)	0,49***	0,10	0,00	0,33	0,75
Household size	1-5 (1)			Reference		
	6-10 (2)	0,39***	0,05	0,00	0,31	0,51
	>10	0,15***	0,05	0,00	0,07	0,30
Type of birth	Single			Reference		
	Multiple	11,24***	2,71	0,00	7,00	18,04
Preceding birth interval	<18 months (1)			Reference		
	18-23 months (2)	0,39***	0,07	0,00	0,28	0,55
	24-35 months (3)	0,34***	0,07	0,00	0,23	0,50
	36-47 months (4)	0,20***	0,05	0,00	0,13	0,31
	>47 months (5)	0,42***	0,09	0,00	0,27	0,65
Age at first intercourse	<15 years (0)			Reference		
	15-18 years (1)	0,89	0,12	0,36	0,69	1,15
	>18 years (2)	0,70*	0,12	0,05	0,50	0,99
Region	Tigray (1)			Reference		
	Afar (2)	1,75	0,55	0,08	0,95	3,26
	Amhara (3)	1,43	0,32	0,11	0,92	2,21
	Oromia (4)	1,44	0,34	0,13	0,90	2,28
	Somali (5)	1,79	0,58	0,07	0,95	3,36
	Benshangul-Gumz (6)	1,29	0,36	0,36	0,75	2,22
	SNNP (7)	1,81*	0,45	0,02	1,12	2,93
	Gambela (12)	1,14	0,35	0,66	0,63	2,08
	Harari (13)	1,06	0,37	0,87	0,53	2,11

	Addis Ababa (14)	0,60	0,36	0,40	0,19	1,94
	Dire Dawa (15)	0,99	0,60	0,99	0,30	3,27
Residenc	Rural (0)	Reference				
	Urban (1)	0,93	0,25	0,78	0,55	1,57
Mothers education	No education (0)	Reference				
	Primary (1)	3,49***	0,67	0,00	2,40	5,08
	Secondary or higher (2)	0,99	0,36	0,97	0,48	2,02
Fathers education	No education (0)	Reference				
	Primary (1)	0,76*	0,10	0,04	0,58	0,98
	Secondary or higher	0,70	0,15	0,09	0,47	1,06
Litracy (mothers)	Can't read (0)	Reference				
	Can read (1)	0,91	0,19	0,65	0,61	1,37
Religion	Orthodox (0)	Reference				
	Moselim (1)	0,65**	0,10	0,01	0,47	0,89
	Protesetant (2)	0,76	0,14	0,13	0,53	1,09
	Other (3)	0,33**	0,12	0,00	0,17	0,65
Sex of household head	Female (0)	Reference				
	Male (1)	1,27	0,23	0,18	0,90	1,80
Wifebeating justified	No (0)	Reference				
	Yes (1)	0,97	0,11	0,78	0,78	1,21
Electricity	No (0)	Reference				
	Yes (1)	0,90	0,23	0,69	0,54	1,49
	Pseudo R2	=	0.5512			
	legend:	* p<0.05	**p<0.01;	*** p<0.001		

6.2 Child mortality

For the previous five years period before 2000

Table 8a shows the analysis result of the odd ratio for the impact of proximate determinants on child mortality. Regarding the environmental factors, the result shows availability of safe drink water and toile facility has a significant negative relationship with child mortality as expected, it reduced by 29 and 39 percent, respectively, relative to children born to households without safe drink water and toilet facility. Floor material with earth sand has insignificant impact on child mortality. The result shows that all bio-demographic determinants have expected sign except household size variable. Particularly Current marital status, household size, birth order, age at first birth, type of birth and preceding birth interval have a significant odd ratio. Children born to married women are about 39 percent less likely to die before reaching age five relative to other categories. Similarly as shown in the model of infant mortality, unexpectedly the increase of household size correlated with the decreased child mortality. Child mortality lower by 54 and 78 percent as the household size increased from 6-10 and more than 10, respectively, relative to 1-5 household size.

Birth order are very strongly negatively correlated to child survival, children born to 2-3, 4-7 and more than 7 birth order reduced child mortality by 71, 72 and 80 percent, respectively, relative to first born children. Child mortality for children born to mothers 15-20 and more than 20 age of at first birth are 30 and 70 percent lower, respectively, relative to those children born to mothers less than 15 ages at first birth. The effect of breast feeding does not a significant effect on child mortality. The risk of child mortality for multiple births is 3.70 times larger than single births.

The preceding birth intervals has a negative association with child mortality, that children born 24-35, 36-47 and more than 47 months after the previous birth reduced the risk of child mortality by 33, 45 and 65 percent, respectively, relative to children born less than 18 months after the previous births. However, children born 18-23 months after the previous birth has a positive association and insignificant impact on child mortality relative to children born less than 18 months after the previous births. Although child gender and mothers age at first intercourse do not have any significant impact on child mortality.

Model (2) in table 8b extends model (1) that present the impact of proximate determinants on child mortality by controlling socioeconomic variables. The addition of socioeconomic variables in model (2) affects the impact of environmental factors on child mortality. The result shows availability of toilet facility and floor material with earth sand negatively associative and do not have any significant effect on child mortality. The availability of safe drink water positively correlated but does not any significant effect on child mortality.

With in bio-demographic variables, the most important variables associated to child mortality are birth order, age at first birth, type of birth and preceding birth intervals.

Children born in 2-3, 4-7 and more than 7 Birth order contributed for the reduction of child mortality 72, 74 and 83 percent, respectively, relative to the first born child. Children born to mothers with more than 20 years of age at first birth is about 55 percent less likely to die before five years relative to child born to mothers less than 15 ages at first birth. Children born to mothers 15-20 ages at first birth does not influence child mortality. Multiple births have a

positive impact on child mortality as the predicated odd ratio is about 3.41 times higher than single birth. As the preceding birth interval increases lower the risk of child mortality, the effect of children born after 24-35, 36-47 and more than 47 months of the previous births reduced child mortality by 29, 44 and 65 percent, respectively, relative to child born after less than 18 months of the previous births. However, child born after less 18-23 previous child births increase the risk of child mortality before reaching at age five by 15 percent relative to children born after less than 18 months of the previous birth.

