ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

SCHOOL OF PUBLIC HEALTH

PREVALENCE AND ASSOCIATED FACTORS OF DIARRHEA AMONG UNDER-FIVE CHILDREN IN LAELAY-MAYCHEW DISTRICT, TIGRAY REGION, ETHIOPIA

BY

TEKLIT ANGESOM (BSc)

ADVISOR

Dr. NEGUSSIE DEYESSA (MD, PhD)

CO-ADVISOR

Mr. SAMSON WAKUMA (BSC, MPH)

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Abbreviations and Acronyms

AOR……Adjusted odds ratio

AIDS……...Acquired immune deficiency syndrome

BF……Breast feeding

CSA……Central Statistical Agency

CI……. Confidence interval

COR……. Crude odds ratio

EDHS……Ethiopian demographic and health survey

Epi Info……. Epidemiological information

HE…….. Health Education

MDG…….. Millennium development goal

MOFED……. Ministry of finance and economic development

UNICEF……. United Nation children's Emergency Fund

ORS……. Oral Rehydration Solution

OR……Odds ratio

PCA……... Principal Component analysis

SD……... Standard deviation

SPSS……Statistical package for social science

SSA…….. Sub Saharan Africa

VIP…….. Ventilated improved pit

WHO……World Health organization

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Abstract

Introduction: Acute diarrheal diseases are the leading cause of preventable death, especially among children under-five in developing countries. Worldwide and nationwide (Ethiopia) diarrheal disease is the second leading cause of death in under-five year children only to pneumonia.

Objectives: The aim of this study was to determine the magnitude and associated factors of under-five diarrhea in Laelay-Maychew district.

Methods: A community based Cross sectional study was conducted from February 01- February 15, 2015. A two stage stratified sampling method was done to select the eligible households. Data was collected by trained data collectors using standard questionnaire and observational check list tested previously which was prepared based on EDHS and WHO core questionnaires related to diarrhea. Data was entered in to a computer using Epi Info 3.5.3 software and exported to SPSS V.21 statistical software for further analysis. Binary Logistic regression analysis was used to determine OR and 95% CI. Variables with p-value <0.2 in the bivariate analysis were entered in to multivariate analysis and with p-value <0.05 in the final model were considered as significant.

Result: The two weeks period magnitude of diarrhea among under-five children was 17.7% with 95% CI (14.5-20.8) which was associated with children being rural residence [AOR: 1.52, 95% CI(1.26,4.87)], female child [AOR: 3.85, 95% CI(1.8,8.22)], education of mothers [AOR: 0.02, 95% CI(0.01,0.12)], households with improved water source [AOR: 0.18, 95% CI(0.02,0.39)], households with ≤20L per capita per day water consumption [AOR: 1.53, 95% CI(1.12,1.97)], and mothers who wash their hand with water and soap/ash [AOR: 0.52, 95% CI(0.24,0.42)].

Conclusion and recommendation: The two weeks period magnitude of acute under-five diarrhea was relatively high and residence, educational status of the mothers, water source of the households, per capita water consumption of the households, and hand washing methods of the mothers/care takers were significant predictors. So, Females' education at least to complete primary school, constructing improved water source and giving HE to the community about hand washing methods to use soap at recommended times were recommended.

1. Introduction

1.1. Background

Acute diarrheal diseases are one of the main problems affecting children in the world, reducing their well-being and creating considerable demand for health services [1]. Diarrheal diseases are leading cause of preventable death, especially among children under five in developing countries. Childhood mortality rate in general and infant mortality in particular, are often used as broad indicators of social development or as specific indicators of health status. Child mortality reduction by two-third is one target of Millennium Development Goal [2]. Diarrhea is defined as a child with loose or watery stool for three or more times during a 24–hours period. The frequency and severity of diarrhea is aggravated by lack of access to sufficient clean water and sanitary disposal of human waste, improper feeding practices and hand washing, poor housing conditions and lack of access to adequate and affordable health care [3].

1.2. Statement of the problem

Worldwide diarrheal disease is the second leading cause of death in under-five year children only to pneumonia which accounts for one in nine child deaths. It is responsible for 1.7 billion morbidity and 760, 000 mortality of children every year and kills 2,195 children every day more than malaria, measles, and AIDS combined [4].

The majority of morbidity and mortality related to under-five diarrhea were in Africa and South Asia. Diarrhea can last several days, and can leave the body without the water and salts that are necessary for survival. Most people who die from diarrhea actually die from severe dehydration and fluid loss. It also predisposes children to malnutrition which makes children more susceptible to other infections [4].

A systematic literature review done in developing countries shows that diarrheal disease was responsible for 19% of total under-five deaths, and Africa and South East Asia regions accounts for 78% of all diarrheal deaths occurring among under-five children in the developing world [5]. A study shows that 23% of all deaths among under-five children in south Asia and 22% in SSA were caused by diarrheal diseases [6].

In Africa diarrhea is responsible for 25-75% of all childhood diseases and accounts for about 14% of outpatient visits and 16% of hospital admissions [8].

Studies and reports on child morbidity and mortality in Ethiopia shows that diarrhea is a major public health problem [9, 10]. A case control study done in Gilgel Gibe field research center in 2005 shows that 30.1% of under five mortality in the study area were caused by diarrheal disease [10]. Even though improvement was made in reducing childhood mortality from 123 under five deaths per 1,000 live births in 2005 [11] to 88 under five deaths per 1,000 live births in 2011, children in the country still suffer from diarrhea, respiratory problems and malnutrition [12].

EDHS 2011 reported that 13% of the children had diarrhea in the two weeks preceding the survey at the national level and in Tigray region [12]. According to the 2010 report of the Ministry of Finance and Economic Development, 20% of the childhood death in the country was due to diarrhea [13]. In Ethiopia diarrhea is the second cause of death among under-five children secondary to pneumonia. Poor sanitation, lack of access to clean water supply and inadequate personal hygiene are responsible for 90% of diarrheal disease occurrence, these can be easily improved by health promotion and education [14].

Childhood morbidity and mortality are results of interactions among many factors in developing countries. The interactions of behavioral, socio-economic and environmental factors influence child morbidity [15, 16]. Understanding childhood morbidity requires explaining the relations and interactions of these factors.

Identifying the causes of diarrhea is very crucial for the effective implementation of child health intervention programs for policy formulation and the general assessment of resource requirements and intervention prioritization.

So, this study was assessed the magnitude and relationship of diarrhea among under-children with the different demographic and socio-economic, environmental and behavioral factors.

1.3. Rational and significance of the study

The cause of child mortality and morbidity in developing countries is multi-factorial. The child's survival depends on the interaction of socio-economic, biological, behavioral and environmental factors [17, 18]. Hence, it is very important to see the relation and interaction of these factors to understand children's health condition. Very limited information on the magnitude and effects of socio-economic, behavioral and environmental factors is incorporated in the few studies conducted on childhood diarrhea especially in Tigray region and there were no similar studies conducted in the area. According to the woreda health office 2006 E.C report, childhood diarrheal prevalence was 10.9% and was the fourth leading cause of morbidity in the district.

Finding the factors associated with childhood diarrhea helps to find possible intervention methods. So, this study will have important policy implications for health intervention programs and with a view of adding to the existing body of knowledge as well as help in policy change that will improve child health care in the study area in particular and in the country in general.

2. Literature review

2.1. Magnitude of under five diarrheal morbidity

Although the major causes of under-five mortality remain the same globally, their relative importance varies across regions of the world. While, in low-income countries, infectious diseases account for a large proportion of under-five deaths in which diarrhea is responsible for 15% of the deaths [19]. A cross-sectional study done in Pakistan (in 2004) revealed that the overall two weeks prevalence of under five diarrhea was 16% [20]. Similar study done in Iraq (in 2000) shows that the two weeks period prevalence of under five diarrhea was 21.3% [21]. A cross sectional study done in India rural community (in 2008) shows that the two weeks prevalence of diarrhea was 25.2% [22].

A community based study done in Egypt revealed that the point prevalence of diarrhea was 19.5% [24]. A cross sectional study done in Ghana urban area in 2005 indicate that 19.2 % of the children covered in the study have had diarrhea in the preceding two weeks of the study [25]. Similar study done in Democratic Republic of Congo and Burkina Faso revealed that two weeks prevalence of diarrhea among under five children was 16% and 10.2% respectively [26, 27]. A community based study from Tanzania shows that the two weeks period prevalence of diarrhea was 6.1% [28].

Community based study from east Gojam zone [29], Benishangul-Gumuz regional state [30] and west Gojam zone [31] shows that the two weeks prevalence of diarrhea was 6.5%, 22.1% and 18% respectively. A community based cross sectional study from Nekemte town and institution based cross sectional study from Debrebirehan referral hospital reveals that under five diarrheal morbidity over a period of two weeks preceding the study was about 28.9% and 31.7% respectively [32, 33]. Similar study done in Arba-Minch rural community (in 2012) shows that the magnitude of diarrhea among under-five children was about 31% [34]. A community based cross sectional study from Kersa district, Eastern Ethiopia which was done in 2011 reveals that under five prevalence of diarrhea was 22.5% [35].

