Addis Ababa University

Faculty of Medicine

School of Public Health

Birth Spacing and Risk of Child Mortality at Kalu District South Wollo Zone of Amhara Region, North East Ethiopia

By

Muluneh Yigzaw (B.Sc)

June 2009

Addis Ababa, Ethiopia

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Acronyms

AAU/MF	Addis Ababa University, Medical Faculty
ANC	Ante natal care
CI	Confidence Interval
CSA	Central Statistics Agency
DHS	Demographic and health surveys
EDHS	Ethiopian Demographic and Health survey
FP	Family planning
HEWs	Health Extension Workers
IRB	Institutional Review Board
ITNs	Insecticide Treated Nets
LMP	Last Menstrual Period
MCH	Maternal and child health
MDGs	Millennium Development Goals
MOH	Ministry of Health
OR	Odds Ratio
PHCCO	Population and Housing Census Commission Office
RH	Reproductive Health
RR	Relative Risk
SSA	Sub-Saharan Africa
UNICEF	United Nations Children's Fund
WHO	World Health Organization
X^2	Chi square Test

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Abstract

Background: Family planning services are usually evaluated in terms of their impact on fertility. Less attention has been given to the way in which changes in family planning related behavior may affect childhood mortality. Identifying the optimal interval between births at which risk of child mortality is the lowest may benefit developing countries to prioritize family planning services and achieve MDG 4.

Objective: To Asses the child mortality rate and determine whether birth spacing is associated with increased risk of childhood mortality at a rural district.

Methods: A house to house census carried out in 13 kebeles with an approximate population of 80 thousand to identify all child deaths one year preceding to the survey and to determine the child mortality rate at kalu district. Sex and age group matched case control study was carried out after the census to assess the association between birth spacing & child mortality. A conditional logistic regression was performed to point out the independent effect birth spacing has on children under 5 years mortality.

Result: The neonatal, post neonatal, infant, child and under five mortality rates were found to be 37, 30, 67, 33 and 99/1000 live births respectively**.** Age group stratified analysis showed a significant decline in the trend of neonatal (X^2 for trend = 13.23, P = 0.0003), post neonatal (X^2 for trend = 4.62, P = 0.03) and infant (X^2 for trend = 17.06, P = 0.0001) mortality as the interval between births increases from less than 15 months to 48 or more months. Multivariate analysis showed that the odds of under five years mortality was 6.45 (95% CI = 1.53, 27.15), 3.20 (95% CI = 1.07, 9.57), 3.21 (95% CI = 1.18, 8.77) and 2.61 (95% CI = 0.97, 7.01) when the interval between births is less than 15, 15-23, 24-35 and 36-47 months respectively compared to birth intervals 48 or more months.

Conclusion: Risk of childhood mortality was significantly associated with birth spacing.

Recommendation: Mothers at the study district should space births for at least 36 months in order to reduce the risk of childhood mortality.

1. Introduction

1.1. Background

Several studies in the world showed that too short birth interval is correlated with child mortality [1, 2, 3, 4]. The literature identified three possible causal relationships that may explain this correlation. First, the maternal depletion hypothesis posits that women need sufficient time to recuperate between pregnancies in order to replenish their bodies and provide adequate nourishment for their fetuses [1]. Pregnancy can lead to a depletion of protein, energy, and micronutrient reserves, possibly resulting in adverse outcomes for women and their children [5]. Second, the sibling competition hypothesis states that closely spaced births lead to adverse health outcomes among siblings. Computation for parental time or material resources and the inability to give a child adequate attention if birth came sooner than desired have been suggested as possible contributors to a detrimental effect of a short preceding interval on child mortality [2, 5]. The third hypothesis suggests that with closely spaced births, an increased likelihood exists of infection among siblings. Maternal depletion hypothesis apply to preceding pregnancies regardless of the outcome while others will only come into play if the preceding child is still alive [1, 5, 6].

Countries pledged to ensure a two-thirds reduction in child mortality by 2015, from the base year 1990 [7]. But the disparity between developing and developed countries in terms of the number of child deaths seems to be unacceptably high in recent years compared to in 1990s. In 1990, there were 180 deaths per 1000 live births in Sub-Saharan Africa and only 9 per 1000 in industrialized countries; a 20 fold gap. This gap has increased to 29 fold in 2000, with mortality rates of 175 and 6 per 1000 live births in sub-Saharan Africa and industrialized countries respectively [8]. Available evidence showed that although half of the world's regions are on

track to meet MDG four, many Sub-Saharan African (SSA) countries have fallen behind and will need to accelerate progress considerably to meet the goal [9]. To achieve the millennium development goal, a substantial reduction in child mortality, particularly neonatal mortality in these countries is needed [10].

The world health organization (WHO) estimates that Ethiopia contributes 4% of neonatal deaths in the world. The country ranks fourth in the world in terms of the number of neonatal deaths [11]. According to Ethiopian Demographic and Health Survey (EDHS) 2005 the neonatal, post neonatal, infant, child and under 5 mortality rates are 39, 38, 77, 50 and 123/1000 live births respectively. The under five years mortality rate is 208/1000 live births when the interval between births is less than two years and drops to 66/1000 live births when the interval is four or more years. There is no evidence, however, whether this difference is statistically significant or is due to some other confounding factors, such as socioeconomic status, maternal reproductive history and breast feeding status of the child [12].

Family planning services are usually evaluated in terms of their impact on fertility. Less attention has been given to the way in which changes in family planning related behavior may affect infant and child mortality [6]. Identifying the optimal interval between births at which risk of child mortality is the lowest may benefit developing countries to prioritize family planning services and achieve Millennium Development Goal (MDG) four.

1.2. Rational of the Study

Health services are not easily accessible to the majority of people in developing countries in general and in Ethiopia in particular. Even those available facilities are said to be substandard; most are inadequately staffed, poorly equipped and underfunded [13]. An understanding of the

determinants of child mortality that are amenable to intervention is required in these countries in order to achieve the 4th millennium development goal; “Reduce Child Mortality” [8].

Family planning services have not needed highly trained health professionals unlike delivery services with which at least a nurse is needed to be a professional assisted delivery [14]. A number of family planning methods can be simply provided by health extension workers. But whether birth spacing is a significant independent determinant factor for child mortality in rural Ethiopia in which prolonged breast feeding is universal, is unknown. Determining the optimal inter-birth interval and developing a coherent conceptual frame work explaining possible causal mechanisms of birth spacing on child mortality is crucial in this country where the contraceptive prevalence rate is the lowest and child mortality rates are the highest in the world, and clinical services are inaccessible to the majority of people. This study was therefore conducted to determine child mortality in association with birth spacing.

2. Literature Review

2.1. *Epidemiology of Child Mortality*

Nearly 10 million children die each year, most by preventable causes and almost all are in developing countries [8, 9]. A few countries account for a very large proportion of all child deaths. Forty two countries account for 90% of global child hood deaths. Close to 41% of child deaths occur in sub-Saharan Africa and another 34% in South Asia. Sub-Saharan Africa, with quite small population sizes, contributes the highest number of child deaths in the world [8]. Of all deaths of children younger than 5 years, about 4 million (38%) occur in the first 28 days of life - i.e., the neonatal period [9, 10]. Nearly 99% of neonatal deaths are in developing countries; developed countries contribute only 1% of neonatal deaths globally [10].

The level of child mortality in Ethiopia is improving in the last few years. The infant and under five mortality rates in 2000 were 97 and 166 /1000 live births respectively [15]. In 2005, this figure dropped to 77 and 123/1000 live births for infant and under 5 deaths respectively [12]. However, this progress is not sufficient to achieve the MDG by 2015 [9].

According to WHO, close 20 % of child deaths globally are caused by acute respiratory infections, more specifically pneumonia, about 17% of deaths are attributed to diarrhea, 37% are due to neonatal causes such as birth asphyxia, low birth weight and preterm birth and the rest are due to malaria, measles, HIV/AIDS and childhood injuries [14, 16]. Malnutrition increases the risk of dying from these diseases; over half of all child deaths occur in children who are underweight [14].

2.2. *Inter pregnancy Interval and Adverse Prenatal Outcomes*

Studies showed that poor prenatal outcomes such as premature births, low birth weight, and intrauterine growth retardation are risk factors for child mortality, particularly neonatal

mortality [10, 17, 18]. There is an increasing argument that maternal depletion as a result of short inter pregnancy intervals may increase the rate of adverse prenatal outcomes [19].

Risk of prematurity, low and very low birth weight, still birth and prenatal death is high when the intervals between pregnancies are either too short or too long. A number of studies in different countries revealed that the risk for adverse birth outcomes is lowest when the inter pregnancy interval is 18-23 months and increases when the interval departed from 18-23 months [18, 20, 21, 22]. A meta analysis in 2005 showed that inter-pregnancy intervals shorter than 18 months are significantly associated with increased risk of adverse prenatal outcomes (preterm birth, low birth weight and small for gestational age) [23] which were known to be risk factors for neonatal mortality [10, 17]. Another study pointed out that compared with mothers with greater than12-month intervals, mothers with less than 6-month intervals had an approximately 50% - 80% increased risk of very low birth weight delivery and a 30% - 90% increased risk of very preterm delivery [22]. Women with intervals less than 18 months were 14–47% more likely to have very premature and moderately premature infants than women with intervals of above18 months. Women with intervals over 59 months were also12–45% more likely to have very premature and moderately premature infants than women with intervals of 18–59 months [24].

A study in Denmark showed that inter pregnancy intervals less than 8 months were associated with preterm birth but not with low birth weight. The adjusted odds ratios for preterm birth were 3.60 for intervals up to 4.00 months and 2.28 for intervals between 4.01 and 8.00 months compared with deliveries after 24 to 36 months, in which the risk of preterm birth was 3.5% [25].

A study in Sweden found a different result. It came with a result that compared with inter pregnancy intervals between 12 and 35 months, very short inter pregnancy intervals (0–3 months) were not associated with increased risks of stillbirth and early neonatal death after adjusting for maternal characteristics and previous reproductive history. On the contrary, women with inter pregnancy intervals of 72 months and longer were at increased risk of stillbirth and possibly early neonatal death [26].

A cross-sectional facility based study in Addis Ababa, Ethiopia in 2007 showed that birth to pregnancy interval has no effect to poor prenatal outcomes (preterm birth, still birth and low birth weight [27].

2.3. *Birth Spacing and Child Mortality*

A considerable number of studies have been carried out both in developing and developed countries on the effect of birth spacing on child mortality. The majority of them came to conclude that birth spacing has a considerable effect on maternal and child mortality and morbidity [1, 2, 3, 4]. Maternal depletion as a result of too frequent pregnancies, competition for household resources and infection are the possible causal relationships that may explain this correlation [1]. The findings among different studies, however, are not uniform. Some found a strong association at neonatal period, some at the time of infancy others at childhood period and even some came with a result that birth spacing has no effect on child mortality [28]. On top of that there is no an agreed upon optimal birth-interval among those who identified an association between birth interval and child mortality.

Studies in developing countries particularly in Africa were based on DHS data [2]; others used longitudinal high quality data from demographic surveillance sites mainly at the international centre for diarrheal disease research in Bangladesh [1, 29].

Most studies prior to 2000 were based on inter birth intervals. As a result, risk of mortality after an abortion or miscarriage was missing. Recent studies, however, are based on either inter-pregnancy or inter outcome intervals [30]. A cohort study using a large sample size in Bangladesh found that shorter intervals are associated with higher mortality. This study included inter-pregnancy intervals that began with inter-pregnancy outcomes other than live births. In the first week of the child's life, the effects of short intervals are greater if the sibling born at the beginning of the interval died; after the first month, the effects are greater if that sibling was still alive [1].

Analysis of DHS data from 17 developing countries collected between 1990 and 1997 retrospectively showed that the risk of dying for neonates and infants decreases with increasing birth interval lengths up to 36 months, at which point the risk plateaus. For child mortality, the analysis indicates that the longer the birth interval, the lower the risk, even for intervals of 48 months or more [2]. Review of DHS findings in developing countries conducted before 2002 showed that if years between births were less than 2, infant mortality rate in 2003 was expected to be 117/1000 live births in developing countries, if 2-3 it was 64/1000 and if it is greater than 4 it was 47/ 1000 [31].