With regard to education variables, in this model only fathers with secondary level education have greatly reduced the risk of infant mortality by 50 percent relative to never attend in school. Mother's educational level and fathers with primary education is not statically significant. On the other hand female household headed reduced child mortality by 28 percent in comparison with those children born in male household headed family. Household that use electricity also important determinates of child mortality that reduced the risk of child mortality by 49 percent.

With regard to regional variation, child mortality clearly varies between the regions. It seems likely that the socioeconomic and health factors variation exist between all regions and it might be the Tigray region improve as compared to other region in those factors. With the exception of Addis Ababa and Harari, all other regions are positively correlated with child mortality relative to the Tigray region. However, only the odd ratios of Afar and Gambela regions have a significant impact on child mortality, which increased by 67 and 73 percent, respectively, relative to the Tigray region. Literacy, wife beating justified and religion variables are no longer significantly associated with child mortality.

For the previous five years period before 2005

The estimated odd ratio for the effect of proximate determinates on child mortality in the previous five years period of 2005 are shown in table 9a. With regard to the environmental factors included in this model are not statistically significant. The effects of safe drink water and toilet facility on child mortality are much better in the previous five years period of 2000 in comparison with in the previous five years period of 2005. However, floor material with earth sand in both previous five years period increased the risk of child mortality but the odd ratio of increasing child mortality decreased from 15 percent (2000) to 4 percent (2005).

According to the result of bio-demographic factors, children born to currently married women reduced the risk of child mortality by 40 percent relative to children born to non married women. The effect of marital status on reducing child mortality only increase by one percent in comparison to the previous five years period of 2000.

The result shows that birth order and preceding birth interval are important determinants for reducing child mortality. The odd of dying before the age five for children born in 2-3, 4-7 and more than 7 birth order are reduced by 74, 82 and 85 percent, respectively, relative to first born children. In both previous five years period the effect of birth order are larger even if the effect is considerably larger in the previous five years period of 2005, it increase the reduction of child mortality by 3, 10 and 5 percent for children born in 2-3, 4-7 and more than 7 birth order, respectively, as compared to the previous five years period of 2000. The increases of preceding birth interval reduce the risk of child mortality by 50, 68, 79 and 89 for the four categories, respectively, relative to the first category. The impact of preceding birth interval on reducing child mortality is large to those preceding birth intervals in the previous five years period of

2000, not only large, but also all categories have significant impact in the pervious five years period of 2005. Similarly as the previous result of infant mortality, the increase of household size also reduced the risk of child mortality. Children born in 6-10 and greater than 10 household sizes reduced the risk of child mortality by about 60 and 90 percent, respectively, relative to children born to less than 5 household size. The effect of household size larger in this recent previous five years period, it increase by about 6 and 13 percent for 5-10 and more than 10 household size in comparison to the previous five years period of 2000. Multiple births reduced the risk of child mortality 3.23 times larger than those single child births. The other bio-demographic variables not mentioned above are does not have any significant impact on child mortality.

The addition of socioeconomic variables in model (2) as shown in table 9b, does not change the impact of proximate determinates observed in model (1) table 9a, that continue the insignificant association between environmental factors that included in the model and child mortality. And also the addition of socioeconomic variables in the model does not substantially diverge the effect of bio-demographic factors observed in model (1) as shown in table 9a.

The result shown in model (2) of table 9b, that children born to mothers of currently married have lower child mortality by 44 percent relative to non-married (other) categories. It increased the reduction of child mortality by 4 percent as compared to the pervious five years period of 2000. Multiple births 3.33 times increase the risk of child mortality than single births.

With regard to birth order variables, the increase children birth order significantly negative association with child mortality. Child born in 2-3, 4-7 and more than 7 birth orders are 74, 83 and 85 percent, respectively, less likely to die before age of five relative to first born child. The role of birth order on reducing child mortality is larger in this recent previous five years period of 2005. And also only children born 2-3 birth orders have a significant impact on child mortality in the previous five years period of 2000 but all other categories do not have any significant impact. Household size also as seen before, unexpectedly negatively associated with child mortality that as the household size increase from 5-10 to more than 10 the child mortality also decreased by 59 and 90 percent, respectively. As compared to the previous five years period of 2000, there exist a small gap of the effect of household size on reducing child mortality but in both previous five years period the gap between the categories of household size wider, that large household member contribute much larger than smaller household size for the reduction of child mortality, it is critical and unexpected.

The results also indicate similar to earlier discussion, birth interval are one of the most important determinant here also. Children born after 18-23, 24-35, 36-47 and more than 47 months of the preceding birth intervals lower the risk of child mortality by 49, 78, 79, and 89 percent, respectively, in relative to children born after less than 18 months. The impact of preceding birth interval on child mortality is lager in this recent period relative to the previous five years period of 2000. Another important variable is mother's age at first intercourse that negatively associated with child mortality but only children born to mothers of 18 year and more age at the first intercourse significantly reduced child mortality by about 30 percent relative to children born to mothers of less than 15 year age at first intercourse. However, in this recent period much better in comparison to the previous five years period of 2000, that all categories of mothers age at first births do not have any significant impact on child mortality.