2.2. Factors associated with under five diarrheal morbidity

The factors that potentially determine the occurrence of diarrhea in children include, poor personal hygiene, environmental problems, water availability and quality, unhygienic feeding

practices, improper use of latrines, early discontinuation of breastfeeding, child's age, maternal education and household income [12, 14, 25, 29-33].

2.2.1 Diarrheal morbidity and demographic and socio-economic factors

A study from Pakistan shows child's own characteristics (age and sex), total number of children born, mothers characteristics (age and education), and economic characteristics (ownership of agricultural land and housing) were significant predictors of under five's diarrheal morbidity. Similar study from Iran revealed that diarrhea was associated with age of child, area of residence, maternal education [20]. Compared to children aged 48–59 months, children in the age groups 6–11months and 12–23 months were 2.22 and 1.84 times more likely to have diarrhea respectively. This study also revealed that children whose mothers had no formal education were 11% more likely to have diarrhea compared to children with mothers who had attained secondary level of education. Children from urban areas were 8% more likely to have diarrhea compared to children from rural areas [21]. Studies and reports shows that prevalence of diarrhea decreased significantly with increased age as highest prevalence were observed in the age group of 6 –11 months and lowest prevalence were observed among children aged 48–59 months [12, 22, 34].

A longitudinal study conducted among a sample of 2408 children under 5 yrs age group shows that maximum cases of diarrhea were in infants (81.2%) and the number of diarrhea episodes per child per year were 4.76 and 2.95 for 0-11 month and 1-5 year respectively [23]. A study from rural community of Egypt revealed that child's age, mothers age and fathers education were significantly associated with under five diarrheal morbidity whereas maternal education was not significantly associated [24].

A cross sectional study from Ghana revealed that about 20.1% of children from poor wealth homes have had diarrhea compared to 16.4% from medium wealth and 11.5% from high wealth homes. In this study children of uneducated mothers account for 60.6% of diarrhea cases followed by 25.5% and 13.8% of mothers with basic education and secondary or higher education [25]. A study from Benishangul Gumuz Regional State shows low level of maternal education, having more than two under five children, higher birth order and the age of children were found to be the risk factors for childhood diarrhea [30].

According to EDHS 2011, highest prevalence of childhood diarrhea was observed among uneducated mothers (13.9%) compared to primary (12.6%), secondary (10.2%) and more than secondary (10.9%) educated mothers [12]. A study shows that mothers' and fathers' occupation was associated with the occurrence of diarrheal morbidity [33]. Similar study revealed that diarrheal morbidity was associated with Mother's education, Mothers age at birth and Wealth of family [12, 31]. Another study from eastern Ethiopia shows that the odds of diarrhea was 1.74 times higher in children from the households with two or more siblings compared to children in the households with only one sibling [35]. A study from southwest Ethiopia rural community indicates that children's whose families monthly income earn less than or equal to 650 Birr were 1.75 times more likely to concede diarrhea than children's whose families monthly income were greater than 650 Birr. In this study children's whose mothers cannot read and write were1.74 times more likely to concede diarrhea than children's whose mothers were literate [36].

2.2.2 Diarrheal morbidity and environmental factors

A study done on the relationship of under five diarrhea and household latrine in Indonesia shows that having improved latrine was associated with decreased occurrence of under five diarrheal morbidity [37].

A study on sanitation and hygiene in relation to childhood diarrhea in Ghana shows that children who lived in households which had water closets in their dwellings recorded the lowest diarrhea prevalence rate (11.1%) whereas the highest prevalence was recorded in households which have water source outside the dwelling. Children who lived in households that used public toilets also recorded 12.7% prevalence rate whilst those that lived in households that used the in compound bucket recorded a 12.5% prevalence rate [38]. A case control study from Tanzania revealed that distance to water source and having a latrine at home were significant predictors of under five diarrheal morbidity [39].

EDHS 2011 report also shows that diarrhea prevalence was highest among children residing in households who drink water from unprotected wells which is 18% [12].

A study shows absence of toilet facility, improper child stool disposal methods were found to be associated with childhood diarrhea [30]. Similar study shows Drinking water source, Latrine facility and Waste disposal system were associated with diarrheal morbidity [31]. Another study from Nekemte town revealed that children from households who dispose refuse in pit/burnt are

69% less likely to have diarrhea compared to children from the households who dispose their refuse haphazardly in open field. In this study children from those households in which feces were observed around the pit-hole/on the slab had about three times more likely to have diarrhea compared to those children from houses in which feces had not observed around the pit-hole [32].

A cross sectional study done in Debrebirehan referral hospital revealed that number of house rooms and living with cattle in one house had significant association with childhood diarrheal diseases [33].

A study reveals that children in the households who open dumped refuse around the house had 2.22 times higher odds of having diarrhea compared to children in the households who used a waste disposal pit. Children in the households without hand washing facilities had 1.92 times higher odds of having diarrhea compared to children in the households with hand washing facility [35]. A study shows that children's whose families practiced improper refuse disposal were 3.19 times more likely to concede diarrhea than children's whose families were practiced proper refuse disposal [36].

A case control study from Derashe district showed that under-five diarrhea was significantly associated with unimproved water source, not having latrine, improper disposal of infant feces, and availability of home-based water treatment [40]. A community based study cross-sectional study from Kefa Sheka zone, western Ethiopia (in 2000) and rural area of Shebedino district, southern Ethiopia (in 2013) revealed that under-five diarrhea was significantly associated with per capita per day water consumption[41, 42].

2.2.3. Diarrheal morbidity and behavioral factors

An observational study done in rural Bangladesh on the effect of hand washing at recommended times on under five diarrhea revealed that compared with children living in households where persons prepared food without washing their hands, children living in households where the food preparer washed at least one hand with water only, washed both hands with water only, or washed at least one hand with soap had less diarrhea. In this study there was no significant association between hand washing with or without soap before feeding a child, before eating, or after cleaning a child's anus who defecated and subsequent child diarrhea [43]. According to a study done in Ghana, under five diarrhea was associated with mother's failure to wash the hands

with water or soap before cooking and after using the toilet [25]. Similar study done on hygiene and sanitation in the same country shows that childhood diarrhea was most prevalent (36%) in children's whose mothers did not wash their hands with water and soap after defecation compared to those who wash their hands [39].

According to the study done in west Gojam in 2009, childhood diarrhea was higher among children's who breastfed for less than two years compared to children's who breastfed for greater than two years. In this study breast feeding status (exclusively, partially or no breastfed) and method of water drawing (dipping or pouring) have no significant association on the magnitude of childhood diarrhea [31].

A study done in Debrebirehan shows that Children's who fed gruel and adult's food were about three and four times more likely to have diarrhea than those who fed cow's milk respectively. Method of drawing/pouring water from storage container, and covering water storage container had significant association with diarrhea. In this study, maternal diarrheal disease was also significantly associated with childhood diarrheal diseases [33].

A community based study from south west Ethiopia revealed that children's whose mother didn't practiced hand washing at critical time were 2.21 times more likely to concede diarrhea than children's whose mothers were practiced hand washing at critical time. Children's whose mothers didn't used soap for hand washing were 7.40 times more likely to concede diarrhea than children's whose mothers were used soap for hand washing [36].

According to case control study done in southern Ethiopia, the odds of developing diarrhea was 2.25 times higher among children whose families did not treat drinking water when compared to children whose families treat their drinking water [43].

Conceptual framework

Because our main concern was demographic and socio-economic, environmental and behavioral factors as main determinants of under-five diarrhea, we have constructed a conceptual framework by reviewing different literatures which is expected to explain how those factors affect under-five diarrheal morbidity.

Under-five diarrheal morbidity is expected to less pronounced in households with less family size, urban residence, higher parental education and with better economic status. Having improved water source, water source within their dwelling, improved latrine facility, hand washing facility, adequate daily per capita water consumption and proper refuse disposal method can potentially decrease the threat of under-five diarrheal morbidity. Under-five diarrheal morbidity is also expected to be less likely in some behavioral factors such as hand washing with soap, child feeding with spoon, breast-feeding for more than two years, exclusive breast feeding and home based water treatment.

Socio-economic factors have an effect on under-five diarrheal morbidity directly or indirectly by their influence on environmental and behavioral factors. Again, environmental factors can affect under-five diarrheal morbidity directly or indirectly by changing the behavior of individuals toward their method of water storage and hand washing practice. The behavior of individuals such as their water storage method, hand was method and child feeding practice could also have direct effect on under-five diarrheal morbidity or indirect effect by their influence on environmental factors.