A study done in Senegal pointed out that the odds of dying in the neonatal and post-neonatal periods are 2.27 and 2.12 times higher, respectively for children born after preceding birth intervals of one year or less compared to children born after longer intervals. Children born within two years of a subsequent birth had about 4 times higher risk of dying in the second year of life than children whose mother gave birth more than 2 years after the index birth [32]. The authors, however, concluded that prolonged breast feeding causes women to space their births at long intervals. Therefore, short birth intervals are a consequence rather than a cause of child

mortality and the direct effects of birth spacing efforts on child mortality are limited. A study using the same design in India suggested that breastfeeding duration has a strong impact in reducing the relative risk of early child mortality; but it does not explain the effect of the length of the preceding birth interval on early childhood mortality [33].

A case control study which was carried out in northern Ghana in 1995, found an increased risk of death if the preceding birth interval was less than 2 years [34].

A retrospective cohort study in Tanzania pointed out that short birth intervals, teenage pregnancies and previous child deaths are associated with increased risk of death, but it did not show the independent effect birth spacing has on child survival [35].

Analysis of the 1992 nationwide Indian fertility data among children less than 2 years showed that short preceding birth intervals are associated with an increased risk of mortality in neonatal (OR=3.13), early post neonatal (OR=3.81) and late post neonatal (OR=3.61) age groups, and the effect is particularly marked in the early post-neonatal period [5].

A study in Bangladesh in 1994 showed that, with the exception of the neonatal period, birth spacing effects were highly significant. A preceding birth interval of less than 15 months was associated with a greater mortality risk in the post-neonatal period for children with an older sibling who survived infancy. However, a short preceding birth interval did not adversely affect post-neonatal mortality if the older sibling died in infancy [29]. Another study in Bangladesh in 1997 using fertility survey data showed that preceding birth interval length, followed by survival status of the immediately preceding child, is the most important factor associated with differential infant and child mortality risks [36].

More recently, a retrospective cohort study in Bangladesh investigated whether the risk of child mortality is low in MCH/FP project areas compared to non MCH/FP areas. It was found that the intensive provision of family planning and maternal and child health services in the MCH/FP area has not only helped reduce fertility but also has helped reduce infant and child mortality [6].

John Bongaarts reviewed a number of studies which was carried out both in developing and developed nations before 1985. He concluded that all investigations had a sort of methodological drawbacks and therefore the observed associations may be spurious associations [28].

A number of studies have been carried out in Ethiopia to pin point risk factors for child morbidity and mortality [37, 38, 39]; but most of them did not include birth interval in the analyses. The only study in Ethiopia that included birth interval as an independent factor for child mortality was the cross sectional survey which was carried out at Sebeta town in 1992. It showed that compared to a preceding birth interval of 3 years or above, a child with birth interval less than 2 years have 1.6 times higher risk of dying [39]. On top of that, the 2000 and 2005 demographic and health surveys showed that the risk of mortality is high among children with short preceding birth intervals [12,15], but possible confounders was not analyzed in the DHS report.

2.4. *Family planning and the Demand for Birth Spacing*

Secondary analysis of data from the Demographic and Health Surveys (DHS) in selected developing countries between 1990 and 2004 showed that demand for birth spacing is the most prevalent reason for an interest in family planning among married women aged 15-29 years. In the 15-19 year age cohort, the demand for spacing is proportionally the most prevalent reason for a demand for family planning [40]. Alike the above study, demographic and health surveys

in Ethiopia showed that the majority of women who use one or more family planning methods use the method for spacing [12, 15]. EDHS 2005 found that thirty-four percent of married women in the country have an unmet need for family planning, with 20 percent having an unmet need for spacing and 14 percent having an unmet need for limiting. The contraceptive prevalence rate (CPR) was nearly 15% with nearly 14% modern contraceptive acceptors [12]. A study done in North and South Wollo administrative zones in 2006 came with a contraceptive prevalence rate of 44.1%, the majority of which (nearly 76%) is for spacing, the rest for limiting [41].

2.5. *Birth Interval in Ethiopia*

Even if the intervals between births in Ethiopia are relatively long, EDHS 2005 showed that the median birth interval is less than three years. 5.9% of women have birth interval less than 2 years which means nearly 6% of women in Ethiopia conceive with in the first 15 months after birth. The median number of months since a preceding birth increases significantly with age, from as low as 26.1 months among mothers age 15- 19 to as high as 38.8 months among mothers age 40-49 years. The median birth interval is more than eight months shorter for children whose previous sibling is dead than for children whose previous sibling is alive. The birth interval does not vary consistently by wealth quintile [12].

2.6. *Summary*

A considerable number of children die each year in the world, most of them by preventable causes. Of all deaths of children under five years, 38% occur in the neonatal period. About 99% of neonatal deaths are occurred in developing countries; developed countries contribute only 1% of neonatal deaths in the world. A number of studies in the West and Far East countries showed that too short inter pregnancy and inter birth intervals are risk factors for poor prenatal outcomes and increased risk of childhood mortality. Studies in Europe reported odds ratios ranging from 1.3-3.6 for poor prenatal outcomes and studies in the Far East reported OR/RR ranging from

1.07-3.9 for childhood mortality. Studies in developing countries based on analysis of DHS findings reported also an increased risk of childhood mortality when the interval between births is too short. However, most studies use different intervals as a reference group and the methodology used were different and therefore the reported findings are not consistent.

2.7. *Significance of the Study*

It is now 9 years since the United Nations (UN) declared the Millennium Development Goals; one of which has focused on child mortality [7]. Global reports showed that the number of childhood deaths in developing countries particularly in SSA is still unacceptably high [9]. Evidence based interventions are needed, therefore, to curb neonatal, infant and child deaths and to achieve the fourth MDG by 2015 in these countries.

A number of studies had been carried out in different countries on the effect of birth spacing on child mortality since the 1980s. Although most of these studies came up with a result that birth spacing has a significant effect on childhood mortality, the magnitude of the effect investigators identified is different for different countries, even for different regions of the same country. A WHO Technical Consultation on Birth Spacing recommended in 2005 that the minimum interval between a live birth and attempting next pregnancy should be 24 months in order to reduce adverse outcomes after reviewing some background papers [42]. It also suggested areas for future research so that a clear relation between birth spacing and childhood mortality will be identified.

Studies showed that prolonged breast feeding has a positive effect for the child, but has a depleting effect for the mother. This study, therefore will determine the relations between birth spacing and neonatal, infant and child mortality in Ethiopian context where prolonged breast feeding is almost universal.

3. Objectives

3.1. *General Objective*

To determine the childhood mortality rate and assess whether birth spacing is associated with increased risk of child mortality at a rural district.

3.2. *Specific Objectives*

- To determine the neonatal, infant, child and under five mortality rates in the study area.
- To assess the influence of inter birth intervals on neonatal and infant mortality.
- To assess the influence of inter birth intervals on children 1-4 years old mortality.
- To assess the influence of inter birth intervals on under five years mortality.

4. Methods

4.1. *Study Design*

This study was a case-control study after a census conducted to assess all under 5 deaths in the study area. It tested the null hypothesis that birth spacing has no effect on neonatal, infant and child mortality against the alternative hypothesis; too frequent or extremely long birth intervals are risk factors for child mortality at the study district. It also determined the child mortality rate at the district.

Cases: - Mothers with neonatal, infant or child deaths one year preceding to the census date.

Controls: - controls were mothers with surviving under five years child (Mothers who had under five years old child, but did not have neonatal, infant or child deaths). Except the outcome of interest (death) controls were as similar as cases.

4.2. *Study Area*

The study was carried out at Kalu district; one of the rural, densely populated districts of South Wollo Zone, Amhara National Regional State. The total population of the district was about 186,650 [43] with male to female ratio of approximately 1:1 [44]. About 16.4% of the population was expected to be children under 5 years of age. The district was organized in to 34 kebeles. The majority of the population was depending on subsistence agriculture. Most of the kebeles have an altitude of 1500-2000 meters above sea level. Amharas are the major ethnic groups living in the district with few Argobas and Oromos. The majority of the population is followers of Islamic religion. There were 7 Health Centers and 25 Health Posts in the woreda. Among the total of 7 Health Centers, 5 were found at rural areas.

4.3. *Study Population*

4.3.1. Source/study Population

- All mothers in the study area with surviving or deceased (one year preceding to the census) under five year old child or children were the source population.

- All mothers with under five deaths one year preceding to the census and corresponding controls selected randomly by sex and age group matching (for children) to cases were the study population. Deaths only in the last one year were considered in order to minimize recall bias.

4.3.2. *Exclusion and Inclusion Criteria*

4.3.2.1. *Exclusion Criteria*

The study did not include those children who were twins, accidental deaths (like child deaths due to injuries) and those who were first births.

4.3.2.2. *Inclusion Criteria*

- ✓ Mothers living in the study area who have under five years old child, but did not have neonatal, infant or child deaths and selected randomly from the original census after frequency (age group) matching for cases were included as a control group.
- ✓ All mothers involved in the study were those with non first births.
- ✓ The child under study was a singleton birth.
- ✓ Only under five deaths which occurred one year preceding to the census and were permanent residents of the study area were included as a case.

4.3.3. Sample Size

The number of cases and controls to be enrolled for the study was calculated based on the sample size formula for pair matched case control studies. We calculated the total number of cases and controls by applying the formula;

$M = m/p_{e,}$ and $p_e = (p_0q_1 + p_1q_0)$

M is the total number of pairs required

m is the number of discordant pairs

P_o is the exposure rate among controls

P_1 is the exposure rate among cases which is= $p_{oR/[1+p_{o(R-1)}]}$

R is the smallest detectable relative risk.

$q_1 = 1- p_1$

$q_0 = 1- P_0$

The average birth interval in Ethiopia is 33.5 months [12]. Taking the rareness of the outcome of interest into consideration, the rate of exposure among the controls (birth below 3 years) is expected to be close to 35%. As a result, by taking $\alpha= 0.05$ (two sided), R = 2 and $\beta= 0.20$, the minimum number of pairs required were 141 (141 cases and 141 controls). Adding 5% allowance for non response, the total number of cases required was 149 (mothers who had a child death one year preceding to the census). The expected number of controls was 149 as the case to control ratio is 1:1. The minimum sample size required was, therefore, 298 mothers.

4.3.4. Sampling Procedures

Out of the total of 34 kebeles (the smallest administrative unites in Ethiopia), only 13 were included by purposive sampling after stratification for altitude. Census was conducted by house to house visit in these kebeles to register the study population.

All mothers who had a died child one year preceding to the census and eligible for inclusion were included in the study as a case. The controls were selected randomly from the census

register after stratified for age and sex. For each case a control was selected from the same kebele where a case was identified.

4.4. *Data Collection*

4.4.1. Data Collection Tools

We prepared a structured questionnaire both for the census and data collection after cases and controls were selected (see Annex I). After cases and corresponding controls were carefully identified, we assigned well trained data collectors to collect the main data from cases and controls using a questionnaire prepared for this purpose. The questionnaire was pre-tested in the same area before the main data collection process was commenced. We did not include mothers who were participating during the pre-test for the main study. High school graduated data collectors were used for data collection from study participants. Two health officers, from the district health office, and the principal investigator were closely supervising data collectors during data collection.

4.4.2. Data Collection Procedure

Census was carried out to register all neonatal, infant and child deaths and corresponding matched alive children as there was no vital events registration system in the study area. All households in 13 kebeles in which a child or children under five years of age were found were listed. On top of that the name of the child, age, area of residence whether he or she is a singleton birth and sex were recorded in a separate register prepared for this particular purpose. The mother's parity was also recorded in order to know whether there was a preceding child before birth of the index child. All under five years of age deaths one year preceding to the census were recorded, including age at death, sex and place of residence. This data was used to select cases and controls in the study area stratified by age of death (neonate, infant, child and generally under five) and sex.

Then after, using a pretested questionnaire, all information needed was collected on controls and cases by interviewing mothers.

4.4.3. Study Variables

The primary outcome variables were neonatal, infant and child deaths. Neonatal deaths include all deaths from birth up to 28 days. Infant deaths include all deaths before celebration of the first birth year. Child deaths are all deaths from one year to four years and under five deaths are all deaths with in the first five years from birth.