With regarding educational variables, mothers education larger effect and fathers education relatively less important on reducing child mortality before reaching age five in comparison to

the previous five years period of 2000. Children born to mothers with primary and secondary or above levels are significantly reduced child mortality by 54 and 66 percent, respectively. This increased the reduction of child mortality by 24 and 8 percent, respectively, in comparison to the previous five years period of 2000. However, according to father's education, only children born to fathers with secondary and above level have a significant impact of reducing child mortality, which reduced the risk of child mortality by 55 percent relative to children born to fathers with no education. There continue to be an insignificant association between regional variation and child mortality except Somalia region. Somalia region differently from the previous regression result, that reduced the risk of child mortality by 62 percent relative to Tigray region, which indicate the improvement of socioeconomic and health infrastructure in the region in this previous five years period. The other variables not discussed here have an insignificant effect on child mortality as shown in the model (2) table 9b.

Table1 8a. Model (1):- Impact of proximate determinants on child mortality For the previous five years period of 2000

Variable	Catagory	Odds Ratio	Std.Err	P-Value	[95%Conf.Interval]	
Drink water	Other (0)			Reference		
	Pipe (1)	0,71*	0,11	0,03	0,52	0,96
Toilate	No toilet facilty (0)			Reference		
	Has toilet facilty (1)	0,61*	0,13	0,02	0,41	0,91
Floor	Other (0)			Reference		
	Earth Sand (1)	1,14	0,11	0,19	0,94	1,39
Child gender	Male (0)			Reference		
	Female (1)	0,91	0,08	0,31	0,76	1,09
Marital status	Other (0)			Reference		
	Married (1)	0,61***	0,09	0,00	0,46	0,81
Birth order	1st birth order (1)			Reference		
	2-3 birth order (2)	0,29***	0,06	0,00	0,19	0,45
	4-7 birth order (3)	0,28***	0,07	0,00	0,17	0,47
	>7 birth order (4)	0,20***	0,07	0,00	0,10	0,38

Breast feeding	<6 months (0)	Reference				
	6 months-1 year (1)	0,80	0,25	0,46	0,44	1,46
Age at first birth	<15 (1)	Reference				
	15-20 (2)	0,70	0,14	0,07	0,47	1,03
	>20 (3)	0,50**	0,11	0,02	0,32	0,77
Household size	1-5 (1)					
	6-10 (2)	0,46***	0,05	0,00	0,37	0,57
	>10 (3)	0,22***	0,08	0,00	0,11	0,45
Type of birth	Single	Reference				
	Multiple	3,70***	0,97	0,00	2,22	6,17
Preceding birth interval	<18 months (1)	Reference				
	18-23 months (2)	1,12	0,21	0,53	0,78	1,61
	24-35 months (3)	0,67*	0,11	0,02	0,48	0,93
	36-47 months (4)	0,55**	0,10	0,00	0,39	0,79
	>47 months (5)	0,35***	0,07	0,00	0,23	0,52
Age at first intercourse	<15 years (0)	Reference				
	15-18 years (1)	0,96	0,11	0,74	0,77	1,21
	>18 years (2)	0,89	0,14	0,45	0,65	1,20
	Pseudo R2	=	0.6220			
	legend:	* p<0.05	**p<0.01;	*** p<0.001		

Table 8b. Model (2):-):- impact of proximate and socioeconomic determinants on child mortality For the previous five years period of 2000

Variable	Catagory	Odds Ratio	Std.Err	p-Value	[95%Conf.Interval]	
Drink water	Other (0)			Reference		
	Pipe (1)	0,73	0,14	0,12	0,50	1,08
Toilate	No toilet facilty (0)			Reference		
	Has toilet facilty (1)	1,41	0,86	0,57	0,43	4,64
Floor	Other (0)			Reference		
	Earth Sand (1)	1,11	0,13	0,37	0,88	1,40
Child gender	Male (0)			Reference		
	Female (1)	0,91	0,09	0,34	0,76	1,10
Marital status	Other (0)			Reference		
	Married (1)	0,73	0,13	0,07	0,53	1,03
Birth order	1st birth order (1)			Reference		
	2-3 birth order (2)	0,28***	0,06	0,00	0,18	0,43
	4-7 birth order (3)	0,26***	0,07	0,00	0,16	0,44
	>7 birth order (4)	0,17***	0,06	0,00	0,09	0,34
Breast feeding	<6 months (0)			Reference		
	6 months- 1 year (1)	0,74	0,23	0,34	0,40	1,37
Age at first birth	<15 (1)			Reference		
	15-20 (2)	0,71	0,14	0,08	0,48	1,04
	>20 (3)	0,48**	0,11	0,01	0,31	0,75
Household size	1-5 (1)			Reference		

	6-10 (2)	0,46***	0,05	0,00	0,37	0,58
	>10 (3)	0,21***	0,07	0,00	0,10	0,42
Type of birth	Single	Reference				
	Multiple	3,61***	0,95	0,00	2,15	6,06
Preceding birth interval	<18 months (1)	Reference				
	18-23 months (2)	1,15	0,21	0,45	0,80	1,66
	24-35 months (3)	0,71*	0,12	0,04	0,51	0,99
	36-47 months (4)	0,56**	0,10	0,00	0,39	0,81
	>47 months (5)	0,35***	0,07	0,00	0,23	0,54
Age at first intercourse	<15 years (0)	Reference				
	15-18 years (1)	0,90	0,11	0,42	0,71	1,15
	>18 years (2)	0,85	0,14	0,33	0,61	1,18
Region	Tigray (1)	Reference				
	Afar (2)	1,67*	0,43	0,05	1,00	2,78
	Amhara (3)	1,28	0,27	0,24	0,85	1,92
	Oromia (4)	1,40	0,30	0,11	0,92	2,14
	Somali (5)	1,42	0,38	0,19	0,84	2,39
	Benshangul-Gumz (6)	1,58	0,38	0,06	0,99	2,54
	SNNP (7)	1,35	0,33	0,21	0,84	2,18
	Gambela (12)	1,73*	0,48	0,05	1,00	2,99
	Harari (13)	0,42	0,29	0,21	0,11	1,62
	Addis Ababa (14)	0,74	0,54	0,68	0,18	3,10
	Dire Dawa (15)	1,77	0,52	0,05	0,99	3,14
Residenc	Rural (0)	Reference				
	Urban (1)	0,74	0,18	0,22	0,46	1,19
Mothers education	No education (0)	Reference				
	Primary (1)	0,98	0,23	0,95	0,63	1,55
	Secondary or higher (2)	0,42	0,19	0,06	0,18	1,02