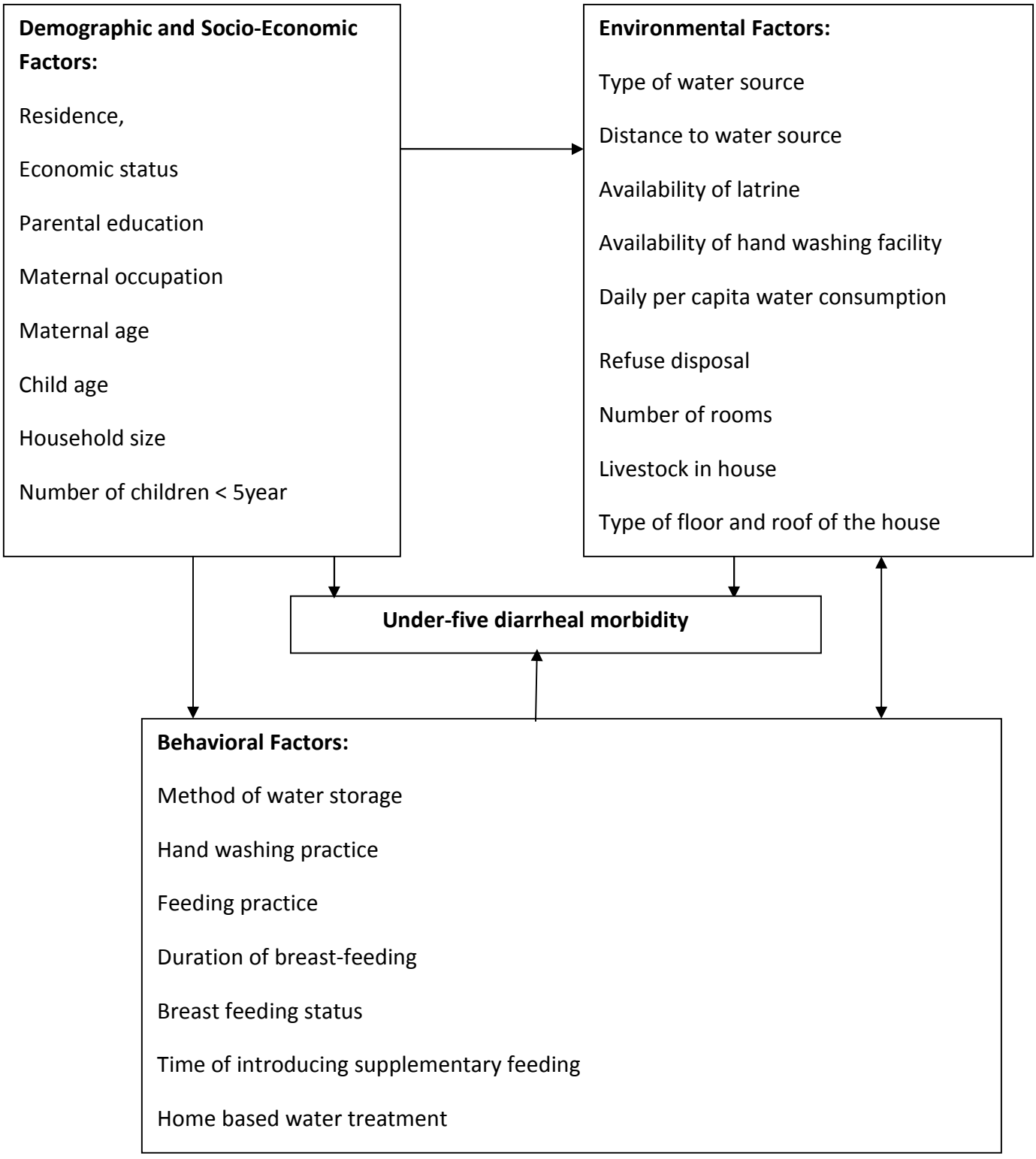

Figure 1: Conceptual framework on the potential determinants of childhood diarrheal morbidity, constructed from different literatures

3. Objectives

3.1.General objective

- To assess the magnitude and associated factors of diarrhea among children under-five years of age

3.2 Specific objectives

- To determine the magnitude of diarrhea among children under-five years of age
- To identify factors associated with diarrhea among children-under five years of age

4. Methods

4.1.Study design

A community based cross-sectional study was done to assess the magnitude and associated factors of acute diarrheal disease among children under-five years of age.

4.2.Study area and period

The study was conducted in Laelay-Maychew woreda and data was collected from February 01 to February 15, 2015. Laelay-Maychew is one of the woredas found in central zone of Tigray region, Northern Ethiopia. The study site is approximately 1024 kilometers from Addis Ababa and 250 kilometers from Mekelle, the capital city of Tigray region. It is bordered by Merebleke (northern), Naeder-Adet (southern), Tahtay-Maychew (western), and Adwa (eastern). The district is divided in to fifteen rural and one urban kebeles (the smallest administrative unit in Ethiopia), having a total population of 89,052 residents with 50.15% of the population were females. The total households of the district were 16,218 and 13.13% of the population were children under five years of age. It has 40 primary and one secondary school. The population is predominantly Orthodox Christian by religion. The main weather condition of the woreda is weyna-dega with some part of it having kola weather condition. Agriculture is the main source of the district's livelihood. Health services in the district were provided by four health centers and thirteen health posts. At the kebele level, health care is delivered by health extension workers who were assigned to render health services at the local level. It has 69% measles, 70% Rota virus-1 and 65% Rota virus-2 immunization coverage. Latrine accessibility, latrine utilization, model households and safe drinking water coverage of the district was 95%, 80%, 60% and 80% respectively (from the woreda health office 2007 E.C report).

Figure 2: Location of Ethiopia in the African continent, 2015 **Figure 3**: Location of Tigray in Ethiopia, 2015

Figure 4: Location of woreda laelay maichew in Tigray region, 2015

4.3.Source and study population

All households with mothers/care takers who have under-five children in the district and randomly selected households with at least one under five-child in selected kebeles were the source and study populations, respectively.

4.4.Inclusion and exclusion criteria

4.4.1. **Inclusion criteria**:

- Households having child/children under five years
- Families who had permanent residence in the area for at least six months

4.4.2. **Exclusion criteria**:

- Children who were chronically ill and with persistent diarrhea for greater than two weeks
- Children of homeless family, because those children may not had comprehensive information on the explanatory variables.
- Critically ill or suffering mothers or care givers of the index child, since it is unethical to take routine information from a suffering person or difficult to obtain complete information

4.5.Sample size calculation

Using EPI INFO for window version 7, sample size was calculated for each specific objective and the highest sample size was taken (n=543).

Specific objective one: magnitude of under-five diarrhea

Using single population proportion formula by assuming 31% of the under five-children had two-week prevalence of diarrhea from a study done in Arba-Minch rural community [34] with 95% confidence level, 5% desired precision and taking design effect of 1.5, accounted for two-stage sampling. Adding 10% for none response rate, the total calculated sample size were 543.

$$n_1 = \frac{[(Z\alpha/2)^2 \times P \times (1-P)]}{d^2} \times D$$

Where: n= the required sample size

Z= the standard score corresponding to 95% CI, and was equal to 1.96

P= the proportion of diarrhea which was assumed to be 31%

d^2= level of precision (margin of error) which was taken 5%

D= design effect taking 1.5

Specific objective two: factors associated with under-five diarrhea

Using two population proportion formula:

Considering maternal education, water source and hand washing practice of mothers as major determinant of under-five diarrhea taken from study done in Arba-Minch rural community, Derashe district and Dejen district respectively.

Determinant factor	$Z\alpha_{/2}$ of 1-β (power)	$Z\alpha_{/2}$ of 95% confidence level	Ratio (Unexposed: Exposed)	P_1	RR	OR	P_2	n
Maternal education	0.84	1.96	1	25.6	1.59	2.00	40.8	541
Water source	0.84	1.96	1	42.1	1.63	3.00	68.6	185
Hand washing practice of mothers	0.84	1.96	1	35.4	1.48	2.00	52.3	482

Where p_1 is the proportion of under-five diarrhea among unexposed (educated mothers, households with improved water source and mothers who wash their hand with water and soap/ash)

Where p_2 is the proportion of under-five diarrhea among exposed (illiterate mothers, households with unimproved water source and mothers who wash their hand with water onl)

4.6.Sampling procedure

A two stage stratified sampling method was employed to select households which have under five children. In the first stage, the urban kebele was taken purposively and four rural kebeles (more than 25% of the total) were selected using simple random sampling (lottery method) from the fifteen rural kebeles after stratifying the existing kebeles by residence. Under-five diarrheal morbidity was assumed to be differing by residence. In the second stage, proportional to size allocation, households with under-five children were selected using systematic sampling technique (every 10^{th} households) out of the sampled kebeles. Households with at least one under five years of age child were eligible for the study. One child was selected at random to collect information on the child's demographic and health characteristics for Households with two or more under 5 years of age children. The first household was selected randomly at the center of the kebele and the subsequent households were selected systematically to the left side of each household. When the selected households had no under-five children, the next neighborhood household was selected.