The main explanatory variables were inter-outcome interval (the time period between date of outcome of index pregnancy and date of outcome of preceding pregnancy even if one or both of these pregnancies had a non-live-birth outcome) and inter-birth interval (the time period between birth date of index child and birth date of preceding live birth). Inter-pregnancy interval (the time period between conception of the index pregnancy and outcome of preceding pregnancy) was not considered here because most women may not accurately recall their last menstrual period (LMP). Instead, the interval between the birth or outcome of the preceding pregnancy and the index child was considered. All explanatory variables were categorical variables and measurement was at ordinal level of measurement. In order to control for confounding, data were collected on variables related to socio-demographic characteristics, household characteristics, maternal reproductive history and child characteristics.

4.4.4. Data quality Assurance

We had taken several data quality measures to keep the validity of the study optimal. The data collection instrument, in this case the questionnaire, was pre-tested in the study area without involving the study subjects.

We gave training for every data collector for a day. The data collection process was closely monitored by supervisors and the principal investigator. Supervisors were checking every questionnaire meticulously so that all incomplete forms were identified while they were at the field. As a result errors were corrected and no forms lost.

4.5. *Data Processing and Analysis*

Data was entered and cleaned in SPSS version 16 computer software and exported to Epi Info for windows version 3.5.1 for bi-variate and multivariate analysis. Birth intervals were grouped as less than 15 months, 15-23 months, 24-35 months, 36-47 months and 48 months or above. First, frequency tabulation was conducted to describe the data used in the study followed by a contingency table analysis to examine the impact of spacing on neonatal, post neonatal and child mortality without adjusting for other covariates. Death rates were calculated per 1000 live births in all cases.

Potential interactions among exposure variables i.e. different birth intervals and other risk factors were assessed. Conditional logistic regression was performed, then after, to identify whether birth spacing is the significant independent determinant of children under five years mortality. A conceptual framework describing the hierarchical relationships between risk factors was developed in order to identify all distal and proximal determinates (see Fig.1). Hence, all variables which are considered to be confounders or effect modifiers and with p- value less than or equal to 0.25 during bivariate analysis were included in the logistic regression model. Sex and age are not affected by economic and environmental variables. However, we included these variables under maternal characteristics in the conceptual framework for ease of analysis.

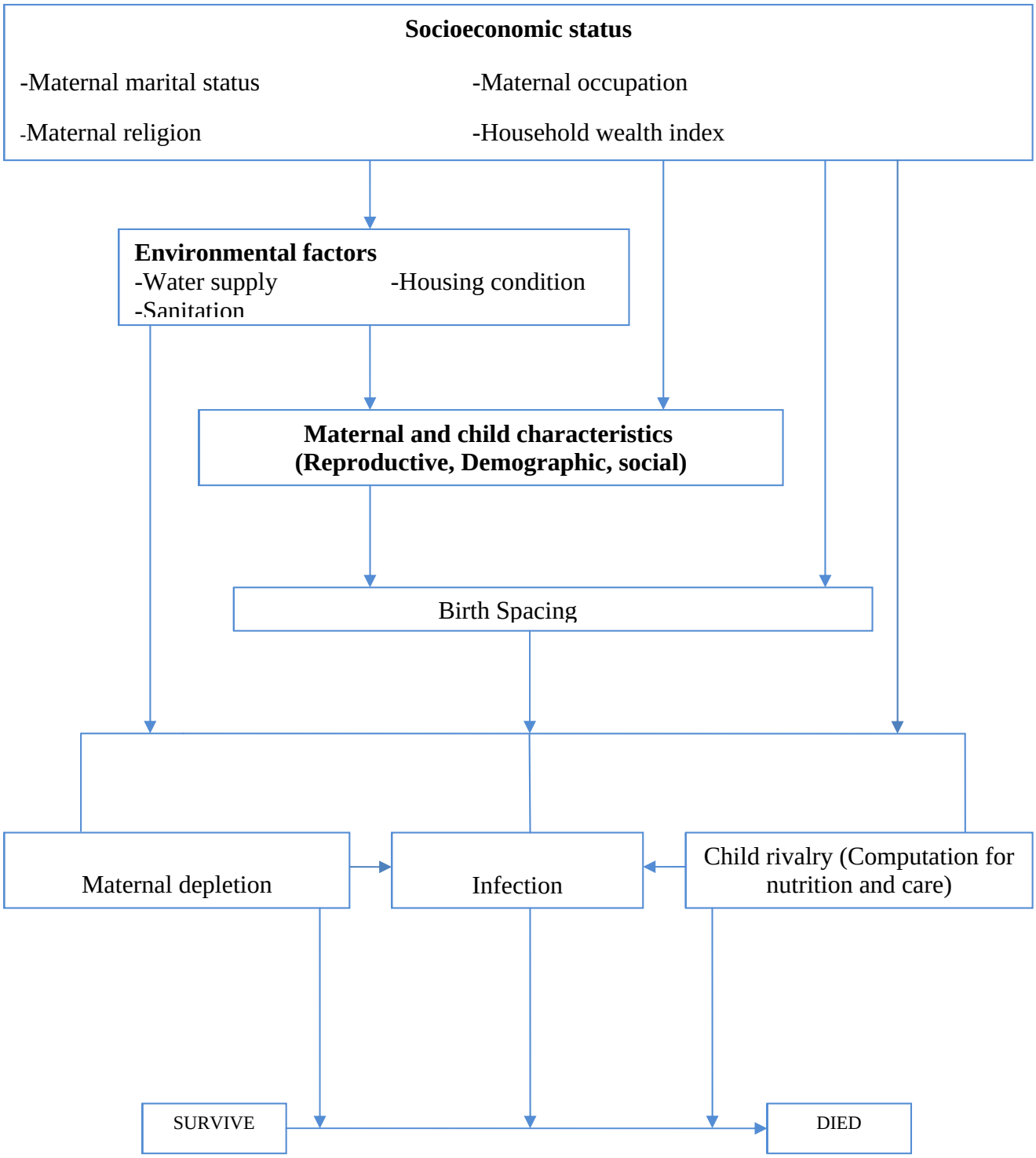


Fig. 1: Conceptual hierarchical framework of risk factors for child mortality in relation to birth spacing.

To measure the magnitude and significance of the association of child mortality across different birth intervals, odds ratios and chi-square for trend were used respectively. Ninety five percent confidence intervals (CIs) were also used to test the significance of the association after bi-variate and multivariate analysis.

4.6. *Ethical Considerations*

Ethical clearance was obtained from Addis Ababa University, the institutional review board (IRB) before the start of field work. Official letter of co-operation was written to Kalu District Administration and Health Office from AAU/MF, School of Public Health. On top of that, all individuals interviewed were requested for verbal consent. Respondents were clearly told about the study and the variety of information needed from them.

Data collectors were trained to provide necessary health education to the respondents about fertility control and its importance after completing the data collection procedure.

4.7. *Dissemination Plan*

The final report of this research will be presented and submitted to School of Public Health,

Addis Ababa University, as partial fulfillment of MPH degree in Epidemiology. The summary of the final report will be submitted to Kalu District Health Office and South Wollo Administrative Zone Health Department and other stake holders who have a keen interest on the subject matter. Organizations that sponsored this research will also get the final report. The result will also be presented at annual conferences of professional associations.

5. Result

5.1. Description of the Study Subjects

5.1.1 The Rate of Child Mortality

We included 11 kebeles in low lands and 2 kebeles in high lands for this study. A total of 173 under 5 deaths were identified. Only 151 deaths were included for this study. The rest 22 deaths were either first births or twines.

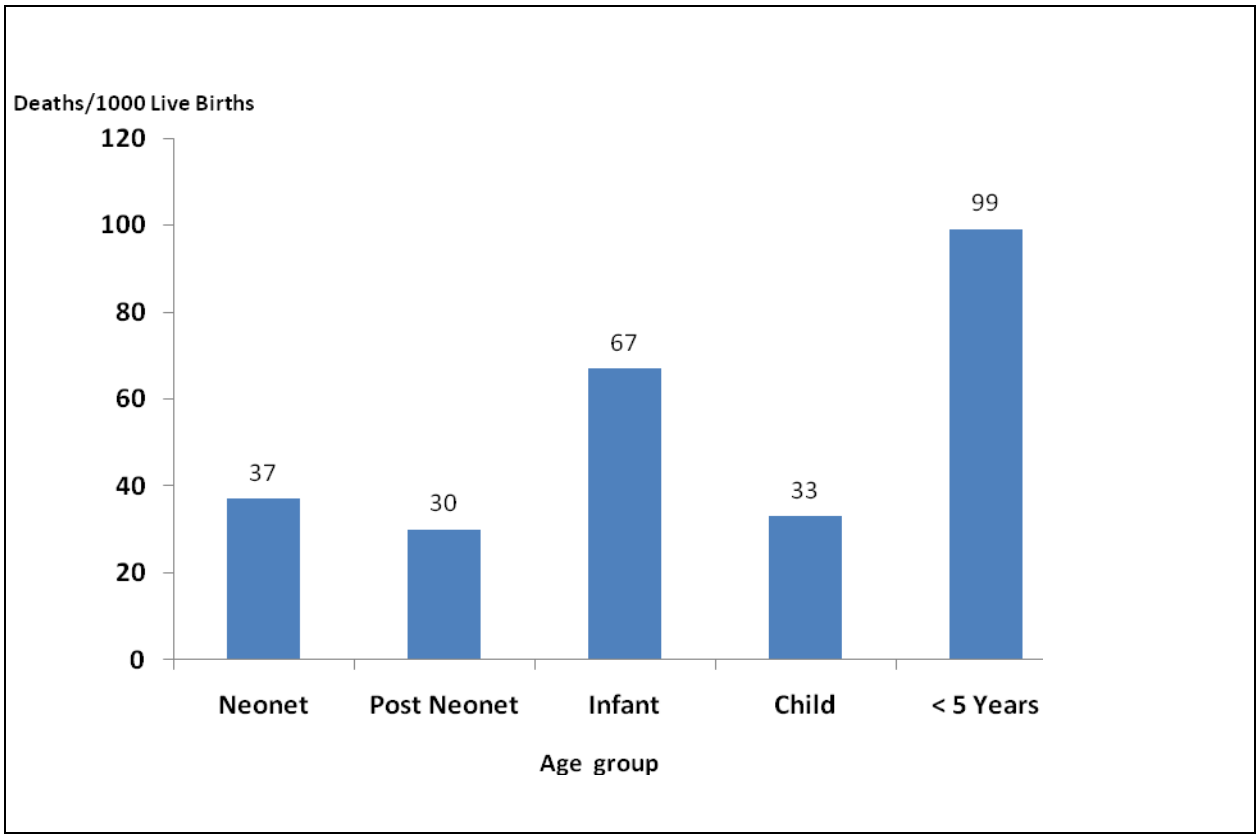
A total of 8229 children undr 5 years of age identified during the census. As shown in Table 1, the under 5 mortality rate was 99.6/1000 live births ranging from 64.1/1000 live births at Gerba to 131.1/1000 live births at Adamie. The total number of live births one year preceding to the census date was 1737.

Table 1: Description of the study subjects from the census; Kalu district February 2009

Kebele	Total number of children <5 years of age	Total number of < 5 deaths in a year	Total number of live births in a year	Under 5 death rate
Tekakie	445	10	96	104.2
Miawa	420	8	87	91.9
Woraba	609	12	138	86.9
Metenie	718	21	191	109.9
Adamie	775	24	183	131.1
Ketetia	719	18	142	126.8
Wodajo	754	17	161	105.6
Abicho	699	13	133	97.7
Gerba	417	5	78	64.1
Harbu	908	16	212	75.5
Bekie	681	11	118	93.2
Ancharo	412	7	72	97.2
Bosena	672	11	126	87.3
Total	**8229**	**173**	**1737**	**99.6**

As shown in Figure 2, the neonatal, post neonatal, infant, child and under 5 mortality rates were 37, 30, 67, 33 and 99/1000 live births respectively.

Fig. 2: Child Mortality Rates at Kalu district one year preceding to the house to house census, February 2009



5.1.2. Demographic and Socio Economic Characteristics of study subjects

The median birth interval in the study area was 31.4 months. As shown in Table 2, about 24% of mothers with age group 20-34 years had birth interval 48 months or more while only 8.0% had interval below 15 months. Similarly, about 22% of mothers with age 35 years or more had birth interval 48 months or more while 7.9% of them had birth interval less than 15 months. It was also found that 33% of mothers with age 20-34 years and 31.6% of mothers with age 35 years or more had birth interval 24-35 months. All mothers with age 19 years or less had birth interval 48 months or more. However, the absolute number of births were very low (only two) for this age group.