Fathers education	No education (0)					
	Primary (1)	0,80	0,10	0,09	0,62	1,03
	Secondary or higher	0,50**	0,12	0,00	0,31	0,79
Litracy (moather)	Can't read (0)	Reference				
	Can read (1)	1,04	0,23	0,84	0,68	1,59
Religion	Orthodox (0)	Reference				
	Moselim (1)	1,24	0,17	0,12	0,95	1,62
	Protesetant (2)	0,87	0,18	0,50	0,59	1,29
	Other (3)	1,36	0,31	0,18	0,87	2,13
Sex of household head	Male (0)	Reference				
	Female (1)	0,72*	0,10	0,02	0,55	0,94
Wifebeating justified	No (0)	Reference				
	Yes (1)	0,96	0,10	0,68	0,78	1,17
Electricity	No (0)	Reference				
	Yes (1)	0,51**	0,10	0,00	0,34	0,76
	Pseudo R2	=	0,0599			
		*		***		
	legend:	p<0.05	**p<0.01;	p<0.001		

Table1 9a. Model (1):-):- impact of proximate determinants on child mortality For the previous five years period of 2005

Variable	Catagory	Odds Ratio	Std.Err	P-Value	[95%Conf.Interval]	
Drink water	Other (0)	Reference				
	Pipe (1)	0,89	0,15	-0,73	0,64	1,22
Toilate	No toilet facilty (0)	Reference				
	Has toilet facilty (1)	0,58	0,16	-2,04	0,34	0,98
Floor	Other (0)	Reference				
	Earth Sand (1)	1,04	0,14	0,27	0,79	1,36
Child gender	Male (0)	Reference				
	Female (1)	0,95	0,11	-0,41	0,75	1,21
Marital status	Other (0)	Reference				

	Married (1)	0,60**	0,11	-2,82	0,43	0,86
Birth order	1st birth order (1)	Reference				
	2-3 birth order (2)	0,26***	0,08	-4,57	0,15	0,47
	4-7 birth order (3)	0,18***	0,06	-4,89	0,09	0,36
	>7 birth order (4)	0,15***	0,07	-4,28	0,07	0,36
Breast feeding	<6 months (0)	Reference				
	6 months- 1 year (1)	0,71	0,25	-0,98	0,35	1,42
Age at first birth	<15 (1)	Reference				
	15-20 (2)	0,99	0,26	-0,04	0,59	1,64
	>20 (3)	0,77	0,23	-0,88	0,44	1,37
Household size	1-5 (1)					
	6-10 (2)	0,39***	0,06	-6,37	0,29	0,52
	>10 (3)	0,09***	0,05	-3,99	0,03	0,29
Type of birth	single	Reference				
	Multiple	3,23***	1,14	3,33	1,62	6,44
Preceding birth interval	<18 months (1)	Reference				
	18-23 months (2)	0,50**	0,11	-3,25	0,33	0,76
	24-35 months (3)	0,32***	0,06	-6,06	0,22	0,46
	36-47 months (4)	0,21***	0,05	-6,92	0,14	0,33
	>47 months (5)	0,11***	0,03	-8,28	0,06	0,18
Age at first intercourse	<15 years (0)	Reference				
	15-18 years (1)	0,93	0,14	-0,47	0,70	1,25
	>18 years (2)	0,70	0,14	-1,85	0,48	1,02

Pseudo R2 = 0.0774 ***

legend: * p<0.05 **p<0.01; p<0.001

Table 9bd. Model (2):-):- impact of proximate and socioeconomic determinants on child mortality For the previous five years period of 2005

Variable	Catagory	Odds Ratio	Std.Err	p-Value	[95%Conf.	Interval]
Drink water	Pipe (0)			Reference		
	Others (1)	1,08	0,20	0,67	0,76	1,54
Toilate	Has toilet facilty (0)			Reference		
	No facility (1)	0,98	0,11	0,89	0,80	1,21
Floor	Earth sand (0)			Reference		
	other (1)	1,03	0,13	0,83	0,80	1,33
Child gender	Male (0)			Reference		
	Female (1)	0,98	0,12	0,85	0,77	1,24
Marital status	Other (0)			Reference		
	Married (1)	0,56*	0,13	0,01	0,35	0,88
Birth order	1st birth order (1)			Reference		
	2-3 birth order (2)	0,26***	0,08	0,00	0,15	0,47
	4-7 birth order (3)	0,17***	0,06	0,00	0,09	0,35
	>7 birth order (4)	0,15***	0,07	0,00	0,06	0,35
Breast feeding	<6 months (0)			Reference		
	6 months- 1 year (1)	0,63	0,23	0,19	0,31	1,27
Age at first birth	<15 (1)			Reference		
	15-20 (2)	1,06	0,17	0,69	0,79	1,44
	>20 (3)	0,88	0,18	0,52	0,59	1,31
Household size	1-5 (1)			Reference		
	6-10 (2)	0,41***	0,06	0,00	0,31	0,55
	>10 (3)	0,10***	0,06	0,00	0,03	0,32
Type of birth	Multiple			Reference		
	single	3,33***	1,20	0,00	1,64	6,76
Preceding birth interval	<18 months (1)			Reference		
	18-23 months (2)	0,51***	0,11	0,00	0,34	0,78
	24-35 months (3)	0,32***	0,06	0,00	0,22	0,47