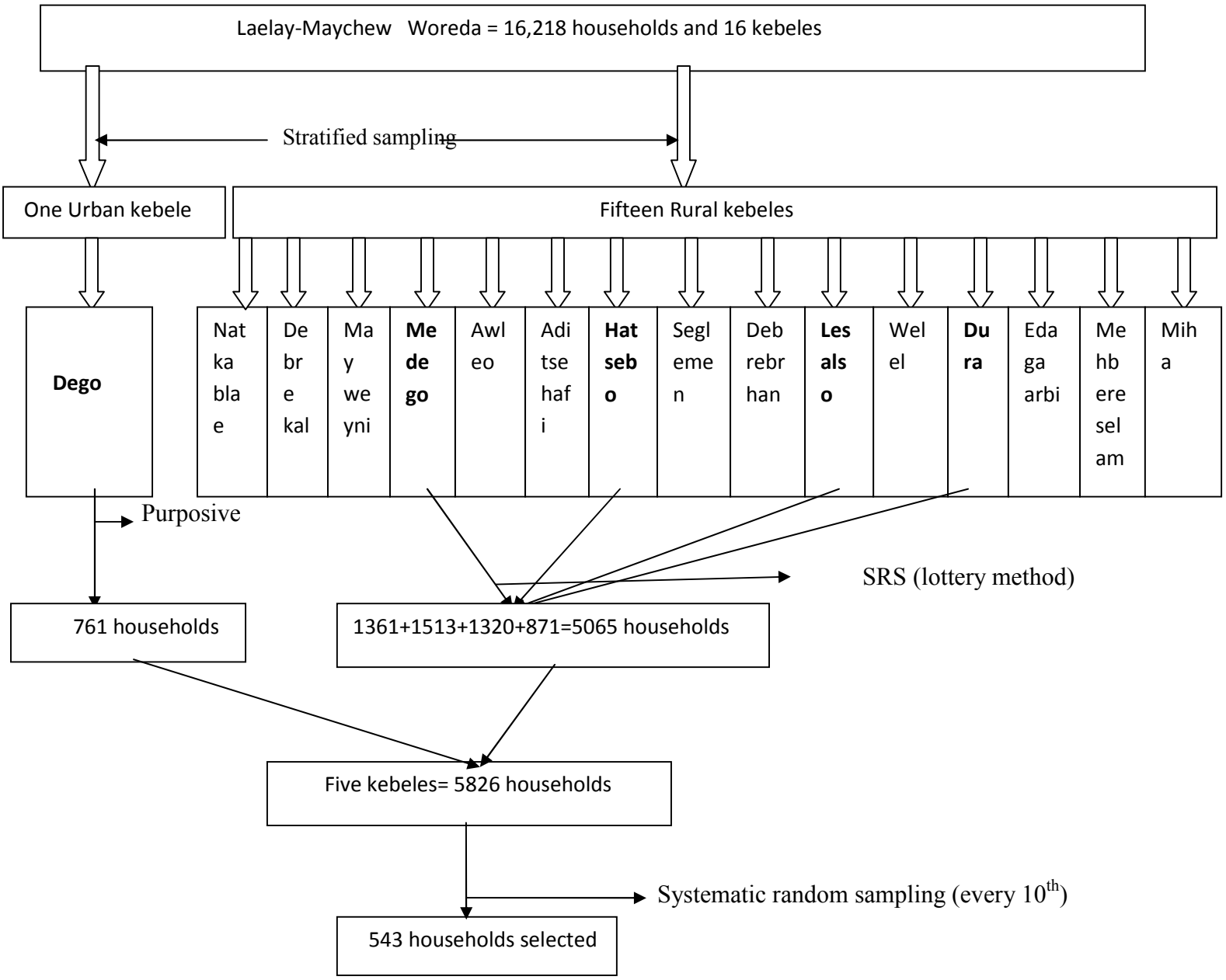

Figure 5: Schematic presentation of sampling procedure

4.7.Data collection procedures (instrument, personnel and data quality control)

Data was collected using standard questionnaire and observational check list tested previously and administered by an interviewer. The questionnaire was prepared based on EDHS and WHO core questionnaires related to diarrhea. The questionnaire was written in English, translated into Tigrigna (local language), and then translated back into English to assure its accuracy. The respondents were primarily mothers of eligible children-under five years of age, but in the absence of the mother, the next primary caregiver was interviewed.

Five data collectors who were clinical nurses and Tigrigna speakers were trained in questionnaire administration and data collection procedures. Pretest was done in 5% the respondents in another Kebele of the same study area. The result of the pretest was used to correct some unclear ideas and statements. The data collection was supervised by two supervisors (Health Officers) and the principal investigator at the center. Their role was to daily check the consistency, clarity and completeness of the collected questionnaires. The data collectors along with their supervisors took two days training about the questionnaire and data collection procedures.

4.8.Study variables

Outcome (Dependent) Variable: experience of diarrhea in a child in the last two weeks period

Explanatory (Independent) Variables

1) **Demographic and Socioeconomic factors:**
   Residence,
   Households' economic status,
   Household size,
   Parental education,
   Maternal occupation,
   Maternal age
   Number of children under-five years of age, and
   Child's age
2) **Environmental factors**:
   Type of water source,
   Distance to the water source,
   Daily per capita water consumption
   Availability of latrine facility
   Availability of hand washing facility,
   Number of rooms,
   Livestock in house,
   Type of floor and roof of the house, and
   Refuse disposal method
3) **Behavioral factors**:
   Feeding practices,
   Hand washing practice,
   Home based water treatment,
   Duration of breast-feeding,
   Breast feeding status, and
   Time of introducing supplementary feeding

4.9.Operational definitions

- Diarrhea: is defined as having three or more loose or watery stools per twenty four hours in two weeks period preceding the data collection, as reported by the mother/care taker of the child.
- Prevalence: the number of diarrhea cases at the time of the interview divided by the total number of households included in the study.
- The economic status of households was categorized in to: lowest, second, middle, fourth and highest using wealth index which was calculated from the household's assets using principal component analysis (PCA) (Rutstein et al., 2000).
- Exclusive breast feeding: A child who receives breast milk only and no other food, solid or liquid with the exception of vitamins, minerals and medicines (WHO and UNICEF, 2010).
- Proper refuse disposal: if the refuses where burned, buried in pit otherwise considered as improper.
- Improved water source: Water from protected springs and/or wells, from pipe and from distribution post unless considered as unimproved (WHO and UNICEF joint monitoring program for water supply and sanitation, 2010).
- Per capita water consumption was calculated by considering frequency of water collection in a day, capacity of the container and family size. Therefore,

$$\text{Per capita water consumption} = \frac{\text{frequency of water collection per day X capacity of container}}{\text{Family size}}$$

- Improved latrine: pour flush to piped sewer system/septic tank/pit latrine, VIP and pit latrine with slab otherwise considered as unimproved (WHO and UNICEF, 2010).
- Index child: refers to a child that was included in the study from a household to have information on the demographic and health characteristics.

4.10. Data management and analysis procedures

The data was entered in to a computer using Epi Info 3.5.3 software and exported to SPSS V.21 statistical software for cleaning and further analysis of the data. Descriptive statistics was done to describe the study populations using measures of frequency, disease occurrence, central tendency and dispersion that were displayed using tables. Due to the binary nature of the outcome variable, binary logistic regression analysis was used to determine the OR and 95% CI of the effect of the different independent variables on the outcome variable. The necessary assumption of logistic regression was checked using Hosmer and Lemeshow goodness-of-fit-test statistics. To reduce excessive number of variables and instability of the model, only variables with P-value < 0.2 in the bivariate analysis were considered for inclusion in the multivariate analysis to control for the effect of confounders. Variables with P-value < 0.05 in the multivariate analysis (final model) were considered as significantly associated with the outcome variable.

4.11. Ethical considerations

Ethical approval and clearance was obtained from Institutional Ethical Review committee (IRC) of Addis Ababa University Medical faculty, School of Public Health. Permission was also obtained from concerned bodies of Laelay-Maychew district. Full verbal consent was obtained from the mothers/caretakers of the child after clear explanation was given about the aim of the study. Confidentiality and privacy was maintained during data collection, analysis and reporting in which the information obtained from the respondents was not shared with anyone other than the data collectors and principal investigator. Children with diarrhea during the data collection process were given ORS and health education related to diarrhea by the data collectors and advised their family to take them to the nearby health institution for better management.

4.12. Dissemination of results

The result of this study will be disseminated to Ministry of Health, Tigray regional health bureau, Laelay-Maychew zonal health department, Laelay-Maychew district health office and AAU school of public Health. The findings will also be disseminated to different concerned organizations that will have contributions to improve the health condition of the community through presentation and publication of the paper.

5. Result

5.1. Descriptive statistics of the study populations

5.1.1. Demographic and socio-economic characteristics of the households

A total of 543 households were included in the study and a complete response (100%) was obtained from all respondents. The mean age of the respondents was 32.7(±7.1) years with the majority of them 248(45.7%) were 35 or greater years of age. The majority of the respondents 280(51.6%) were illiterate and 403(74.2%) were farmers by occupation. The majority of the households 423(77.9%) had one under five child in their family and the mean family size of the households was 5.7(±1.9) persons. Almost all 532(98%) of the respondents were Christian in religion (see table 1).