Cross tabulation for birth order showed that 3.1% of mothers who have second order births had birth interval below 15 months while 11.4% of mothers who have birth order 5 or more gave birth with interval between births of 15 months or less. Close to 34% of mothers with birth order 2 had birth interval 48 or more months while 16.4% of mother with birth order 5 or more had birth interval 48 or more months. Near to 34% of mothers who were in the second birth order, 43.3% of mothers who were in fourth birth order, 36.8% of mothers in the fourth birth order and 26.4% of mothers with birth order 5 or more had birth interval 24-35 months.

Coming to wealth quintiles, 16.7% of mothers who were in the lowest wealth quintile and 25% of mothers who were in the highest wealth quintile had birth interval 48 or more months. Near to 48% of mothers in the lowest wealth quintile and 25% of mothers in the highest wealth quintile had birth interval from 24-35 months. Cross tabulation for maternal educational status and birth interval showed that 22.8% of mothers who had no any type of education and 22.7% of mothers who had formal education had birth interval 48 or more months. Close to 8% of illiterate mothers, 7.7% of mothers who can read and write and 9.1% of mothers who had formal education had birth interval 15 months or less.

Table 2: Percent distribution of non-first births by number of months since preceding birth, according to some background characteristics; Kalu district 2009.

Background Characteristic	No. of Births*	Interval between Births in months					Median interval
		Below 15	15-23	24-35	36-47	48 or more	
maternal age group							
19 years or less	2	0	0	0	0	100.0	17.5
20-34 years	224	8.0	8.5	33.5	26.3	23.7	32.0
35 years or more	76	7.9	21.1	31.6	17.1	22.4	29.0
Birth Order							
2nd	64	3.1	10.9	34.4	17.2	34.4	36.7
3rd	60	8.3	1.7	43.3	23.3	23.3	31.4
4th	38	2.6	10.5	36.8	15.8	34.2	36.0
5th or more	140	11.4	16.4	26.4	29.3	16.4	30.8
Wealth Quintile							
1st	54	11.1	7.4	40.7	24.1	16.7	30.2
2nd	63	7.9	15.9	34.9	20.6	20.6	30.0
3rd	58	6.9	8.6	36.2	27.6	20.7	31.6
4th	67	4.5	11.9	28.4	20.9	34.3	38.0
5th	60	10.0	13.3	25.0	26.7	25.0	39.0
Maternal Education							
Illiterate	190	7.8	14.0	31.6	23.8	22.8	31.1
Only Read and write	82	7.7	9.2	43.1	12.3	27.7	30.1
Has formal Education	22	9.1	4.5	22.7	40.9	22.7	38.7
Total	302	7.9	11.6	32.8	23.8	23.8	31.4

*Non first births

As shown in Table 3, description of cases and controls by demographic and socioeconomic characteristics showed that 103 (68.2%) of mothers for cases and 121 (80.1%) mothers for controls were 20-34 years old at the time of birth of the child. Only 1 (0.7%) of cases and 1

(0.7%) of controls were with maternal age less than 20 years. The rest (47 cases and 29 controls) were 35 or more years of age. The mean maternal age was 30.4 ± 6.2, ranging from18 to 45 years for cases and 28.7 ± 5.7, ranging from 18 to 40 years for controls.

About 148 (98.7%) of cases and 146 (96.7 %) of controls were Amhara by ethnicity. The majority of cases and controls were unemployed. Only 3 (2%) of cases and 2 (1.3 %) of controls were employed. Concerning marital status of the mothers, 142 (94%) of cases and 145 (96%) of controls were married. Coming to the educational status of mothers, 118 (78.1%) of cases and 75 (49.7%) of controls were illiterate, 17 (11.3%) of cases and 48 (31.8%) of controls can read and write and 60 (10.6%) of cases and 28 (18.5%) of controls had either primary or secondary education. Analysis for paternal education showed that 98 (64.9%) of cases and 92 (60.9%) of controls were illiterate, 35 (23.2%) of cases and 47 (31.1%) of controls were only read and write and 12 (8%) of cases and 10 (6.6%) of controls had formal education.

A total of 19 (12.6%) cases and 41 (27.2%) controls were found in the highest wealth quintile. More controls 32 (21.2%) than cases 26 (17.2) were found in the third wealth quintile and, on the contrary, more cases 35 (23.2%) than controls 32 (21.2%) were found in the fourth wealth quintile. A considerable number of cases 71 (47.0%) were found in the lowest and second wealth quintiles and relatively higher number of controls 73 (48.3%) were found in the fourth and fifth wealth quintiles.

Table 3: Description of the study subjects by maternal and paternal demographic and socio economic status, Kalu district, February 2009

Maternal characteristics/ Socio Economic status	Cases (N=151)		Controls (N=151)	
	Number	%	Number	%
Maternal age during child birth				
< 20 years	1	0.7	1	0.7
20 – 34	103	68.2	121	80.1
35 and over	47	31.1	29	19.2
Ethnicity of Mother				
Amhara	149	98.7	146	96.7
Other	2	1.3	5	3.3
Maternal Occupation				
Employed	3	2.0	2	1.3
Not Employed	148	98.0	149	98.3
Maternal Marital Status				
Married	142	94.0	145	96.0
Single	9	6.0	6	4.0
Maternal Education				
Illiterate	118	78.1	75	49.7
Only Read and Write	17	11.3	48	31.8
Formal Education	16	10.6	28	18.5
Wealth Index(Wealth Quintiles)				
1st Quintile	32	21.2	22	14.6
2nd Quintile	39	25.8	24	15.9
3rd Quintile	26	17.2	32	21.2
4th Quintile	35	23.2	32	21.2
5th Quintile	19	12.6	41	27.2
Paternal Education				
Illiterate	98	64.9	92	60.9
Only Read and Write	35	23.2	47	31.1
Formal Education	12	8.0	10	6.6

5.1.3. Description of the Study Subjects by Past Obstetrics and Gynecological History.

As shown in Table 4, 18 (11.9%) of cases and 6 (4%) of controls had birth interval less than 15 months, 21 (13.9%) of cases and 14 (9.3%) of controls had birth interval 15-23 months, 51 (33.8%) of cases and 48 (31.8%) of controls had birth interval 24-35 months and 24 (15.9%) of cases and 48 (31.8%) of controls have birth interval 48 or more months.

Coming to birth order, 28 (18.5%) of cases and 36 (23.8%) of controls had birth order two, 34 (22.5%) of cases and 26 (17.2%) of controls had birth order three, 11 (7.3%) of cases and 27 (17.9%) of controls had birth order four and 78 (51.7%) of cases and 62 (41.1%) of controls have birth order five or more. The mean birth order was 4 ± 2.5, ranging from 2 to 9 for cases and 3 ± 1.9, ranging from 2 to 9 for controls.

Only 1 (0.7%) of cases and 2 (1.3%) of controls are attended by health extension worker while giving birth. The majority 126 (83.4%) of cases and 114 (75.5%) of controls gave birth with the assistance of a family member. Only 4 (2.6%) of controls gave birth at a health facility where as 17 (11.3%) of cases gave birth at a health centre or hospital.

Eighty nine (58.9%) of cases had antenatal (ANC) follow up while 122 (80.8%) of controls had ANC follow up. The numbers of cases who have post natal follow up were not considerably different from the number of controls who have post natal follow up. In both cases, we found that the number of women who have postnatal follow up were extremely low.

It was also found that close to 83% of deaths (cases) and 82% of alive children (controls) were primarily planed while only about 2% of cases and controls were unwanted.

Table 4: Description of the study subjects by past obstetrics and gynecological history of the mother, Kalu district February 2009

Obstetrics and Gynecologic History	Cases (N=151)		Controls (N=151)	
	Number	%	Number	%
Birth Order				
2nd	28	18.5	36	23.8
3rd	34	22.5	26	17.2
4th	11	7.3	27	17.9
5th and above	78	51.7	62	41.1
Birth Interval				
Less than 15 months	18	11.9	6	4.0
15-23 months	21	13.9	14	9.3
24-35 months	51	33.8	48	31.8
36-47 months	37	24.5	35	23.2
48 or more months	24	15.9	48	31.8
Place of Delivery				
Home	134	88.7	147	97.4
Health Institution	17	11.3	4	2.6
Attendant at Time of Delivery				
Health worker	16	10.6	4	2.6
Health Extension Worker	1	0.7	2	1.3
Trained or Untrained TBA	8	5.3	31	20.5
Relatives	126	83.4	114	75.5
Had ANC Follow up?				
Yes	89	58.9	122	80.8
No	62	41.1	29	19.2
Had Post Natal Follow up?				
Yes	3	2.0	2	1.3
No	148	98.0	148	98.0
Desire for Pregnancy (wanted?)				
Wanted then	126	83.4	124	82.1
Wanted Later	21	13.9	24	15.9
No more Wanted	4	2.6	3	2.0

5.1.4. Household Characteristics of the Study Subjects

Table 5 shows that the numbers of households with latrine are notably different for cases and controls. Seventy seven (51%) of cases were used to any type of latrine, where as 103 (68.2%) of controls were using latrine instead of open field defecation. About 53 (35%) of cases and 60 (39%) of controls were using pipe water for drinking, while 46 (30%) of cases and 35 (23.2%)

controls depend on unprotected surface water. It was also found that 62 (41.1%) of cases and 63 (41.7%) of controls were living in the house with thatched roof while 89 (58.9%) of cases and 88 (58.3%) of controls were living in the house with a roof made from corrugated iron sheets.

Coming to availability of windows, 68 (45.0%) of cases and 78 (51.7%) of controls were living in the house with windows and 83 (55.0%) of cases and 73 (48.3%) of controls were living in a house without windows. It was also found that 131 (86.8%) of cases and 142 (94.04%) of controls were living in a house that have enough light while 20 (13.2%) of cases and 9 (5.96%) of controls were living in the house that do not have enough light.

Respondents were asked if they have a separate kitchen for cooking. It was found that 66 (43.7%) of cases and 75 (49.7%) of controls had a separate kitchen for cooking and 85 (56.3%) of cases and 76 (50.3%) of controls did not have a separate kitchen. One hundred thirty nine (92.1%) of cases and 143 (94.7%) of controls used ITNs during the night.

Table 5: Household characteristics of the study subjects; Kalu district February 2009

Household characteristics	Cases (N=151)		Controls (N=151)	
	Number	%	Number	%
Availability of Latrine				
Available	77	51.0	103	68.2
Open Field	74	49.0	48	31.8
Water Source				
Piped	53	35.1	60	39.7
Protected well or Borehole	52	34.4	56	37.1
Surface Water (unprotected)	46	30.5	35	23.2
Roof Type				
Thatched	62	41.1	63	41.7
Corrugated Iron sheets	89	58.9	88	58.3
Availability of Window				
Available, with Screen or glass	4	2.7	7	4.7
Available without Screen or glass	64	42.4	71	47.0
Housing without window	83	55.0	73	48.3
Separate Kitchen?				
Yes/Available	66	43.7	75	49.7
No/Not Available	85	56.3	76	50.3
ITNs Availability and Use				
Available and children use it	139	92.1	143	94.7
Not available	12	7.9	8	5.3
Does the House have Enough light?				
Yes	131	86.8	142	94.04
No	20	13.2	9	5.96

5.2. The Effect of Birth Spacing on Neonatal, Infant and Child Mortality

5.2.1. Results for the Bi-variate Analysis of the Study Population

As shown in Table 6, the odds of under five years mortality significantly declined as the interval between births increase from OR = 5.66 (95% CI = 1.96, 16.20) when the interval between births is below 15 months to 2.87 (95% CI=1.25, 6.64), 2.26 (95% CI 1.13, 4.49), 2.25 (95% CI=1.13, 4.49) when the interval is 15-23, 24-35 and 36-47 months respectively compared to birth intervals 48 months or more (X^2 for linear trend = 13.67, P=0.0002).

Bi-variate analysis also showed that children under five years mortality was associated with availability of latrine (OR=2.06 95% CI=1.26, 3.39). However, source of drinking water was

not significantly associated with under 5 years mortality. Compared to households who were depend on piped water for drinking, the odds of under five mortality was 1.05 (95% CI = 0.60, 1.85) when the source of drinking water is bore hole or well and 1.46 (95% CI = 0.81, 2.75) when the source is surface water.