	36-47 months (4)	0,21***	0,05	0,00	0,14	0,34
	>47 months (5)	0,11***	0,03	0,00	0,07	0,19
Age at first intercourse	<15 years (0)	Reference				
	15-18 years (1)	0,89	0,12	0,36	0,69	1,15
	>18 years (2)	0,70*	0,12	0,05	0,50	0,99
Region	Tigray (1)	Reference				
	Afar (2)	1,67	0,55	0,12	0,88	3,17
	Amhara (3)	1,58	0,40	0,07	0,96	2,60
	Oromia (4)	0,89	0,26	0,70	0,51	1,57
	Somali (5)	0,38*	0,17	0,03	0,16	0,91
	Benshangul-Gumz (6)	1,70	0,52	0,08	0,93	3,10
	SNNP (7)	1,30	0,39	0,39	0,72	2,32
	Gambela (12)	1,17	0,45	0,69	0,54	2,50
	Harari (13)	1,06	0,42	0,89	0,48	2,32
	Addis Ababa (14)	0,21	0,27	0,23	0,02	2,71
	Dire Dawa (15)	0,13	0,17	0,12	0,01	1,69
Residenc	Urban (0)	Reference				
	Rural (1)	1,23	0,40	0,53	0,65	2,34
Mothers education	No education (0)	Reference				
	Primary (1)	0,46*	0,14	0,01	0,25	0,84
	Secondary or higher (2)	0,34*	0,18	0,04	0,12	0,95
Fathers education	No education (0)	Reference				
	Primary (1)	0,83	0,14	0,25	0,60	1,14
	Secondary or higher	0,45*	0,14	0,01	0,24	0,84
Litracy (moather)	Can't read (0)	Reference				
	Can read (1)	1,62	0,49	0,10	0,90	2,92
Religion	Orthodox (0)	Reference				
	Moselim (1)	1,16	0,22	0,43	0,80	1,68
	Protesetant (2)	1,03	0,25	0,92	0,64	1,64
	Other (3)	0,97	0,35	0,93	0,48	1,95
Sex of household head	Female (0)	Reference				

	Male (1)	1,08	0,23	0,72	0,71	1,63
Wifebeating justified	No (0)			Reference		
	Yes (1)	0,90	0,12	0,44	0,70	1,17
Electricity	Yes (0)			Reference		
	No (1)	0,87	0,28	0,67	0,47	1,62
	Pseudo R2	=	0.5512			
		*		***		
	legend:	p<0.05	**p<0.01;	p<0.001		

6. Discussion

The objective of the thesis is to investigate the proximate (bio-demographic) determinants and socioeconomic factors impact on infant and child mortality. This chapter aims some explanation of the results of multivariate analysis of proximate and socioeconomic determinates impact on infant and child mortality in related to theoretical back ground and previous researches.

6.1 Infant mortality

The Ethiopian Demographic Health Survey of 2005 indicated that infant mortality had reduced in the previous five years period of 2005 relative to the previous five years period of 2000. This reduction exists mainly through the improvement of socioeconomic status and health infrastructures as well as due to the effect of bio-demographic factors.

The empirical result shows that the environmental variables such as source of drink water, toilet facility and floor material do not have consistent effect on infant mortality in both previous five years period of 2000 and 2005. This is not inline with my hypothesis and the previous researches. Instead the reduction of infant mortality explained by bio-demographic and socioeconomic factors. However, among those factors some of these have an increasing effect. Other factors have larger pronounced effect for the improvement of infant mortality.

Among proximate determinants birth order, breast feeding, type of births, preceding birth interval and marital status are important determinants of infant mortality for both previous five years period of 2000 and 2005.

An increase children birth orders have a large and negative impact on both five years period of 2000 and 2005, particularly the 2^{nd} and 3^{rd} birth order are dominant determinate for infant mortality in both five years period. And also even children with birth order greater than seven do not have any significant impact on infant mortality but have an increasing impact on infant mortality. In the pervious five years period of 2005 children born in 4-7 birth order also dominant variable for reducing infant mortality but the contribution for the reduction of infant mortality relatively less to those of children born in 2-3 birth order, which is inline with the theories and previous researches. Therefore the U-shape relation ship between birth order and infant mortality is confirmed, that the risk of infant mortality higher for the first and for more than 7 birth order. This result is consistent with what was obtained by Kummar and Gemechis (2010) in Ethiopia.

The logistic analysis in both previous five years period of 2000 and 2005 confirmed that breast feeding is the most important factors for reducing infant mortality. That children breast fed for more than six months highly reduced the risk of infant mortality. This is inline with the majority of Ethiopian mother's economical statuses that very poor and have no access to provide alternative nutrition choice for children and there by prolonged breast feeding common in Ethiopia.

As expected, the effects of birth interval have a negative impact on infant mortality in both previous five years period of 2000 and 2005. Long birth intervals are largely reduced the risk of infant mortality relative to the short birth interval and as the increase the previous birth interval the risk of child mortality decreased. The high risk of infant mortality in short birth interval might be similar to other developing countries. Short birth interval increases the risk of infant and child mortality due to physiological and nutrition depletion of the mothers which relate to premature child birth and the mothers exposed to pregnancy complication (Boerma and Bicego, 1993). However, as indicated earlier the magnitude and significance for the recent five years period are larger than from the previous five years period of 2000. This finding is inline with what was found by Kummar and Gemechis (2010) that the risk of infant deaths is higher for children born less than two years of the previous period and lower for children born more than 4 years of the previous births. Similar result also obtained in Ghana (Goro, 2007) and Zimbabwe (Kombo and Ginneken, 2009).

Multiple births are a serious issue in Ethiopia and getting worse. And also it exposed to higher economic burden and affects the quality of nutrition and health care of children. In both previous five years period of 2000 and 2005, the effect of multiple births is associated with the increases of infant mortality due to biological and socioeconomic factors. However, the risk of infant mortality is much larger in the recent five years period in comparison to the previous five years period of 2000. This finding is inline with Kombo and Ginneken (2009) finding in the case of Zimbabwe that multiple births are highly correlated with high infant mortality than single births.