Table 1. Demographic and socio-economic characteristics of the households in Laelay-Maychew district, Tigray region, Ethiopia, 2015

Variable name	frequency (n=543)	Percentage (%)
Number of under five children in the household		
One child	423	77.9
Two child	120	22.1
Household family size		
five and Less	258	47.5
More than five	285	52.5
Educational status of the mother		
Illiterate	280	51.6
Primary	187	34.4
Secondary and above	76	14

Variable name	Frequency (n=543)	Percentage (%)
Occupation of the mothers		
Farmer	403	74.2
housewife	103	19
others	37	6.8
Age of mothers category		
18-24	72	13.3
25-34	223	41.1
35 and more	248	45.7
Education of the fathers		
Illiterate	220	40.5
Primary	212	39.1
Secondary and above	111	20.4
Occupation of fathers		
Farmer	448	82.5
Government employee	35	6.4
Others	60	11.1
Marital status		
Married	504	92.8
Divorced	28	5.2
Others	11	2
Residence		
Urban	71	13.1
Rural	472	86.9
Religion		
Christian	538	99.1
Others	5	0.9

Variable name	Frequency	Percentage
Relation of respondents to child	**(n=543)**	**(%)**
Mother	532	98
Care taker	11	2
Wealth index		
Lowest	108	19.9
Second	97	17.9
Middle	120	22.1
Fourth	107	19.7
Highest	111	20.4
Mean age of mothers/care takers	32.7(±7.1 SD)	

5.1.2. Environmental characteristics of the households

Four hundred eighty six(89.5%) and 483(89%) of the households had dwelling with mud floor and corrugated iron roof respectively. 316(58.2%) and 70(12.9%) of the households had latrine and hand washing facility respectively. Majority of the latrine facility of the households were 300(94.9%) private and 195(61.7%) of them were not improved type and 217(68.7%) of the households had no feces seen in the hole of pit latrine. Most of the households 415(76.4%) disposes their waste material properly. Four hundred sixty(84.7%) of the households use improved type of water source and 293(54%) of the households take 30 minute or more to fetch water. The majority of the households 426(78.5%) had per capita per day water consumption 20 liter or less. One hundred sixty five(30.4%) of the households treat their drinking water at home (see table 2).

Table 2. Environmental characteristics of the households in Laelay-Maychew district, Tigray region, Ethiopia, 2015.

Variable name	Frequency (n=543)	Percentage (%)
Household floor type		
Mud	486	89.5
Cement	57	10.5
Household roof type		11
Wood	60	89
Corrugated iron	483	
Number of rooms		
One room	129	23.8
Two rooms	161	29.7
Three and more	253	46.5

Variable name	Frequency (n=543)	Percentage (%)
Animals live in same house n=485		
Yes	58	11.9
No	487	88.1
Latrine availability		
Yes	316	58.2
No	227	41.8
Type of latrine n=316		
Improved	121	38.3
Not improved	195	61.7
Latrine ownership n-316		+5
Private	300	94.9
Shared	16	5.1
Feces seen in the pit hole n=316		
Yes	99	31.3
No	217	68.7
If no latrine where they use n=227		
Open field	211	93
Other	16	7
Hand wash facility		
Yes	70	12.9
No	473	87.1
Refuse disposal method		
Proper	415	76.4
Improper	128	23.6
Water source		
Improved	460	84.7
Not improved	83	15.3

Variable name	Frequency (n=543)	Percentage (%)
Daily per capita water consumption		
Twenty liter and less	426	78.5
More than twenty liter	117	21.5
Time to water source		
Thirty minute and less	379	69.8
More than thirty minute	164	30.2
Home based water treatment		
Yes	165	30.4
No	378	69.6
Mean per capita per day water consumption	17.84±13.3SD	

5.1.3. Behavioral characteristics of the respondents

Majority of the respondents give their child 453(84.3%) other food in addition to BF. Most of the respondents 259(56.4%) were prepare gruel and 283(61.7%) of the respondents feed their children using cup and spoon. Most of the respondents 385(70.9%) wash their hand using soap/ash and water (see table 3).

Table 3. Behavioral characteristics of the respondents in Laelay-Maychew district, Tigray region, Ethiopia, 2015.

Variable type	Frequency (n=543)	Percentage (%)
The child take other food than breast feed		
Yes	459	84.3
No	85	15.7
Type of food the child take mostly n=459		
Cow's milk	46	10
Gruel	259	56.4
Adult food	121	26.4
Other	33	7.2
Child feed method n=459		
Hand	176	38.3
Cup and spoon	283	61.7
Hand washing method		
Water and soap/ash	385	70.9
Water only	158	29.1

5.1.4. Demographic and health characteristics of the indexed children

Three hundred four(56%) of the children were females with the majority of the children 195(35.9%) were in the age group of 36-59 months. The mean age of the children was 26.5(±15.4 SD) months. Four hundred sixty nine(95.9%) and 322(59.3%) of the children receive Rota and measles virus vaccine respectively. In this study, 96[17.7%, 95% CI(14.5-20.8) of the children had experience diarrhea in the two weeks period preceding the study (see table 4).

Table 4. Demographic and health characteristics of the indexed children in Laelay-Maychew district, Tigray region, Ethiopia, 2015

Variable name	Frequency (n=543)	Percentage (%)
Sex		
Male	239	44
Female	304	56
Age category		
Eleven month and less	107	19.7
12-23 month	140	25.8
24-35 month	101	18.6
Greater than 35 month	195	35.9
Current breast feeding status n=533		
Exclusive breast feed	80	14.7
Partial breast feed	210	38.7
No on breast feed	253	46.6
Age at supplementary feeding		
Less than six month	19	4.1
At six month	294	63.1
Greater than six month	153	32.8
Duration of breast feeding		
Less than 24 month	287	53.2
Greater month and more	252	46.8

Variable type	Frequency (n=543)	Percentage (%)
Measles virus vaccine		
Yes	469	95.9
No	20	4.1
Rota virus vaccine		
Yes	322	59.3
No	221	40.7
Have diarrhea in the last two weeks		
Yes	96	17.7,95%CI(14.5,20.8)
No	447	82.3
Mean age of children in month		26.5±15.4 SD

5.2. Determinants of childhood diarrhea: Bivariate analysis

5.2.1. Demographic and Socio-economic determinants

In the bivariate analysis, educational status of the respondents, age of the respondents and residence were found to be significantly associated with under-five diarrhea. Children of mothers/care takers who completed primary education were less probable to have diarrhea compared to children of mothers who were illiterate [COR: 0.51, 95%CI(0.31,0.84)]. Likewise children of mothers who were secondary and above educational status were less likely to experience diarrhea compared to children of mothers who were illiterate [COR: 0.13, 95% CI(0.04,0.43)]. Children of mothers aged 18-24 were about two times more likely to have under five diarrhea compared to children of mothers 35 or more age [COR: 2.34, 95% CI(1.31,4.18)]. But children of mothers 25-34 years of age were less likely to experience diarrhea compared to children of mothers 35 or more age [COR: 0.55, 95% CI(0.33,0.94)]. Children from households of rural community were about five times more likely to have diarrhea compared to children of urban community households [COR: 5.56, 95% CI(1.71,18.07)]. In this study the number of under five children in the household, households family size, educational status of fathers and households wealth status were not showed significant association with under five diarrhea (see table 5)**.**

Table 5. Demographic and socio-economic determinants of under-five diarrhea in Laelay-Maychew district, Tigray region, Ethiopia, 2015.

Variable name	Diarrhea n(%)	No diarrhea n(%)	COR(95% C.I)
Number of under-five children			
One	73(17.3)	350(82.7)	0.88(0.52,1.48)
Two	23(19.2)	97(80.8)	1
Household family size			
Four and less	31(17.2)	149(82.8)	0.95(0.59,1.53)
More than four	65(17.9)	298(80.1)	1
Education of the mother			
Illiterate	67(23.90)	213(76.10)	1
Primary	26(13.90)	161(86.10)	0.51(0.31,0.84)*
Secondary and above	3(3.90)	73(96.10)	0.13(0.04,0.43)*
Education of father			
Illiterate	31(14.10)	189(85.90)	1
Primary	38(17.90)	174(82.10)	1.33(0.79,2.23)
Secondary and above	27(24.30)	84(75.70)	1.96(1.10,3.49)*
Age of mother(year)			
18-24	25(34.70)	47(65.30)	2.34(1.31,4.18)*
25-35	25(11.20)	47(65.30)	0.55(0.33,0.94)*
More than 35	46(18.50)	202(81.50)	1
Residence			
Urban	3(4.20)	68(95.80)	1
Rural	93(19.7)	369(80.30)	5.56(1.71,18.07)*
Wealth index			
Lowest	26(24.10)	82(75.90)	1.28(0.67,2.44)
Second	14(14.40)	83(85.60)	0.68(0.33,1.42)
Middle	22(18.30)	98(81.70)	0.91(0.47,1.75)
Fourth	12(11.20)	95(88.80)	0.51(0.24,1.09)*
Highest	22(19.80)	89(80.20)	1

5.2.2. Environmental determinants

Households' environmental variables and their relationship with under-five diarrhea were assessed on the bivariate analysis. But only water source and daily per capita water consumption were found to be significantly associated with under-five diarrheal morbidity. Children from households who use improved water source were less likely to experience diarrhea compared to children from households who use unimproved water source [COR: 0.32, 95% CI(0.19,0.53)]. Similarly children from households with less than or 20 liter per capita per day water consumption were 2.7 times more likely to develop diarrhea than children from households with greater than 20 liter per capita per day water consumption [COR: 2.71, 95% CI(1.36,5.4)] (see table 6).

Table 6. Environmental determinants of under-five diarrhea in Laelay-Maychew district, Tigray region, Ethiopia, 2015.