The odds of under five years mortality was 1.90 (95% CI=1.08, 3.36) when maternal age is 35 years or above and 1.17 (95% CI = 0.02, 92.97) when maternal age is 19 years or below. Analysis for wealth quintiles showed that the odds of under five years mortality was 3.14 (95% CI = 1.36, 7.31), 3.51 (95% CI = 1.56, 7.94), 1.75 (95% CI = 0.77, 3.99) and 2.36 (95% CI = 1.08, 5.21) for the lowest, the second, the middle and the fourth wealth quintiles respectively compared to households in the highest wealth quintile.

Bi-variate analysis also showed that the odds of under five years death was 2.93 (95% CI=1.69, 5.09) for those who have no ANC follow up compared to mothers who have at least one ANC follow up and the odds of death was 2.75 (95% CI=1.33, 5.74) when the mother has no education compared to mothers who have formal education. Compared to second order births the odds of under five years mortality was 1.68 (95% CI = 0.78, 3.65), 0.52 (95% CI = 0.20, 1.34) and 1.62 (95% CI = 0.85, 3.07) with birth order three, four, five or more respectively.

Table 6: Selected child, maternal, pre-delivery, delivery, post-delivery and environmental factors associated with children under five years mortality; Kalu district February 2009.

Exposure Variables	OR (95% CI) for risk of under 5 mortality	X^2 for linear trend (p value)
Birth Interval		
<15 Months	5.66 (1.97, 16.20)	
15-23 Months	2.87 (1.25, 6.64)	
24-35 Months	2.26 (1.13, 4.49)	13.67 (0.0002)
36-47 months	2.25 (1.13, 4.49)	
48 and above	1.00	
Birth Order		
2nd	1.00	
3rd	1.68 (0.78, 3.65)	
4th	0.52 (0.20, 1.34)	2.36 (0.1244)
5th or more	1.62 (0.85, 3.07)	
Availability of latrine		
Available	1.00	
Not Available	2.06 (1.26, 3.39)	
Source of drinking water		
Piped	1.00	
Bore hole or well	1.05 (0.60, 1.85)	
Surface water	1.46 (0.81, 2.75)	
Roof type		
thatched	0.97 (0.60, 1.58)	
Corrugated Iron	1.00	
Maternal Age		
<20 years	1.17 (0.02, 92.97)	
20-34 years	1.00	5.394 (0.0202)
35 years and above	1.90 (1.08, 3.36)	
Wealth Index		
1st Quintile	3.14 (1.36, 7.31)	
2nd Quintile	3.51 (1.56, 7.94)	
3rd Quintile	1.75 (0.77, 3.99)	9.838 (0.0017)
4th Quintile	2.36 (1.08, 5.21)	
5th Quintile	1.00	
Maternal Education		
Elementary	1.00	
Only read and write	0.62 (0.25, 1.53)	10.786 (0.001)
Illiterate	2.75 (1.33, 5.74)	
Separate Kitchen?		
Yes/Available	1.00	
No/Not Available	1.27 (0.81, 2.00)	
History of ANC Follow up		
Yes	1.00	
No	2.93 (1.69, 5.09)	

5.2.2. Age Group Stratified Analysis of the Study Population.

We carried out age group stratified analysis to control age related confounders and to check for interactions. Primarily data was collected after frequency (age group) matching of the study subjects. As shown in Table 7, there is a decline in the trend of mortality as the interval between births increases in the case of neonates (X^2 for trend = 13.23, P = 0.0003), post neonates (X^2 for trend = 4.62, P = 0.03) and infants (X^2 for trend = 17.06, P = 0.0001). However, it was found that risk of child (1-4 years) mortality did not show a decline trend with birth spacing (X^2 for trend = 0.33, P = 0.57). The odds of neonatal mortality with birth interval less than 15 months was 33. (95% CI=3.18, 149.08) compared to neonates with birth interval 48 months or more.

The odds of infant mortality was nearly 12 times higher when the interval between births was below 15 months (95% CI = 2.53, 74.63) and 3.77 times higher when the interval between births was 15-23 months (95% CI=1.23, 11.78) compared to infants with birth interval 48 months or more. The association was not statistically significant when the intervals between births are 24 or more months (see Table 7).

Table 7: Age group stratified analysis of under five years mortality by birth interval; Kalu district February 2009

Birth Interval	OR(95% CI)	Chi Square for linear trend (P-Value)
Neonates		
<15 months	33.00(3.18-149.08)	
15-23 Months	3.00(0.65-14.53)	13.23 (0.0003)
24-35 Months	3.55(0.90-14.64)	
36-47 Months	1.64(0.35-7.85)	
48 or more months	1.00	
Post Neonates		
<15 months	4.69(0.57-56.69)	
15-23 Months	7.50(1.05-83.46)	4.615 (0.0317)
24-35 Months	1.66(0.53-5.25)	
36-47 Months	2.06(0.52-8.34)	
48 or more months	1.00	
Children (1-4 Years)		
<15 months	1.00(0.07-10.47)	
15-23 Months	1.88(0.31-11.81)	0.326 (0.5683)
24-35 Months	2.05(0.58-7.31)	
36-47 Months	2.14(0.66-7.06)	
48 or more months	1.00	
Infants		
<15 months	12.57 (2.53-74.63)	
15-23 Months	3.77 (1.23-11.78)	17.06 (0.0001)
24-35 Months	2.29 (0.99-5.37)	
36-47 Months	1.91 (0.71-5.15)	
48 or more months	1.00	

As shown in Table 7, spacing between births and risk of under five years mortality is most pronounced when the interval is below 15 months. Cognizant of this, we regrouped birth intervals into two groups to point out the magnitude of the relation when the interval is below 15 months and 15 or more months. The result after regrouping is shown in Table 8. The odds of death for neonates with birth interval less than 15 months was nearly 15 times higher compared to those neonates with birth interval 15 months or more (OR = 15.60, 95% CI = 2.49, 70.98).

The relation between mortality and spacing between births was not still statistically significant for post neonates (OR = 2.6, 95% CI = 0.46, 20.32) and children 1-4 years old (OR = 0.59, 95% CI = 0.07, 4.13).

Table 8: Age group Stratified Analysis of under five years mortality with birth interval less than 15 months and 15 or more months; Kalu District February 2009.

Birth Interval	OR	P-Value
Neonates		
Less than15 Months	15.60 (2.49, 70.98)	0.001
15 Months and Above	1.00	
Post Neonates		
Less than15 Months	2.60 (0.49, 20.32)	0.219
15 Months and Above	1.00	
Children (1-4 Years)		
Less than15 Months	0.59 (0.07, 4.13)	0.452
15 Months and Above	1.00	
Infants		
Less than15 Months	6.44 (1.96, 28.51)	0.001
15 Months and Above	1.00	

We derived the pooled OR by applying the Mantle Hansel method. The overall odds of death for those children under 5 years of age with birth interval less than 15 months was 3.23 (95% CI = 1.28, 8.16) compared to those with birth interval 15 or more months after adjusting for age group. However, the Woolf test for heterogeneity showed that the differing odds ratios across different age groups were not because of chance variation rather it was because of interaction (effect modification) ($X^2 = 4.47$, P = 0.035). Therefore, the adjusted odds ratio does not reflect what is really happening. Our result showed that the odds of neonatal mortality was 15.00 (95% CI = 2.49, 353.98) times higher when the interval between births was less than 15 months and

the odds of infant mortality was nearly 6.00 (95% CI = 1.96, 28.51) times higher when the interval between births was less than 15 months. There was no statistically significant association between birth spacing and risk of child (1-4 years) mortality (OR = 0.59, 95% CI = 0.07, 4.13).

5.2.3. Results of Multivariate Analysis of the Study Population

We carried out conditional logistic regression to determine the independent effect of birth spacing on children under five years mortality after controlling for age group. We developed 3 models based on a conceptual framework describing the hierarchical relationships between risk factors to derive the adjusted odds ratio.

Primarily, we adjusted for wealth index and socio demographic variables and we found a significant decline in the trend of under five years mortality with increase in the interval between births. The odds of under five years mortality was 5.57 (95% CI = 1.68, 18.44), 3.44 (95% CI = 1.40, 8.45), 2.57 (95% CI = 1.20, 5.53) and 2.52 (95% CI = 1.19, 5.31) when the interval between births is less than 15, 15-23, 24-35 and 36- 47 months respectively compared to the interval 48 months or more.

Including environmental characteristics to the model showed that birth spacing had still an effect on children under five years mortality. The odds of under five years mortality was 5.51 (95% CI = 1.38, 9.15) when the interval between births is less than 15 months, 3.55 (95% CI = 1.38, 9.15) when the interval is 15-23 months, 2.69 (95 % CI = 1.19, 6.06) when the interval is 24-35 months and 2.86 (95% CI=1.28-6.39) when the interval is 36-47 months compared to the interval 48 months or more.

As shown in Table 9, the declining trend of under five years mortality persists even after adding maternal reproductive and socio demographic variables to the model. The odds of under five years mortality was 6.45 (95% CI = 1.53, 27.15), 3.20 (95% CI = 1.07, 9.57), 3.21 (95% CI = 1.18, 8.77) and 2.61 (95% CI = 0.97-7.01) when the interval between births is less than 15, 15-23, 24-35 and 36-47 months respectively compared to birth interval 48 months or more.

Table 9: Adjusted odds ratios and corresponding CIs for risk of children under five years mortality in relation to birth spacing.

Birth Interval	Adjusted for wealth Index	Adjusted for wealth index and environmental characteristics	Adjusted for wealth Index, maternal and environmental characteristics
	OR(95% CI)	OR(95% CI)	OR(95% CI)
<15 months	5.57 (1.68, 18.44)	5.51 (1.56, 19.52)	6.45 (1.53, 27.15)
15-23 Months	3.44 (1.40, 8.45)	3.55 (1.38, 9.15)	3.20 (1.07, 9.57)
24-35 Months	2.57 (1.20, 5.53)	2.69 (1.19, 6.09)	3.21 (1.18, 8.77)
36-47 Months	2.52 (1.19, 5.31)	2.86 (1.28, 6.39)	2.61 (0.97, 7.01)
48 or more months	1.00	1.00	1.00

6. Discussion

This study assessed the magnitude of neonatal, infant, child and children under five years mortality and its association to birth spacing. It was also tried to point out the median birth interval at the study area. Thirteen rural kebeles were included for the study; all but two have an altitude of 2000 meters or less above sea level.

Description of the study subjects from the census showed that the under five years mortality rates considerably varied from kebele to kebele. It showed that the under 5 mortality rate at Adamie is almost double to that of the mortality rate at Gerba. This may be due to the fact that Adamie is found very far from the main road and geographical access to health services is very limited while Gerba is a semi urban area with relatively better public services.

The neonatal, infant, child and under 5 years mortality were found to be 37, 67, 33 and 99/1000 live births respectively. This showed that the child mortality rates at this district were very much lower than the national finding in 2005 [12]. The study covers a very small area and may not be comparable to the EDHS data which covered all regions in the country. However, since the last few years, mortality due to malaria is considerably dropped [46] and therefore, the observed relatively low infant, child and under five mortality rates may be due to the fact that mortality due to malaria and vaccine preventable disease has substantially dropped and contributed to this finding. But this difference was no observed for the neonatal mortality rate.

A retrospective cohort study in Butajira in 2006 showed that the neonatal, post neonatal, infant and under five years mortality rates were 64, 60, 124 and 174/1000 live births respectively [38] which were again very much higher than the findings in our study. Studies showed that

infectious diseases like malaria are among the leading causes of child (1-4 years) death [16]. This supports the above notion that reduction in the burden of malaria may be contributed to the current relatively low rate of child mortality at Kalu district in which the majority of study kebeles are endemic for malaria.

Description of study subjects by demographic and socio economic status showed that a noticeable number of cases than controls were illiterate (did not have either formal or informal education). EDHS 2005 indicated that the rate of under fives mortality among children born to mothers with no education was 139/1000 live births while the rate is 54/1000 live births for children born to mothers with secondary and higher level of education [12]. We also found that a considerable number cases than controls were found in the lowest wealth quintile and vice versa. Analysis of DHS surveys in five countries carried out from 1992 – 1998 showed that the number of child deaths were almost a three to one ratio between the lowest and highest quintiles [47]. However, the relation between child mortality and wealth does not seem consistent across different wealth quintiles in our case. This is also in line with the finding from EDHS 2005 [12]. In our study, more controls than cases were found in the third wealth quintile and, on the contrary, more cases than controls were found in the fourth wealth quintile.