Many studies indicated in the background section that marital status is the important determinant for infant mortality; almost all show married women reduced the risk of infant mortality relative to divorced, widowed and other categories. Inline with this, the main finding of this study that in both previous five years period of 2000 and 2005 children born to married women play an important significant role for the reduction of infant mortality in comparison to children born other categories (non-married, divorced, widowed and other). This might be due to socioeconomic factors, traditions and the lifestyle of the non-married women. However, there is a small difference in magnitude between the previous five years period of 2000 and 2005.

The result of this study also showed that female children experience reducing infant mortality in compression to male children du to biological factors, since female children are less vulnerable than males (Waldron, 1993). Sex of child is crucial determinant that does not link with improvement of socioeconomic variables. This is in line with most of African countries result and Kummar and Gemechis (2010) also confirmed this in their analysis in Ethiopia.

Mother's age at first birth and intercourse are negatively correlated with infant mortality that decreased the risk of infant mortality as increase mother's age at first birth and at first intercourse. The estimated result also show that mothers age at first birth and intercourse

increases reduced the risk of infant mortality and mothers born their first child and mothers start sexual intercourse at younger age face high infant mortality risk due to social and reproduction immaturity. This result inline with many studies, in Ethiopia Kumar and Gemechis (2010) and in Zimbabwe Kombo and Ginneken (2009) found similar results. However, child gender, mothers age at first birth and mother's age at first intercourse were significant only for the previous five years period of 2005 but not in 2000.

Therefore, the estimate of birth order, breast feeding, type of births, preceding birth interval and marital status for both pervious five years period of 2000 and 2005 and child gender, mothers age at first birth and mothers age at first intercourse reveal similar Pattern and inline with my hypothesis in related to the theoretical section and the previous researches.

On the other hand with regard to socioeconomic variables, the effects of education play an important role for the reduction of mortality, particularly mothers educations are greater contribution than fathers education, in line with this in Nigeria Caldwell (1981) found infant and child mortality are highly associated mother's education that increase the awareness of how to care her children before births and after births and enables her to change feeding and child care practices by shaping and modifying the traditional familial relationships. Education plays an important role to improve knowledge of medical and health care, particularly mother's education enhance to improve more effective preventative and health care practice, this increase her productivity and influence infant and child mortality. In Ethiopia Kumar and Gemechis (2010) also found that infant mortality lower for children born to mothers whose educational level is secondary and above relative to children born to illiterate mothers. However, the estimated result in this study shows mixed and the father's education are more important than mother's education level. Inline with my hypothesis children born to mothers with secondary education level are a significant impact on reducing infant mortality in the previous five years period of 2000. As expected in both previous five years period of 2000 and 2005, father's education negatively associated with infant mortality. Inline with this few studies found that socioeconomic factors (education) do not have any significant impact on mortality for instance Kombo and Ginneken (2009) using the result of 2005-06 Zimbabwean DHS found that maternal education does not significant at all.

The result also suggests that female household head are associated with the decrease of infant deaths in comparison to male household head. However, household head has significant impact on infant mortality in the previous five years period of 2000 but not in 2005. This is no doubt that in most developing countries women are dominated by male and women are responsible for domestic work such as care for children and other family members.
Surprisingly, as household size increases the risk of infant mortality significantly decreased. In both previous five years periods the effect of more than 10 household size largely reduced infant mortality. This is not supported by the previous researches and this needs further investigations.

The results show that a striking wide variation of infant mortality between regions. This is mainly unequal distribution of socioeconomic and health infrastructures between regions. In the previous five years period of 2000, the Gambela region show a significant decreases of infant mortality relative to Tigray region, however, significantly increased infant mortality in Somali region, it might be the region has security problem lead to difficult to distribute or expand socioeconomic and health infrastructure in the region, however, this contradict the reality, that the region is characterized by rural dominate and a child friendly regions. These results indicated needs further investigation. On the other hand, in the previous five years period of

2005 the result found different from the previous five years period of 2000 that except the two administrative region Addis Ababa and Dire Dawa, all other region show an increase of infant mortality relative to Tigray region, this might be related to current political situation that the imbalance investment in socioeconomic and health infrastructures favor to this region and also the HIV prevalence decreased in this region. However, only a significant increase observed in SNNP region.

The estimate for all religion categories negatively correlated with infant mortality, however, protestant religion in the pervious five years of 2000 and Muslim and other category of religion in the previous five years period of 2005 have a significant impact on infant mortality.

Many scholars observed a significant difference between urban and rural infant mortality, however, in this study the magnitude are in the expected direction but do not have any significant impact on infant mortality. Literacy of women, use of electricity and wife beating justified variables also do not have any significant effect in both previous five years period of 2000 and 2005.

Generally the result shows that the pattern, magnitude and significance consistency does not exist in the relationship between socioeconomic variables and infant mortality and it makes difficult to generalize and compare the strength and the relationship between socioeconomic variable and infant mortality. This inconsistence relationship is observed previously in other countries (Mturi and Curtis, 1995; Kombo and Ginneken, 2009). However, the consistency of proximate determinants much better than as compared to socioeconomic determinants in term of pattern, magnitude and consistency. Marital status, birth order, breast feeding, type of birth and preceding birth interval are the most dominant proximate determinates of infant mortality observed in this analysis in both previous five years period of 2000 and 2005 and the significant slightly larger for the recent previous five years period.

6.2 Child Mortality

Similar to the effect of environmental factors on infant mortality as earlier discussed, the effect of safe drink water, toilet facility and floor material with earth sand on child mortality is not consistent and the addition of socioeconomic variables in the model makes its effect on child mortality worst. This is difficult to explain and compare and require further investigation.

Of all the proximate determinants in child mortality models marital status, birth order, type of birth and preceding birth interval are important determinants of child mortality for both previous five years period of 2000 and 2005.