Variable name	Diarrhea n(%)	No diarrhea n(%)	COR(95% C.I)
Latrine availability			
Yes	59(18.70)	257(81.30)	1.18(0.75,1.85)
No	37(16.30)	190(83.70)	1
Type of latrine			
Improved	26(21.50)	95(78.50)	1.34(0.76,2.38)
Not improved	33(16.90)	162(83.10)	1
Latrine ownership			
Private	51(17.00)	249(83.00)	0.21(0.07,1.57)
Shared	8(50.00)	8(50.00)	1
Hand washing facility			
Yes	14(20.00)	56(80.00)	1.19(0.63,2.24)
No	82(17.30)	391(82.70)	1
Refuse disposal method			
Proper	70(16.90)	345(83.10)	0.79(0.48,1.31)
Improper	26(20.30)	102(79.70)	1
Water source			
Improved	67(14.60)	393(85.40)	0.32(0.19,0.53)*
Not improved	19(34.90)	54(65.10)	1
Per capita water			
Twenty liter and less	86(20.20)	340(79.80)	2.71(1.36,5.4)*
More than twenty liter	10(8.50)	107(91.50)	1
Time to water source			
Thirty minute and less	65(17.20)	314(82.70)	1
More than thirty minute	31(18.90)	133(81.10)	1.13(0.70,1.81)
Home water treatment			
Yes	31(18.90)	134(81.10)	1.11(0.69,1.79)
No	65(17.20)	313(82.90)	1

5.2.3. Behavioral determinants

In the bivariate analysis, hand washing method of mothers/care takers was the only behavioral variable that showed significant association with under-five diarrheal morbidity. Children of mothers/care takers who wash their hand using water and soap/ash were less likely to develop diarrhea compared to those children of mothers/care takers who wash their hand with water only [COR: 0.59, 95% CI(0.37,0.94)]. Type of food the child take and child feed method were not showed any significant association with under five diarrheal morbidity (see table 7).

Table 7. Behavioral determinants of under-five diarrhea in Laelay-Maychew district, Tigray region, Ethiopia, 2015.

Variable name	Diarrhea n(%)	No diarrhea n(%)	COR(95% C.I)
Type of food the child take			
Cow's milk	14(30.40)	32(69.60)	1
Gruel	43(16.60)	216(83.40)	0.45(0.22,1.92)
Adult food	15(12.40)	106(87.60)	0.32(0.14,1.74)
Other	6(18.20)	27(81.80)	0.51(0.17,1.50)
Child feed method			
Hand	28(15.90)	148(84.10)	1
Cup and spoon	50(17.70)	233(82.20)	0.88(0.53,1.46)
Hand washing method			
Water and soap/ash	59(15.30)	326(84.70)	0.59(0.37,0.94)*
Water only	37(23.40)	121(76.60)	1

*p-value less than 0.2

5.2.4. Child health and demographic determinants

Bivariate analysis was done on the relationship of child demographic variables and under five-diarrhea. Therefore; sex, age, and duration of BF were showed significant associations with under-five diarrhea. According to this study, being a female was 1.8 times more likely to experience diarrhea than being a male [COR: 1.82, 95% CI(1.14,2.91)]. Children within the range of 36-59 months age were less likely to develop diarrhea compared to those less than eleven months age [COR: 0.49, 95% CI(0.26,0.95)]. But children within the range of 12-23, and 24-35 months age were not showed any significant association with under-five diarrheal morbidity. Children who were breast feed for less two years were about two times more likely to have diarrhea compared to children who breast feed for two and more years [COR: 2.34, 95% CI(1.46,3.76)] (see table 8).

Table 8. Child demographic and health determinants of under five diarrhea in Laelay-Maychew district, Tigray region, Ethiopia, 2015.

Variable name	Diarrhea n(%)	No diarrhea n(%)	COR(95% C.I)
Sex			
Male	31(13.00)	208(87.00)	1
Female	65(21.40)	239(78.60)	1.82(1.14,2.91)*
Age (month)			
Less than 11	21(19.60)	86(80.40)	1
12-23	42(30.00)	98(70.00)	1.75(0.96,3.19)
24-35	12(11.90)	89(88.10)	0.55(0.26,1.19)
More than 35	21(10.80)	174(89.20)	0.49(0.26,0.95)*
Current breast feeding			
Exclusive breast feed	18(22.50)	62(77.50)	1.16(0.13,4.13)
Partially breast feed	48(22.90)	162(77.10)	1.20(0.34,3.63)
Not breast feed	30(11.90)	223(88.10)	1
Age at supplementary feeding			
Less than six month	3(15.80)	16(84.20)	0.1290.25,3.37)
At 6 month	52(17.70)	242(82.30)	1.05(0.63,1.76)
Greater than 6 month	26(17.00)	127(83.00)	1
Duration of BF			
Less than 24 month	67(23.30)	220(76.70)	2.34(1.46,3.76)*
24 month and more	29(11.50)	223(88.50)	1
Measles virus vaccine			
Yes	80(17.10)	389(82.90)	3.91(0.52,29.6)
No	1(5.00)	19(95.00)	1
Rota virus vaccine			
Yes	60(18.60)	262(81.40)	1.17(0.75,1.85)
No	36(16.30)	185(83.70)	1

*p-value less than 0.2

5.3. Determinants of under five diarrhea: Multivariate analysis

In the bivariate analysis any possible confounders were not controlled and assessing the independent effects of the covariates was difficult. So, an enter method of binary logistic regression technique was used to assess the independent effects of explanatory variables on under five diarrhea. To avoid excessive number of variables and unstable estimate in the final model, only variables with P-value less than 0.2 in the bivariate analysis were taken in the multivariate analysis. Model fit was checked by Hosmer-Lemeshow goodness-of-fit test statistics.

The multivariate binary logistic regression analysis identified that residence, sex of the child, mothers' educational status, water source, per capita per day water consumption, and mothers/care takers hand washing method had significant association with the occurrence of under-five diarrhea.

The odds of having diarrhea in children who lived in households of rural community were 1.5 times higher than the odds in children who lived in households of urban community [AOR: 1.52, 95% CI(1.26,4.87)]. According to this study, being a female was 3.8 times more likely to develop diarrhea compared to males [AOR: 3.85, 95% CI(1.8,8.22)]. Children of mothers who completed primary education were less likely to develop diarrhea compared to children of mothers who were illiterate [AOR: 0.16, 95% CI(0.06,0.41)]**.** Similarly children of mothers who completed secondary and above education were less likely to have diarrhea compared to children of illiterate mothers [AOR: 0.02, 95% CI(0.01,0.12)].

The odds of having diarrhea in children who lived in households where they had improved water source were less than the odds in children who lived in households where they had unimproved water source [AOR: 0.18, 95% CI(0.02,0.39)].

Likewise, children from households who use less than equal to 20 liter daily per capita water consumption were 1.5 times more probable to have diarrhea than those children from households who use greater than 20 liter per capita per day water consumption [AOR: 1.53, 95% CI(1.12,1.97)].

Children of mothers/care takers who wash their hand with water and soap/ash were less likely to develop diarrhea compared to children whose mothers/care takers who wash their hand with water only [AOR: 0.52, 95% CI(0.24,0.42)] (see table 9).

Table 9. Multivariate analysis on determinants of under-five diarrhea in Laelay-Maychew district, Tigray region, Ethiopia, 2015.

Variable name	COR(95%C.I)	AOR(95%C.I)
Residence		
Urban	1	1
Rural	5.56(1.71,18.07)	1.52(1.26,487)*
Sex of child		
Male	1	1
Female	1.82(1.14,2.91)	3.85(1.80,8.22) *
Age of child		
<11 month	1	
12-23	1.75(0.96,3.19)	1.85(0.60,5.65)
24-35	0.55(0.26,1.19)	0.16(0.02,1.09)
36+	0.49(0.26,0.95)	0.12(0.02,1.89)
Education of mother		
Illiterate	1	1
Primary	0.51(0.31,0.84)	0.16(0.06,0.41)*
Secondary and above	0.13(0.04,0.43)	0.02(0.01,0.12)*
Education of father		
Illiterate	1	1
Primary	1.33(0.79,2.23)	3.08(0.33,7.16)
Secondary and above	1.96(1.10,3.49)	1.91(0.56,6.50)
Age of mother		
18-24	2.34(1.31,4.18)	1.97(0.68,5.70)
25-35	0.55(0.33,0.94)	0.22(0.08,1.64)
Greater than 35	1	1

*p-value <0.05

Variable name	COR(95%C.I)	AOR(95%C.I)
Wealth status		
Lowest	1.28(0.67,2.44)	4.03(0.31,12.43)
Second	0.68(0.33,1.42)	0.42(0.14,1.27)
Middle	0.91(0.47,1.75)	0.68(0.25,1.85)
Fourth	0.51(0.24,1.09)	0.60(0.20,1.78)
Highest	1	1
Water source		
Improved	0.32(0.19,0.53)	0.18(0.02,0.39)*
Un improved	1	1
Per capita water consumption(liter)		
≤20	2.71(1.36,5.4)	1.53(1.12,1.97)*
>20	1	1
Hand wash method		
Water soap/ash	0.59(0.37,0.94)	0.52(2.40,4.20)*
Water only	1	1
Duration of breast feeding		
Less than 24 month	2.34(1.46,3.76)	0.29(0.05,1.59)
24 month and more	1	1

*p-value <0.05

6. Discussion

The finding of this study revealed that the two weeks period magnitude of diarrhea among under-five years of age children was 17.7% with 95% CI (14.5-20.8). From the demographic and socio-economic factors; maternal education, residence and sex of child were showed significant association after adjusting the other variables. Controlling the other variables, households water source and per capita per day water consumption were the only environmental factors which showed significant association with under-five diarrhea. Of all behavioral factors tested in, mothers/care takers hand washing method remained significant making the other variables constant.