The numbers of cases with birth order five or more was also higher than the number of controls with birth order five or more. Among the total study subjects, nearly 47% had birth order 5 or more. This is in line with a study in Butajira in 2006 at which 46.3% of births were fifth or higher order births [38].The mean birth order was 4 ± 2.5, ranging from 2 to 9 for cases and 3 ± 1.9, ranging from 2 to 9 for controls. EDHS 2005 showed that childhood mortality is higher when birth order is seven or more [12].

Our result showed that as maternal age increases, the percent distribution of the interval between births increases, but as birth order increases the change in percent distribution of birth intervals are not consistent. Similarly, the percent distribution of birth intervals did not show a considerable difference among illiterates and those who had informal education. Unlike our result, EDHS 2005 found that as maternal age increases, the interval between births decreases. Similar to our study, however, EDHS reported that there is no a considerable difference in the percent distribution of birth intervals as birth order increases. It also showed that mothers with secondary or higher education have a very long birth interval [12].

Description of the study subjects by household characteristics indicated that 51% of cases and close to 68% of controls have a latrine, 35.1% of cases and 39.7% of controls have piped water and close to 41% of cases and 42% of controls were living in a house made from corrugated iron sheets. These are very much higher than the findings from a study in Butajira in 2006 [38].

Age group stratified analysis has shown a decline in the trend of mortality with an increase in the interval between births from less than 15 months to 48 or more months for neonates, post neonates and infants. The risk of child mortality did not show any trend with an increase in the interval between births. A study in Bangladesh showed that the neonatal and post neonatal mortality declines as the interval between pregnancies increase up to 60 months which is in line with our result. Unlike our finding, however, the finding of this study indicated a downward trend for child mortality as well [1].

A study based on analysis of DHS data from 17 developing countries found a significant association between childhood mortality and birth intervals. This study indicated that the risk of neonatal and infant mortality decreases with increasing birth interval lengths up to 36 months at which point the risk plateaus. However, unlike our finding, a significant association was also

observed between child (1-4 years) mortality and birth spacing even for intervals of 48 months or more [2].

Stratified analysis indicated that the risk of neonatal mortality was not significantly associated with birth spacing when the interval between births is 15 months or more. Although frequency matching was used during data collection, it should be noted that our sample size calculation was not based on sample size calculations for stratified (frequency matching) case control studies. This was occurred by the fact that, the number of child deaths in the study area one year preceding to the study was not as high as we expected. We failed to get adequate sample sizes for each specific age group. As a result, we calculated sample size for the general under fives mortality matched for sex. Therefore, the insignificant association we found for neonates with birth intervals 15 months or more and the totally non significant associations between child (1-4 years) mortality and birth spacing might be due to low power of the study.

Despite overlapping confidence intervals, interaction among different age groups is very likely in our study. Here, the range of associations is wide enough, and odds ratios are different among different age groups. This is possibly because of interaction (effect modification). The Woolf test for heterogeneity also showed that the odds ratios across different age groups are not homogonous ($X^2 = 4.47$, $P = 0.035$).

The magnitude of point estimates (ORs) for neonatal, infant and under fives mortality in our study is higher than studies done in different countries [1, 2, 5, 29, 39]. However, the confidence intervals for the odds ratios for each age group in this study were very wide which strengthens our notion on inadequateness of the sample size for stratified analysis. In addition to

this, some of these findings may be due to residual confounding, i.e. to factors not included in the analysis (such as breast feeding status of the preceding child and the index child).

A study done in Senegal pointed out that the odds of dying in the neonatal and post-neonatal period is 2.27 and 2.12 times higher respectively for children born after preceding birth intervals of one year or less compared to children born after longer intervals [32]. The odds of neonatal death were very much lower than the odds of death we had found even though the interval investigators choose was lower than that of ours.

Unlike our finding, a study in Bangladesh showed that birth spacing has no effect on neonatal mortality. The study found that a preceding birth interval of less than 15 months was associated with a greater mortality risk in the post-neonatal period for children with an older sibling who survived infancy [36]. This supports the sibling competition and the increased likelihood of infection hypotheses [48].

Another study in Bangladesh found that in the first week of the child's life, the effects of short intervals are greater if the sibling born at the beginning of the interval died; after the first month, the effects are greater if that sibling was still alive [29]. This was in line with the hypothesis that 'computation for parental time or material resources and the inability to give a child adequate attention if birth came sooner than desired have been contributed to a detrimental effect of a short preceding interval on child mortality. In our case, the relation was stronger at the neonatal period than the post neonatal period and, therefore, it supports the maternal depletion hypothesis as explained above unlike the findings of the above study. But our study did not take in to consideration the status of the sibling born at the beginning of the interval. The design of the studies was also different. Further study is, actually, needed to develop theoretical frameworks explaining the possible causal mechanisms of birth spacing on child mortality in rural Ethiopia.

According to the WHO Technical Consultation on Birth Spacing, the recommended interval before attempting the next pregnancy is at least 24 months in order to reduce adverse health outcomes [42]. This recommendation is based on the interval between pregnancies instead of the interval between births. After adjusting for possible confounders, the result of our study showed that spacing between births and risk of under five years mortality was statistically significant for intervals of 35 months or less, after 35 months the association was not significant. Therefore, the optimal birth interval based on our finding is beyond the international recommendation even though the exact optimal birth interval was not identified from this study. In spite of all these, it is our strong belief that longitudinal studies that take more potential confounding factors into account should be carried out before concluding that the optimal birth interval at which the risk of child mortality is the lowest in Ethiopia is beyond the international recommendation.

7. Strengths and Limitations of the study

7.1. *Strength of the study*

- Census was conducted.
- Matched case control design applied.
- Community based.

7.2. Limitations of the study

- The intervals between births, instead of the interval between pregnancies, were used for our study.
- Nutritional status and birth weight of children under study was not included.
- Breast feeding status of children was not included in the analysis.
- Relatively small Sample size.
- Extremely long intervals (birth intervals 60 months or more) were not included in our interval category.

8. Conclusions

From this study, considering all limitations, it can be concluded that:

1. The median birth interval at the study area was 31.4 months.
2. The neonatal, post neonatal, infant, child and under five mortality rates were 37, 30, 67, 33 and 99/1000 live births respectively.
3. Risk of children under five years mortality was significantly associated with birth spacing.
4. The effect of short birth intervals on childhood mortality is more pronounced at neonatal age group.

9. Recommendations

1. More emphasis should be given to reduce neonatal mortality at the district as the mortality rate of this age group was relatively found to be high.
2. Considering the increased risk of child mortality for births with birth interval below 36 months, we recommend that mothers at the study area should space births at least 36 months.
3. The result should be communicated to Health Extension workers in the study area so that appropriate health massage on the risks of child mortality when the interval between births is short will be transmitted to the population living there.
4. Longitudinal studies that take more potential confounding factors into account, with adequate sample size for stratified analysis and covering different parts of the country should be carried out in order to generalize the finding to the whole country and identify the optimal birth interval at which risk of child mortality is the lowest.

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11. Annexes

Annex I: Data Collection Form for House to House Census

Kebele---------- Gote----------Name of Data Collector----------

House No.	Name of Head of House Hold	Children under five years of age in the house hold					Children under five years of age who died one year preceding to the census			
		Name of the child	Age*	Birth order	Sex	Twine; (Yes/No)	Age*	Birth order	Sex	Twine; (Yes/No)
		1.								
		2.								
		3.								
		1.								
		2.								
		3.								
		1.								
		2.								
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		3								
		1.								
		2.								
		3.								

*In days if age below 4 weeks, in months for those age 28 days to 1year, in years for children age 1-5 year

Annex II. Questionnaires (English)

Informed consent form for study Participants

Hello. How are you? My name is _____. I live in this district. Now I am a research team member of Addis Ababa University. I am here today to collect data for the study on the interval between births and its risk on child mortality at kalu district. The objective of the study is to see or identify the relation between the interval between births and child survival. We are collecting data from mothers who are giving birth at least for the second time. You were selected to participate in this study just by chance/ because you have a child who died within the last one year. The questions are simple and focus only on the interval (in months) between the child under study (Name) and his immediate sibling, your socio economic and demographic condition, housing condition, sanitation, and your past medical, obstetric and gynecologic history. It will take about 20 minutes to finish the interview. I assure you that the information you provide me is completely confidential and will not be shared with anyone else without your consent. I will not keep a record of your name or any identifying information. You have a right to stop the interview at any time, or to skip any question that you do not want to answer. By doing so you will face no other problem or the care that is given to you will not be changed in any form.

I would like to assure you that all the information that you give me will be used only for research purpose. You have full right to refuse to take part or to interrupt the interview at any time. But the information that you will give me is quite useful to achieve the objective of the study and to bring change in the service provision for women and children.

If you wish to find out more about this study before taking part, you can ask me all the questions you want. Are you willing to participate in the study?

1- Yes 2 - No

If the answer is yes, thanks! Read the following paragraph, make it to be signed and conduct the interview. If the answer is no, Thanks! Proceed to the next eligible client

I have received sufficient information about the project, I have had opportunities to ask questions and these questions have been answered to my satisfaction. I consent voluntarily to this study and I understand I have the right to withdraw at any time without any consequence on the type of medical care or any other public service I receive.

Signature _____. Date (E.C.) _____.

Section I. Information on Economic and Socio Demographic characteristics of parents

No	Question	Categories	skip
101	What is the marital Status of the Mother?	Married……..1 Divorced ……..2 Separated……..3 Widowed ……..4	
102	Maternal religion	Muslim ……1 Orthodox……..2 Protestant …….3 Other (Specify) …...89	
103	Ethnicity	Amhara……1 Oromo……2 Other(specify)……89 No response…….99	
104	Mother's age during chilled(name) birth	Years (age in completed Years) ……..	
105	Maternal Education	Elementary ……1 Secondary……..2 Tertiary……...3 Only read and write……..4 No Education …….5 No Response …….99	
106	Paternal Education	Elementary……1 Secondary…….2 Tertiary…….3 No Education…….4 No response…….....99	

107	Do you own any livestock, or farm animals?	Yes…….1 No…….....2	➔114
108	Total Cows, Oxen and Bulls 00 if not any, 99 if no response	[……]	
109	Total number of Horses, Donkeys and Mules 00 if not any, 99 if no response	[……]	
110	Total numbers of Camels 00 if not any, 99 if no response	[……]	
111	Total number of sheeps 00 if not any, 99 if no response	[……]	
112	Total number of Goats 00 if not any, 99 if no response	[……]	
113	Total number of Hens 00 if not any, 99 if no response	[……]	
114	Income per month (from trade or monthly salary), in Birr 0000 if no income from trade or monthly salary.	[……]	
115	How many (LOCAL UNITS) of agricultural land do you own?	[……]	
116	What is the mother's occupation?	House wife…….1 Farmer……....2 Student ……...3 Government employee…4 Privet Employee…….5 Other (Specify) ……89 No response…….99	

117	What is the Father's occupation?	House wife…….1 Farmer……....2 Student ……...3 Government employee…4 Privet Employee…….5 Other (Specify) ……89 No response…….99	

Section II. Information on sanitation, Water supply and Housing Conditions

No	Questions	Categories	Skip
201	What is the main source of drinking water for members of your house hold?	Piped water ……. 1 Tube well or Borehole …… 2 Protected well …….. 3 Un protected well ……..…4 Rain water ……... 5 Surface water ……. .6	
202	Do you use soap while you wash your hands to prepare food for your child?	Yes …… 1 No ……..… 2 No response……99	
203	What kind of toilet facility do members of your house hold usually use?	VIP latrine……. ……...1 Tradition al pit Latrine …….. .2 Flash latrine ……...3 No facility(open field)……4 Other (specify)……..89 No response……99	
204	Main Material of the floor (Record observation)	Natural floor…….1 Rudimentary floor……2 Finished floor……...3 Other (specify)……..89	
205	Main Material of the walls (Record observation)	Natural walls……...1 Rudimentary walls…….2 Finished walls…….3 Other (specify)……..89	
206	Main Material of the roof (Record observation)	Natural roofing(Thatched)…….1 Rudimentary roofing (plastic)……..2 Finished roofing (CIS)……3 Other (specify)……...89	