The result show that the effect of marital status significantly reduced child mortality in both previous five years period of 2000 and 2005. However, the full model (the addition of socioeconomic variables in the proximate determinates) marital status in the previous five years period of 2000 had no significant impact on child mortality. In general the result from the previous five years period of 2000 and 2005 show that a small larger impact of marital status on child mortality than infant immortality.

Birth orders also play a most important role in reducing child mortality with large magnitude and statistical significance that as the birth order increases the risk of child mortality largely decreased in both previous five years period of 2000 and 2005, however, as discussed in the background section no U-shape relationship between birth order and child mortality in this

analysis. Such evidence is not in line with my hypothesis and the previous research obtained by Kumar and Gemechis (2010) that they found the first birth order and 7 and higher birth order suffer higher rates of child mortality. However, in the case of infant mortality the U-shape relationship found but the higher birth order does not significant effect on infant mortality. The magnitude of the effect of birth order on child mortality is larger than the effect of birth order on infant mortality in both previous five years period of 2000 and 2005.

As expected, multiple births positively associated with child mortality in both five years period of 2000 and 2005. Despite the result suggest that the effect of multiple births on child mortality slightly decreased as compared to infant mortality in both previous five years period of 2000 and 2005.

Moreover, the effect of preceding birth interval negatively correlated with child mortality. Except children born after 18-23 months that increased child mortality in the previous five years period of 2000, as argued in the hypothesis and previous researches all other categories of preceding birth interval are significant in both previous five years period of 2000 and 2005, however, the effect somewhat diminished in the previous five years period of 2000 in comparison with the recent previous five years period of 2005. The estimated result shows that the impact of preceding birth interval on child mortality is larger relative to the impact on infant mortality.

On the other hand the effect of child gender, breastfeeding, mothers age at firs birth (except children born to mothers greater than 20 years at first births has a significant impact on child mortality) and mothers age at first intercourse are negatively associated with child mortality but unexpectedly all are not significant.

Similarly, what I found for infant mortality, large household size also largely reduced the risk of child mortality in both previous five years period of 2000 and 2005. This is not inline with my hypothesis and previous researches and this needs further investigations.

With regard to education variables, the estimated result shows that secondary level father's education in both previous five years period of 2000 and 2005 and both primary and secondary father's education in the previous five years period of 2005 is associated with lower child mortality. This is inline with my hypothesis and theoretical and previous researches. However, primary and secondary mother's education in the previous five years period of 2000 and primary father's education in both previous five years period of 2000 and 2005 have expectedly negatively associated with child mortality but do not have any significant impact on child mortality.

On the other hand, the relationship between mother's literacy and child mortality is unexpected and also not significant. Although the mother's literacy rates is as expected negatively correlated with infant mortality but not significant. This result is not inline with my hypothesis. Many studies shows the opposite result, such as Mosley and Chen (1984) and (Hobcraft, McDonald and Rutstein, 1984) found that mothers literacy strongly correlated with infant and child mortality. This insignificant effect of mother's literacy might be due to the correlation with other variables or small number of literate mothers included in the sample in comparison with illiterate mothers.

Female headed household and use of electricity reduced child mortality in the previous five years period of 2000 but insignificant impact in the previous five years period of 2005. Wife

beating variable does not have any significant impact on child mortality in both previous five years period of 2000 and 2005.

Similar to the result infant mortality, a wide variation exist in child mortality between regions. In the previous five years period of 2000 child mortality is higher in all region except Addis Ababa and Harari, where the child mortality decrease relative to Tigray region. However, the magnitude is not significant for all regions except Afar and Gambela. In the previous five years period of 2005 child mortality in Addis Ababa, Dire Dewa, Oromia and Somalia region decreased relative to Tigray region and all other region increase child mortality. However, only Somalia region does have a significant effect on child mortality. This variation of infant and child mortality might be due to the related factors associated with region and require in-depth investigation. On the other hand the religion variable does not have any significant impact on child mortality in both previous five years period of 2000 and 2005.

7. Conclusion

The study has empirically investigated and identified the bio-demographic (proximate) and socioeconomic determinants of infant and child mortality in Ethiopia in both previous five years period of 2000 and 2005 using logistic regression method. The results of the logistic regression reveal interesting insight have substantial impact of bio-demographic (proximate) determinants on improving infant and child mortality. However, the result shows that the diminishing impact of socioeconomic factors on infant and child mortality and the lack of significant of environmental factors, this is not inline with the theoretical background and previous research and rejected the hypothesis.

According to infant and child mortality model (2) marital status, birth order, type of births and preceding birth interval are the dominant significant proximate determinants of infant and child mortality. Breast feeding is also an important significant factor for infant mortality but not for child mortality. Children born to women not currently married, first born children, children born multiple, children born after less than 18 months of the previous birth and children who breast fed less than 6 months exposed to the high risk of infant and child mortality mainly due to biological reasons. Among socioeconomic variables household size and to some extent, fathers and mothers educational levels and sex of household are the most significant determinants of infant and child mortality. That children born in small household size, children born in males household headed, children born to mothers and fathers with no education and to some extent children born to mothers and fathers with primary education exposed to the high risk of infant and child mortality.

However, it is difficult to generalize and compare the strength and weakness of the impact bio-demographic (proximate) and socioeconomic determinants on infant and child mortality in previous five years period of 2000 and 2005 due to the results found to some extent inconsistent and needs in-depth investigation. This indicates infant and child mortality had not consistent relationship over time which might be the change of the effects of different factors and this supported by the regional difference due to uneven distribution of socioeconomic and health infrastructures.