The magnitude of under-five diarrhea in this study is similar with EDHS 2011 report (13%) and studies conducted in Egypt (19.5%), Ghana (19.2%), Benishngul-Gumuz (22.1%), west Gojam zone (18%) and eastern Ethiopia Kersa district (22.5%) [12, 24, 25, 30, 31, 35]. But this is relatively high compared to a study done in east Gojam zone (6.5%) [29] and relatively low compared to a study done in Arba-Minch rural community (31%) [34]. This difference could be due to the population difference in which in east Gojam zone the study was conducted purposively in a woreda with 90% latrine coverage. And this discrepancy in magnitude with the study done in Arba-Minch rural community could be their difference in socio demographic, basic environmental and behavioral characteristics of the respondents.

The finding on maternal education proposed that mothers with higher education experienced better chance of a child being spared of diarrhea compared to lower education mothers controlling other variables which is consistent with cross-sectional studies done in Iraq [21], Ghana [25], Benishangul-Gumuz [30], west Gojam zone [31] and south west Ethiopia rural community [36]. This is probably due to education provides important information about

personal and environmental hygiene, weaning and feeding practices, and disease symptoms which boosts timely action on childhood illness.

Children from rural community were more probable to have diarrhea compared to children from the urban community. This is in contrast with the study done in Iraq [21] but in line with the studies conducted in Pakistan [20], Debrebirehan referral hospital [33] and eastern Ethiopia [35]. This could be due to the urban community may have an access to improved water source, sanitation facility, health care facility and better Knowledge about the prevention and control of disease.

The study also shows that being a female child was more likely to develop diarrhea compared to male child. This can be due to the community might favor to males in food preparation, weaning practices and other prevention methods.

Children from households who use improved water source were less vulnerable to experience diarrhea compared to children from households who use unimproved water source which is consistent with cross-sectional studies done in west Gojam zone [31], and case control study done in Derashe district [40]. This is can be explained by improved water source tends to be less contaminated by pathogenic microorganisms than unimproved water source and thus decrease under-five diarrhea.

Children from households who use 20 liter and less as their per capita per day water consumption were more probable to develop diarrhea compared to children from households who use greater than 20 liter as their per capita per day water consumption.

This finding is in contrast with a study from Nekemte town [32] but in agreement with studies from south western Ethiopia, Keffa Sheka zone and southern Ethiopia, rural Shebedino district which showed that per capita per day water consumption was lower in households where child had diarrhea [41, 42]. This is might be due to households with adequate amount of water provides them for better personal hygiene and environmental sanitation and hence reduces under five-diarrhea [44, 45].

Children whose mothers/care takers wash their hand with water and soap/ash were less likely to develop diarrhea compared to children whose mothers/care takers wash their hand with water only. This is in agreement with the findings from Bangladesh [38], Ghana [25, 39], south west Ethiopia [36], and Dejen district, North West Ethiopia [46]. This could be explained by since they are the main care givers of the child and hand washing with soap/ash clears microorganisms in their hand highly compared to hand washing with water only.

In this study, the sanitary facility (availability of hand washing facility, availability of latrine, type of latrine, and waste disposal method) were not showed any significant association with under-five diarrhea after controlling the other factors. This is in line with the findings from Sheko district rural community [36] and Arba-Minch rural community [34]. But it is in contrast with cross-sectional studies done in Benishangul-Gumuz Regional State [30], west Gojam zone [31], and Derashe District, Southern Ethiopia [40]. This may be explained by having of this facilities doesn't necessarily indicate their utilization and again may be due to the homogeneous effect of the populations.

The number of under-five children and family size were not significantly associated under five-diarrhea. This is consistent with the studies done in urban south western Ethiopia [9] and Derashe district [40] but in contrast with the finding from Gojam Hullet Ejju Ense woreda where greater family size was associated with under five diarrhea [29]. There might be a difference in maternal attention and general living standard that could explain the discrepancy. As the family size of the household becomes higher, there may be crowding which deteriorates the hygiene condition, which in turn increases the probability of contact with pathogens. Also there may be a competition for mother's attention and other resources.

7. Strengths and Limitations of the study

7.1. Strength of the study

- Being a community based study help to detect the true magnitude and factors, and helps to generalize the finding.
- Using WHO and EDHS core based standard questionnaire
- It was tried to cover the different demographic and social-economic, environmental and behavioral factors that were supposed to determine under-five diarrhea.

7.2. Limitation of the study

- Recall bias may occurred on two weeks occurrence of diarrhea and it may under estimate the magnitude
- Respondents difference in perception on definition of diarrhea, some behavioral and environmental factors
- As being a cross sectional study, it is difficult to detect seasonal variations (since it was done in the dry season it may under estimate the magnitude) and to setup cause effect relationship

8. Conclusions and recommendations

8.1. Conclusion

From this study we conclude that the magnitude of diarrhea among under five children was 17.7% and this was relatively high despite water and sanitation programs were conduct in the district. The major predictors of under-five diarrhea were residence, sex of child, mothers/care takers educational status, water source of the households, daily per capita water consumption of the households, and mothers/care takers hand washing method. The sanitation facilities (availability of latrine, type of latrine, hand washing facility, and waste disposal method) and water supplies (distance to water source, home based water treatment) were not showed any significant associations.

8.2. Recommendation

- According to this result it is better if the woreda administration support females education at least to complete primary school
- Also it is better to construct improved water source so as to provide safe water and increase their daily water consumption in the community.
- We also recommend to the woreda administration in general and woreda health office in particular to give health education program to the community about hand washing methods to use soap at recommended times.
- Executing of these recommendations will be expected to improve under-five diarrheal morbidity in the community.

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10. Annex I: Questionnaire English version

Addis Ababa University

College of Health Science

School of Public Health

Questionnaire prepared to assess childhood diarrheal disease and associated factors

in Laelay-Maychew district, 2014/15

Introduction and Consent

Hello. My name is _____ I am on behalf of Teklit Angesom, student of Addis Ababa University School of Public Health. He is conducting a research for the partial fulfillment of masters' degree on "demographic and socioeconomic, environmental and behavioral effects on childhood diarrhea among children under-five years of age in laelay-Maychew woreda. Your household is selected randomly to participate in this study and there are other households to be selected randomly in the woreda. Therefore, I am going to ask you several questions about those factors and related issues about the research.

He has received permission from Addis Ababa university medical faculty school of public health, Woreda council office and respective health offices to conduct this study.

I would very much appreciate your participation in this interview. This information will help the government and NGOs to plan health services. We assure that the interview process will not bring any harm to you and your family. Whatever information you provide will be kept strictly confidential, and will not be shared with anyone other than the investigator.

Participation in this survey is voluntary, and if we should come to any question you don't want to answer, just let me know and I will go on to the next question; or you can stop the interview at any time. However, we hope you will participate in the survey since your views are important.

At this time, do you want to ask me anything about the survey?

Would you be willing to participate? Yes No

Signature of the respondent:

Date:

Interviewer name:

Signature:

Date:

How to approach and interview households

- Once you get the household, you should get permission to enter in to the house. Do not rush in to the house without the permission of the household members.
- Introduce yourself by name, and explain the purpose of your visit.
- Tell the household member "WHY" and "HOW" the household is selected for the study.
- Ask whether the mother/caretaker of the child is present.
- Briefly explain the purpose of the study by reading what is written on the questionnaire, and ask for her consent.
- If the mother/caretaker is not around, take an appointment for another visit.
- At the end of the interview, tell the respondent that it is the end of the interview, and thank the individual for giving her view.