207	Type of Windows (Record Observation)	Yes No Any windows…….1 2 Windows with glass….. 1 2 Windows with screens…. 1 2 Windows with curtains or shutters…… 1 2	
208	Has the house enough light?	Yes …….. 1 No …… 2	
209	Is the cooking usually done in the house, in a separate building, or outdoors?	In the house . . . . . 1 In a separate building . . . . . 2 Outdoors . . . . . 3 Other (specify)……...……...89	➔301 ➔301 ➔301
210	If in the house, do you have a separate room which is used as a kitchen?	Yes…….1 No……..2	

Section III. Information on medical, obstetric, gynecologic history, family planning history and child rearing practice

No	Questions	Categories	Skip
301	What is the interval between the preceding and the index birth (name)?	<15months ……....1 15-23 Months…..….. 2 24-35 months …..…..3 36-47 months …….4 48-59 months …….5 60 months or above….6 Don't know……..98 No respond ……99	
302	Was there an abortion or miscarriage between them (Name)?	Yes……..1 No……..2 No response…… 99	➔304
303	If your answer for question number 302 is yes, could you tell me the interval between the abortion and the index child (Name)?	<15months ……....1 15-23 Months…..….. 2 24-35 months …..…..3 36-47 months …….4 48-59 months …….5 60 months or above….6 Don't know……..98 No respond ……99	
304	Was there a still birth between this child (name) and the preceding child?	Yes……..1 No……2	➔306
305	If your answer for question number 304 is yes, could you tell me the interval between the	<15months ……....1 15-23 Months…..….. 2	

	still birth and the index child (Name)?	24-35 months …..…..3 36-47 months …….4 48-59 months …….5 60 months or above….6 Don't know……...98 No respond ……99	
306	Does the mother have history of chronic medical illness?	Yes……...1 No……2 No response…….99	➔308
307	If yes, what are the problems? (multiple responses are possible)	Diabetes mellitus……1 Cardiac Disease……2 Hypertension……...3 Renal Disease……...4 Other(Specify)……...89	
308	Was the child (Name/under study) desired or wanted?	Wanted then……...1 Wanted later……...2 Wanted no more…… 3 No response……99	
309	Parity(for the child under study/Name)	As a continuous Variable ……	
310	Gravidity(while she is Pregnant for the child under study/Name)	As a continuous variable ……	
311	How many abortions, miscarriages or still births have you had in your life?	As a continuous variable ……..	
312	How money alive children do you have now?	No of alive children ……..1 I don't have Alive children…..98 No response ……99	

313	Did you have ANC history for that specific pregnancy (child name)?	Yes …….. 1 No …….. 2 Do not know ……98 No response……..99	→316
314	If yes; when was your 1st visit?	Within 16 weeks of pregnancy …… 1 From 17-28 weeks of pregnancy…. ……2 After 28 Weeks of pregnancy …….. 3 Don't now ……98 No response…….99	
315	How many times did you visit a Health facility for ANC while you were pregnant(Name/child under study)?	Only once …….. 1 2 – 3 times …….. 2 4 times ……3 More than 4 times 4 Don't know ……98 No Response……..99	
316	Where did you give birth?	Home …….. 1 At Health post ……..2 At Health center or Hospital …….3 Other (specify)…….. ……89 No Response……..99	→318 →318 →318 →318
317	If you gave birth at home, who was assisting the delivery?	Health worker …….. 1 Health Extension Worker …….... 2 Traditional birth attendant …….. 3 Unattended …….. 4 Don't know ……..…… 98 No response ……..……..99	

318	What was the mode of delivery?	Caesarean section……1 Non caesarean section……..2 Other (specify)……89 No response……99	
319	Did you have a post natal visit for that pregnancy (Name/child under study)?	Yes …….. 1 No ……2 Don't remember……98 No Response……99	
320	When did you start weaning for your child (Child under study/name)? (Not include children who died immediately after birth)	Within the first 4 months……..1 4-6 months……2 After 6 months …….3 Do not remember…….98 No response……..99	
321	For how many months your child (Name/child under study) breast feed?	Not breast feed at all……1 Only in the first 1 month…….2 For the first 6 months……3 For one year……4 Up to two years…….5 More than two years……6 Do not remember……98 No response……99	
322	Do you and your child sleep under a bed net during the night?	Yes …….. 1 No ……2 Sometimes……..3	
323	Was there traditional practices undertaken on the child	Yes……..1 No…….2	→325

	(Name)?	No response……..99	
324	If yes, do you tell me each type of practice undertaken on the child?	Milk teeth extraction…….1 Giving butter immediately after birth…….2 Other (specify)……89 No response……99	
325	Did you take any type of modern family Planning methods before you conceived your child (Name)?	Yes……1 No……..2 No response……..99	→327
326	If Yes, did you tell me the method you had used?	Pills…….1 Injectables……2 Implants……..3 Others (specify)…….89 No response……..99	All skip to 328
327	If your answer for question number 425 is no, do you tell me the reason why you did not take (space) contraceptives?	I was wanting a child soon……1 I had no information on contraceptives……2 Contraceptives were not available……..3 Other (specify)…….89	
328	Do you take modern contraceptives currently?	Yes……..1 No…….2 No response……..99	→330
329	If yes, where do you get it?	Heath Centre……..1 Health post(Health extension worker)……2 Community health agent……..3 Hospital……..4 Other (specify)…….89	

330	If no, do you tell me the reason? Multiple answer possible	Not available (facility far)…….1 Available, butI do not get my preference…….2 I have no information where to get Contraceptives……...…….…3 I cannot afford for contraceptives……..4 Other (specify)……89	
331	Do you have the intention to take contraceptives in the future?	Yes……...1 No……2	→334
332	If yes, which method do you prefer?	Injectables……...1 Pills…….2 Implants…….3 Other (specify)……..89	
333	If your answer for question number 331 is yes, do you tell me the people you prefer to provide you the method.	Health Extension worker…..1 Community health agent…..2 Health worker……3 Other (specify)……...89 No response…….99	
334	Do you discuss with your husband at home about contraceptives?	Yes, regularly…….1 Yes, sometimes…….2 Not at all……...3 No response……99	

Annex-III Amharic Qustionnaire

¾ትT `ኛ nK SÖÃp pê

K}dታò- ች ¾T ትÑ አß ` S [Í ና ¾eU U ነት T [ÒÑÝ pê &

Ö ኛ Ã eØ Mኝ: እንÅU ን አK<: eT@ ------------------------- ÃvLM:: ¾U ኖ[¨ < u² ‡ ¨ [Ç c∃ ን አG‹ን እ² ‡   ¾ ÑኘG‹ት አ^ ` q   S ¨ ‹KÉ ና  ¾ éናት  V ትን  u} S Kከ} uአÇ∈  አuv  ¿ነቓ` c⇉ KT ቻÖ ና Ø ናት S [Í   KS cwcw ነ¨ <: ¾Ø ና~ ª ና አLT   አ^ ` q   S ¨ ‹KÉ ና  ¾ éናት  V ት  U ን አÃ ነት  Óንኘ‹ት    እንÇLቸ¨ <  T ¾ት  ¨ Ã U   S K¾ት  ነ¨ <:  እ` e-   u² ‡   Ø ናት   እንÇ≐} ~ ¾ Å[Ñ¨ < uአÒ× T ቶ vKð ¨ < አንÉ አS ት ¨ ‹eØ uV ት ¾ K¾ MÏ   eLK- ት ነ¨ <: ¾U ÖÃ k- ØÁo - ች k LMና uI éናት S "ከM ¾u[¨ ‹ን ¾ ^ ት M¿ነት&¾T I u^ ©& አ∉ኖT ቶ©ና eነI ´ v© Ñêታ¨ ች& eKS ኖ] Á   u?ት- &eKS çÇÍ u?ትና eLKð ¨ < Ñ? ¾T I çንና ê ንe እንÇ∈G‹U   ¾ ¡ U ና ታ] ¡ -   Ã J ናM::ቃለ ምልልሱን KS Ú [e   እeከ 30 ደቂቃ ይፈጃል፡፡   L[ÒÓØ M-   ¾U ð MÑ¨ < ነÑ   u⁘` የ T>cÖ<ኝ  መረጃ  ሚስጥራዊነቱ  መሉ  በመሉ  የተጠበቀ  c∃ ን  ከእ` e-   ð n É ¨ ‹ß   uU ንU አÃ ነት   S Mከ< KKÍ አ" M } LMö አÃ cØ U ፡፡   eU -   ¨ Ã U   ¾እ` e-  ን  T ንነት  ¾T ÑMê T ነኛ¨ ‹U    S [ Í     አÃ S ² ÑuU  ::     n KU MMc‹ን    ¾T s [ Ø     ¨ Ã U     ÅÓV      S S Ke ¾T Ã ð MÑ‹ቸ¨ ‹ን  ÁKS S Ke  S ‹K< S wት  አK-  ት  ::  Ã I ን  uT É [ Ó-    uT ÅÑና‹ት  ¾ ¡ U ና አÑMÓKAት U   J ነ  uKKÃ  ከS  ንÓc ት  } s T  ት  uT ÅÑና‹ቸ¨ < አÑMÓKA ች  LÃ   U ንU  አÃ ነት ችÓ`   አÃ ÑØ S - ትU ::

አG‹ንU   uÉ ÒT @L[ÒÓØ M-   ¾U ð MÑ¨   ¾T ቋÖ‹ኝ S [Í   G‹K< KØ ና~   አLT   wቻ ¾T ≥ ‹M S J ነ‹ን ነ¨ <: n KU MMc‹ን ÁKT É [Ó ¨ Ã U   ¾T É [Ó ¨ Ã U   ÅÓV   ¾T s [Ø   S ‹K< S wት አK- ት:: ነገር   ግን   የሚስጠኝ መረጃ ¾Ø ና~ ን ¯LT   Ç`   KT É [eና ¾እናቶችና I éናት Ö ኛ አÑMÓKAትን ለማሻሻል   በጣም ጠቃሚ ነው፡፡

 un KU MMc< ÓMê   ÁMJ ነM- ትና KS Ö¾p   ¾T ቋMÑ‹ት ØÁo   " K K∈ÖÃ I ን Ã ችLK< ¨ Ã U ÅÓV   ueM¡ I Ø `   091174 24 15 Å¨ ‹K¨ < K∉Áነ ÒÓ\ ን Ã ችLK<:

በØ ና~   KS d} õ   ð n Åኛ ነ- ት;

1. አ-   2. አÃ ÅKG‹U

አ-   ካሉ አመስግነው ከ² ‡   k Ø KA ÁK¨ ‹ን አንk ê   አንwu‹ቸ¨ ‹ eKS eT T ታቸ¨ < እንÇ∋` S < አÉ ` Ñ¨ < n KU MMc‹ን   Ã k Ø K<:   አÃ ÅKG‹U   " K< አS eÓነ¨ < አሰናብተው ወደ   ሌላ   ተጠያቂ ይለፉ፡፡

¾ ÖÁm¨ < ¾ð n É ኝነት T [ÒÑÝ

eKý a Ë¡ ~   um S [Í   ¾ cÖኝ c∃ ን & uT w^] ¨ ‹U   [¡ ቻKG<: u² ‡   n KU MMe LÃ KS d} õ   ¾ eT T G< c∃ ን uT ነኛ¨ ‹U   Ñ? n KU MMc‹ን ¾T s [Ø   S w‹ እንÅ} Öuk   G‹ ነ¨ <:

ፈቃደኛ ስለመሆናቸው የ }Öያቂው ፊርማ   - - - - - - - - - - - k ን------------------

uØና~ u} ''}~ kuK? ች ¨ ቂØ ul Ã- ት LKና vKð¨ <ስንÉ ¯S ት ¨ ቂØ KV ~
l éናት S S ´ Ñu≠Á pê ::

kuK? ------------------------- ÔØ---------------------------- ¾S[Í cwdu=¨< eU-------------------------------

		uuንት ¨ ቂØ ÁK<ħ5 ስS ት uታች l éናት					vKñት 12 ¨ ^ ት uV ት ¾ኣ KÂ ħ5 ¯S ት uታች Gé3			
	¾ħv¨ ^ /¾ኡፐ¨¨^ eU ክነአvት	eU	°ÉT ®	e3} ኖ Mï ነ¨ ፋናት;	Ëታ	S ንትÁ ነ¨ ፋች;	°ÉT ®	e3} ኖ Mï ነ¨ ፋናት;	Ëታ	S ንትÁ ኪu` /[ች;
		1.								
		2.								
		3.								
		1.								
		2.								
		3.								
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		3								
		2.								
		3.								