In general to some extent bio-demographic factors have consistent and substantial effect on infant and child mortality. The finding suggest that infant and child mortality can be reduced substantially by encouraging mothers to continue breast feeding practice, to increase the age at firs birth and to prolong birth intervals. The result also shows that multiple births of children experienced higher risk of infant and child mortality relative to singleton. These results suggest

that maternal and child health services should focus and identify such cases and provide those good health care services and guidance. The study also suggests that encourage mothers and fathers to increase their education levels up to at least secondary levels. This shaping parental behavior toward children and increase the awareness and capacity to manipulate health services for their children (Caldwell, 1979; Hobcraft, 1993). Although mothers education is highly associated with child quality and the empowerment of women. However, educating fathers and mothers do not lead to reducing infant and child mortality if it is not incorporate with the availability of health infrastructures.

On the other hand as mentioned earlier one of the most unexpected finding in this study concerns the relationship between household size and infant and child mortality. Infant and child mortality high for children born in small household size and lower for children born in large household size and these needs further research to understand the relationship.

This study also suggest that infant and child mortality widely varied between regions in Ethiopia due to unequal distribution of socioeconomic and health infrastructures. However, most variation between regions does not have any significant impact on infant and child mortality. Surprisingly these studies found that children born in rural and urban areas do not have any significant impact on infant and child mortality this might be due to small number of children born in urban areas included in the study.

In conclusion, government policy should be focus on the above important determinants of child survivals and in the remaining years, health intervention policies should revise and implement to achieve the Millennium Development Goals (MDGs) of reducing infant and child mortality by 2015.

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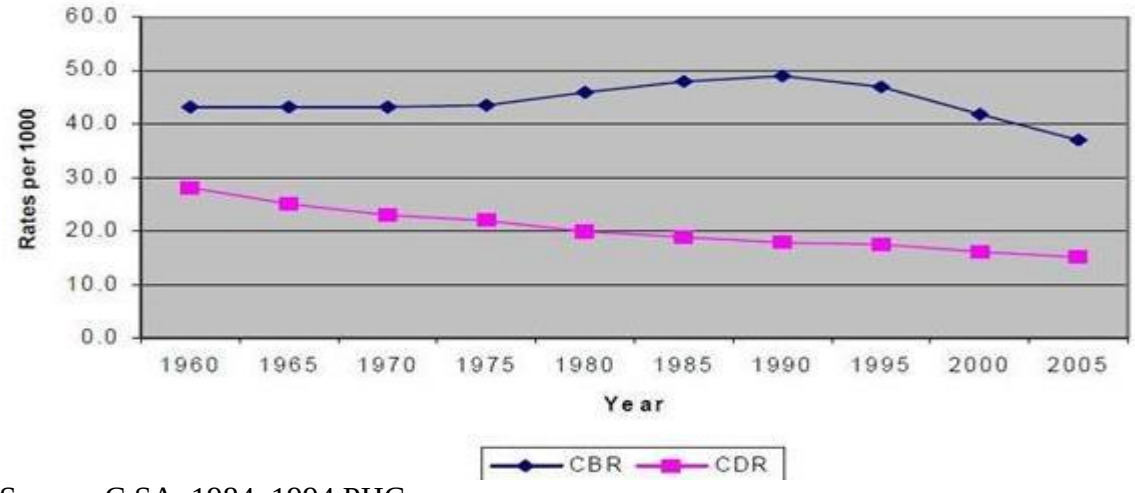
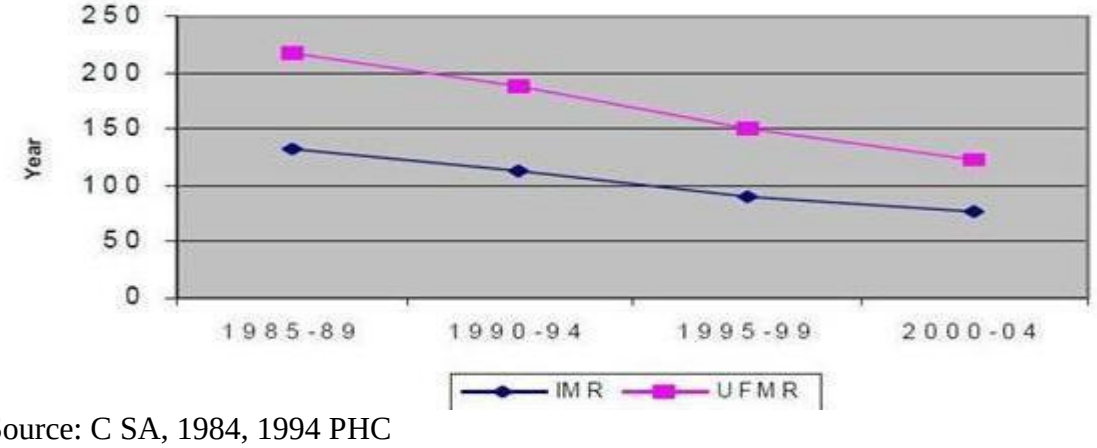
Appendix 1: Trends in CBR and CDR: 1960-2005



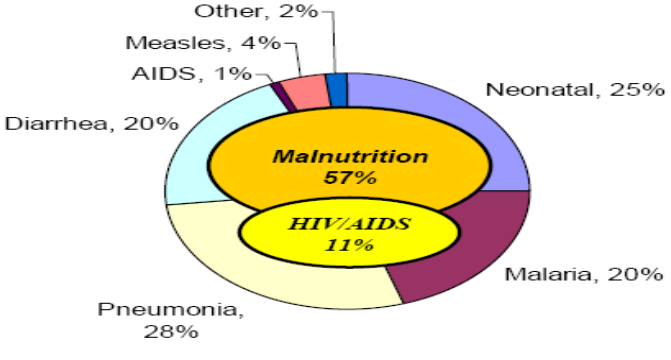
Source: C SA, 1984, 1994 PHC

Appendix 2: Infant and under-five mortality rate: 1985-2004



Source: C SA, 1984, 1994 PHC

Appendix 3: Causes of infant and child Mortality



Source: Ethiopia Child Survival Situation Analysis, 2004