*ħ28 kን uታች KJ ነ<ukን Ãéõ &ħ28 kን እeħ 1 ስS ት LK<l éናት u¨ ` Ãéõ &1 እeħ 5 ስS ት LK<Géናት uስS ት Ãéõ ::

ክፍል 1. ማህበራዊ፤ ኢቼኖT ኦ© እና ሥነ -ህዝባዊ ገጽታዎች

ተ.ቁ	ጥያቄዎች	ምድብ	´ ለል
101	የ ጋብቻ ሁኔ ታ	ያገ ባች / አብራ የ ምትኖር .....1 የ ፈታች.....2 KÑ፻? <} KÁÃ} ¨ <¾T ÷Ÿ\ .....3 የ ሞተባት .....4 መግለጽ ያልፈለገ ች ...99	
102	የ ሚከተሉት የ ትኛወን ሀይማኖት ነ ው፤	እስልምና ......1 ኦርቶዶክስ.....2 ፕሮቴስታንት....3 ሌላ (ይገ ለጽ) ......89 መግለጽ ያልፈለገ ች 99	
103	ብሄርዎ ምንድን ነ ው፤	አማራ......1 ኦሮሞ......2 ሌላ (ይገ ለጽ)......89 መግለጽ ያልፈለÑች.......99	
104	¾እናት እÉT @éነ<ን (Y U) eት¨ MÉ	[......]	
105	¾Qéነ< እናት ያጠናቀቁት ከፍተኛ የትምህርት ደረጃ ¾ቱኛ ¨< ነው;	አንÅኛ Å[Í ......1 G<K}ኛ Å[Í.....2 ከõ} ኛ ትU l ` ት ÁÖናk k ች.....3 ማንበብና መጻፍ .....4 ያልተማረ ች.......5 መግለጽ ያልፈለገ ች 99	

106	¾Qé'<አvት ¾ትU l ` ት Å[Í	አንÅኛ Å[Í ......1 G<K}ኛ Å[Í ....2 ከõ } ኛ ትU l ` ት ÁÖና k k ....3 T ንuwና S éõ ¾T ቻM...........4 ያልተማረ ....5 መግለጽ ያልፈለገ /ች......99	
107	KÓw` ና ¨ ÃU KK? አÑMÑKA ት ¾T ` ¡K< ¾u?ት አንed ት አK- ት;	አ- ......1 ¾K?U 2	→114
108	Öp LL ÁK< ት ¾ } ት LV ች&u_¨ ችና ØÐች ከK? ቶ¨ < 00 & S ÓKê " Mð KÑ< 99 ያeÑu<	[........]	
109	Öp LL ÁK< ት ð [f ች&up KA ችና አl Äች ከK? ቶ¨ < 00& S ÓKê " Mð KÑ< 99 ያeÑu<	[........]	
110	Öp LL ÁK< ት ÓS KÅች ከK? ቶ¨ < 00 & S ÓKê " Mð KÑ< 99 ያeÑu<	[........]	
111	Öp LL ÁK< ት uÕች ከK? ቶ¨ < 00 & S ÓKê " Mð KÑ< 99 ያeÑu<	[........]	
112	ÖpLL ÁK< ት õ ¾KÅች ከK? ቶ¨ < 00& S ÓKê " Mð KÑ< 99 ያeÑu<	[........]	
113	Öp LL ÁK< ት Êa ች ከK? ቶ¨ < 00& S ÓKê " Mð KÑ< 99 ያeÑu<	[........]	
114	u? cu< ከንÓÉ ¨ ¾U ¨ ` G© ÅV ´ " K¨ < &Öp LL ¨ ` G© Ñu= < ¨ ÃU ከÅV ´ ¾T ቃÑች¨ < ¾Ñን² w S Öን U ንU T ÁÑኝ ከJ ነ 0000 ÃS ¡K< vMና T ቋት G¡K~ U ¨ ` G© ÅV ´ " Lቸ¨ < ¾G<K~ ን ÅU [¨ < Ãéñ	[........]	

115	u‡ cu<U ን ¾ M ØT É ¾ˆ h S _ት አK¨ ኍ ክK‡ቸ¨ < 00 ÃV L	[.....]	
116	¾ናት የሥራ ሁኔታ	የቤት እማኪት .....1 ¾Ów` ና Y ^ .....2 ተማሪ .....3 ¾S ነÓeት W^ } ኛ...4 ¾ÓM É ` Ï ት } k ×] ....5 ሌላ (ይገለጽ) .....89 መግለጽ ያልፈለÑቸ.....99	
117	¾ሐvት ¾e^ G‹@	¾Ów` ና e^ } ኛ.....1 ¾S ነÓeት W^ } ኛ...4 ¾ÓM É ` Ï ት } k ×] ....5 ሌላ (ይገለጽ) .....89 S ÓKê አMð KÑ‡U 99	

¡õM **2**: ¾S çÇÍ u?ት& ¾ ቃ አp^ xትንና ¾S ና] Á u?ት G<ኔ@ታን u} S Kከ}

ተ.ቁ	ጥያቄዎች	ምድብ	ዝለል
201	u?ቱ cu< KS ÖØ አÑMÓKA ት ¾T > ‹K¨ ‹ን ¨<% T>ÁÑ"ን¨ <¾ት ነ¨ ‹?	x? ¨ ÃU ከÓM vEvE....... 1 ከØMp ¾¨<% Ñ<ÉÑEÉ ...... 2 ¾}Öuk ¾Ñ<ÉÑÉ ¬ኃ .... 3 ÁM}Öuk ¾Ñ<É3É ¬ኃ....4 ¾ ናw ¨ ቃ..... 5 ከከ<_ ¨ ÃU ከ¨ ^ Ï ¨ ቃ 6	
202	Kl é ነ< (Y U) U Ów c=Á² ÒÌ dS ‹ና ÃÖkTK<?	አÖ k T KG<..... 1 አMÖ k U U .... 2 መገለጽ ያልፈለÑቸ......99	
203	u?ቱ cw- ¾T >Ö k U uት S çÇÍ u?ት U ን አÃ ነት ነ¨ <?	i ታ አMv S çÇÍ u?ት........1 ¾}KU Ê S çÇÍ u?ት ..... .2 S çÇÍ u?ት ¾KU......3 K?L (ÃÖke).......89 መገለጽ ያልፈለÑቸ...99	
204	¾S ና] u?‹ ¨ KM ¾} c^ uት l dl e U ን አÃ ነት ነ¨ ና (¾} S Kከ~ ትን Ã é ñ)	አð ` ¨ ÃU ¾} Kk Kk S _ ት.......1 ከ× ¨ ‹L ¨ ÃU ከk ` n H ¾} W^ ¨KM...2 ከc=T ቓቶ ¨ ÃU ከÖ‹w ¾} W^ ¨KM...3 K?L (ÃÖke).....89	
205	Ó` ÓÇ¨ <¾} c^ uት l dle U ንÉ ን ነ¨ ና (¾} S Kከ~ ትን Ã é ñ)	ከp ` n G ¨ ÃU ከአÑÇ..............1 ከ እንÚ ትና ከß n ....2 ከwKA ከ?ት ¨ ÃU ከÉ ንÒÃ ....3 K?L (ÃÖke)....................89	

206	× ^ ¨ <¾ W^ uት l dl e (¾ S Kh~ ትን Ãéñ)	hd` .....1 hýLe+¡.....2 hq` qa .....3 K?L (ÃÖke).....89	
207	¾S e¢~ አÃነት (¾ S Kh~ ትን Ãéñ)	አK ¾KU T ነኛ¨ ሩ አÃነት S e¢ት...1 2 Se;ታ¨ ቂት ÁK¨ <S e¢ት. ... 1 2 S Ò[Í ÁK¨ <S e¢ት..... 1 2 i x ¨ ÃU አÛu` ÁK¨ <... 1 2	
208	u?~ um w` Hን አK¨ ? ¾ S Kh~ ትን Ãéñ	አK¨ <..... 1 ¾K¨<U 2	
209	U Ów ¾T ≥ÒË¨ <¾ት ነ¨ ?	u?ት ¨ ቀØ .. . . . . 1 K² ‡ አÑMÑKAት u} ² ÒË KŁ u?ት . . . 2 hu?ት ¨ ቀß . ..... 3 K?L (ÃÖke).....89	➔301 ➔301 ➔301
210	u?ት ¨ ቀØ hJ ነ KU Ów T wcM አÑMÓKAት ¾T ≥ M ¾ K¾ ¡ õ M አK?	አK....1 ¾KU....2	

¡õM 3. ¾ ¡ U ና& ¾ê ንeና T l çን እንÇ=G<U ¾Q éነ< Áe} ÇÅÓ G<@ u} S Kh}

(ት¡ ¡ Kኛ¨ < l Ø` ያ¡wu<)

ተ.ቁ	ጥያቄዎች	ምድብ	ዝለል
301	ul éነ<(YU) እና uእ`c< ታLp S"hM ÁK¨< ¾እÉT @M¿ነት U ንÁl M ነ¨ <	ከ15 ¨ ` uታች .......1 ከ15-23 ¨ ^ ት..... 2 ከ24-35 ¨ ^ ት.....3 ከ36-47 ¨ ^ ት .......4 ከ48-59 ¨ ^ ት.......5 60 ¨ ` ና ከ² Á uLÃ....6 አLeታ¨<eU........98 መገለጽ ያልፈለÑች......99	
302	ul éነ<(YU) እና uእ`c< ታLp S"hM ¨<`Í ÑØV-ታM;	አ- ....1 አMነu[U ....2 መገለጽ ያልፈለÑች...... 99	→304
303	S Me- አ- ከJ ነ ul éነ<(eU)ና u¨ < Í ¨ < S " hM ያK¨ < ¾Ñ> ?M¿ነት u=Ó\ ኝ	ከ15 ¨ ` uታች....1 ከ15-23 ¨ ^ ት..... 2 ከ24-35 ¨ ^ ት.....3 ከ36-47 ¨ ^ ት .......4 ከ48-59 ¨ ^ ት.......5 60 ¨ ` ና ከ² Á uLÃ....6 አLeታ¨<eU........98 መገለጽ ያልፈለÑች......99	
304	¾ ‡ l éን ታLp ¾ ¨ KÅ¨ < ul Ã- ት ነu` (Was not he a still birth)?	አ- ....1 አMነu[U 2	→306
305	ul Ã- ት "Mነu[&ul éነ<(eU) ul Ã- ት vM} ¨ KÅ¨ < MÏ S " hM ያK¨ < ¾እÉT@ M¿ነት U ን ÁI M ነu` ;	ከ15 ¨ ` uታች....1 ከ15-23 ¨ ^ ት..... 2 ከ24-35 ¨ ^ ት.....3 ከ36-47 ¨ ^ ት .......4 ከ48-59 ¨ ^ ት.......5 60 ¨ ` ና ከ² Á uLÃ....6 አLeታ¨<eU........98 መገለጽ ያልፈለÑች......99	

306	¾q¾ና ¾ፐ ቃታ¨ p ¾Ö ፃ ችÓ` አKu- ት?	ኡ- ....1 አMነu[ችU ......2 መግለጽ ያልፈለ Ñች.......99	➔308
307	ኡ- "K<U ን አÃነት ¾Ö ፃ ችÓ` ; (ከአንÉ uLÃ S Me Ãቻ LM)	¾e£` uiታ ......1 ¾Mw ISU......2 ¾ÅU Óò ት........3 ¾ክ‹K=ት QS U .....4 K?L (ÃÑKê).....89 መግለጽ ያልፈለ Ñች 99	
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Declaration

I, the undersigned, declare that this thesis is my original work in partial fulfillment of the requirement for the Degree of Masters of Public Health in Epidemiology and has not been presented for a degree in this or any other university. All sources of materials used for this thesis have been duly acknowledged.

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This thesis has been submitted for examination with my approval as the university advisor.

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