THANK YOU FOR YOUR COOPERATION

Interviewer name:

Supervisor name:

Date:

Identification

Q101. Name of kebele----------

Q102. Residence: 1. Urban 2. Rural

Q103. Number of persons in the household----------

Q104. Number of under-five children in the household----------

Part one: Demographic and socioeconomic characteristics

No	Questions	Response
Q105.	Relation of the respondent to the child	1. Mother 2. Care taker
Q106.	Age of the mother/caretaker	----------years
Q107.	Marital status of the mother/caretaker	1. Married 2. Divorced 3. Single 4. Widowed
Q108.	Religion of parents/caretaker	1. Christian 2. Muslim 3. Other (specify)
Q109.	Educational status of the mother/caretaker	1. Illiterate 2. Read and write 3. 1-4

		4. 5-8 5. 9-12 6. 12+
Q110.	Occupation the mother/caretaker	1. Government employee 2. Housewife 3. Merchant 4. Farmer 7. Others (specify)
Q111.	Age of the child's father	----------years
Q112.	Educational level of the father	1. Illiterate 2. Read and write 3. 1-4 4. 5-8 5. 9-12 6. 12+
Q113.	Occupation of the father	1. Government employee 2. Merchant 3. Farmer 4. Daily labour 5. Others (specify)

Q114.	Do you have any of the following? (More than one is possible) Radio? Television? Mobile Telephone? None mobile telephone? Electricity? Electric mitad? Chair? Table Bed with cotton/sponge/spring mattress? Watch/clock? Refrigerator? Kerosene lamp/pressure lamp?	Yes (√) No (x)
Q115.	Does any member of this household own: Bicycle? Motorcycle or motor scooter? Animal-drawn cart? Car or truck?	Yes(√) No (x)
Q116.	Does any member of this household	1. Yes

	own any agricultural?	2. No
Q118.	Does the family have livestock herds, Other farm animals or poultry?	1.Yes 2.No skip ⟶ Q120
Q119.	If the answer for Q118 is yes, type their number Milk cows, oxen or bulls? Horses, donkeys, or mules? Camels? Goats? Sheep? Chickens? Beehives?	Milk cows, oxen or bulls ---------- Horses, donkeys, or mules ---------- Camels ---------- Goats ---------- Sheep ---------- Chickens ---------- Beehives ----------
Q120.	Does any member of this household have a bank or microfinance saving account?	1.Yes 2. No

Part two: Environmental health conditions

Q121.	Type of floor material of the living house (observation)	1. Mud 2. Wood 3. Cement 4. Other (specify)
Q122.	Type of roof material of the living house (observation)	1. Wood 2. Thatched

		3. Corrugated iron sheet 4. Others (specify)
Q123.	Do animals live in the same house where the member of the family live (observation)	1.Yes 2.No
Q124.	Number of rooms in the house	----------
Q125.	Do you have hand washing facility?	1.Yes 2.No
Q126.	Do you have latrine?	1.Yes 2.No skip → Q130
Q127.	Type of latrine facility (observation)	1. Flush/pour flush to piped sewer system 2. Flush/pour flush to septic tank 3. Flush/pour flush to pit latrine 4. Ventilated improved pit (VIP) latrine 5. Pit latrine with slab 6. Pit latrine without slab 7. Others (specify)
Q128.	Ownership of the latrine	1.Private 2.Shared with neighbors
Q129.	Is feces seen around the pit hole (floor)? (observation)	1. Yes 2. No
Q130.	Is feces seen around the house (compound)? (observation)	1. Yes 2. No

Q131.	If the household has no latrine, where do you dispose human waste?	1. Open field 4.Other (specify)
Q132.	How do you dispose refuse?	1. Pit 2. Open field 3. Burning 4. Garbage can 5.Other

Q133**.**	From where do you get water for drinking?	1. Pipe 2. Protected well/spring 3. Unprotected well/spring 4. River 5. Other (specify)
Q134**.**	Distance from house to water source	---------Minutes
Q135.	Type of collection container	1. Pot 2. Plastic bucket 3. Iron bucket 4. Jerry can 5. Other
Q136.	How did you transport the collected drinking water to the house yesterday?	1. In a covered container 2. In an uncovered container 3. Other (specify

Q137.	How many times did you collect water for drinking yesterday?	----------
Q138.	Capacity of the container, which you used to collect water for drinking yesterday?	----------liter
Q139.	Do you treat your water in any way to make it safer to drink?	1.Yes 2.No skip ⟶ Q138
Q140.	What do you usually do to the water to make it safer to drink?	1. Boil 2. Add bleach/chlorine 3. Strain through a cloth 4. Others (specify)

Part three: Behavioral conditions

Q141**.**	Does the child take other food than breast milk?	1. Yes 2. No skip ⟶ Q142
Q142.	Do you separately prepare food using separate material for the child?	1. Yes 2. No
Q143.	What food/fluid is the child mostly taking (if the child is not on exclusive breast feeding)?more than one is possible	1. Cow's milk 2. Powder milk 3. Gruel 4. Adult food 5. Other (specify)
Q144.	What do you use to feed the child?	1. Hand 2. Cup and spoon

		3. Cup 4. Bottle 5. Other
Q145.	Did you wash your hands yesterday?	1.Yes 2.No skip ⟶ Q145
Q146.	In which condition did you wash your hand?	1.Before food preparation and eating 2. After eating 3.After visiting latrine 4. After cleaning of child bottom 5. other (specify)
Q147.	What did you use to wash your hands?	1.Soap & water 2. Ash & water 3. Only water 4. Others (specify)

Part four: Information of the index child

Q148.	Age	----------Months
Q149.	Sex	----------
Q150.	Birth order of the child	
Q151.	Have you ever breastfed your child?	1. Yes

		2. No skip ⟶ Q153
Q152.	For how long did you breastfed your child?	---------- Months
Q153.	What is his/her current breast feeding status?	1.Exclusive breast feeding 2. Partial breast feeding 3. Not breast feeding
Q154.	At what age did the child start supplementary feeding/weaning food?	----------Months
Q155.	Did the child receive measles vaccination(for those greater than nine months age)	1. Yes A. by the response of the respondent or B. by checking card 2. None
Q156.	Did the child receive Rota virus vaccination?	1.Yes Rvv1 Rvv2 A. by the response of the respondent B. by checking card 2.No
Q157.	Does your child experience diarrhea in the last two weeks	1. Yes 2. No ⟶ end.

Date of the interview---------- Name of the interviewer---------- Signature----------

Name of the supervisor…… Signature……

11. Annex II: Questionnaire Tigrigna version

ኣዲስ ኣበባ ዩኒቨርስቲ

ፋኩሊቲ ሕክምና

ትምህርቲ ክፍሊ ሓለዋ ጥዕና ሕብረተሰብ

ኣብ ወረዳ ላዕላይ ማይጨይ ዕድሚኡ ምትሕቲ ሓሙሽተ ዓመት ኣብ ዘለዉ ህፃናት ዝክሰት ናይ ዉፀኣት ሕማምን ወሰንቲ ዝኾኑ ምክንያታትን ንምፍላጥ ዝተዳለወ መሕትት,2015

<u>ቃለ መሕትት ቅድሚምጅማር ካእዞም ዝስዕቡ ነጥብታት ኣስተዉዕል</u>

1. እቲ ንዕንዓት ዝተመረፀ ገዛ ምስ ረከብካ ንዉሽጢን ምእታው መጀመርያ ኣብቲ ገዛ ምስ ዘሎ ፍቃድ ክትረክብ ኣለካ ፤ ፍቃድ ከይረከብካ ብፍፁም ከይተኣቱ ።
2. ኣብቲ ገዛ ምስ ዘሎ ሽምካ ብምዝራብ ባዕልካ ኣፋልጥ፤ ዝመፃካሉ ዓላማን እቲ ገዛ ንዕንዓት ከመይን ንምን ታይን ከም ዝተመረፀን ንገሮም ።
3. እቲ ዝረከብካዮ ሰብ ናይቲ ህፃን ኣዶ ወይ ተከናካኒት እንተዘይኮይና ነኽፅወዐልካ ሕተቶ/ታ ።
4. ናይቲ ህፃን ኣዶ ወይ ተከናካኒት ምስ ረከብካ፤ ናይቲ ዕንዓት ዓላማኣብቲ ናይ ስምምዕ መሕትት ዝተፀሓፈ ብንባብ፤ ነቲ ቃለ መሕት ፊቓደኛ መካና ጠይቕ ።
5. ናይቲ ህፃን ኣዶ ወይ ተከናካኒት እንተዘይረኪብካያ፤ መኣስ ከምእትርከብ ሓቲትካ ንካሊእ ግዘ ቆፀሮ ሒዝካ ናብቲ ዝቅዕልገዛ ሕለፍ ።

<u>ናይ ፍቓድ/ስምምዕ መሕትት</u>

ሽመይ ----------ይበሃል ። ኣነ ኣብ ክንዲ ተክሊት ኣንገሶም ዝተበሃለ ናይ ኣዲስ ኣበባ ዩኒቨስቲ ፤ ክፍሊ ትምህርቲ ሓለዋ ጥዕና ሕብረተሰብ ተምሃራይ እየ መፅየ ዘለኩ ። እዚ ተምሃራይ ብዛዕባ ኣብ ትሕቲ ሓሙሽተ ኣመት ኣብ ዘለዉ ህፃናት ዝክሰት ናይ ዉፀኣት ሕማምን ምስ ማሕበራዊ ፣ ኢኮኖምያዊ ፣ ከባብያዊ ጥዕናን ኣተሓሕዛ ህፃንን ዘለዎ ርክብ ኣብ ወረዳ ላዕላይ ማይጨውንካለኣይ ዲግሪ ንምምላእ መፅናዕቲ ኣብ ምክያድ ይርከብ ። ስለዚ ገዛኩም ካብተን ንመፅናዕቲ ዝተመረፃ ሓንቲ ስለ ዝኾነት፤ እዞም ኣብ ላዕሊ ዝተገለፁ ምስ ዉፀኣት ትሕቲ ሓሙሽተ ዓመት ዝተተሓሓዙ ክሓተኩም እየ ።

እዚ መፅናዕቲ ንምክያድ ካብ ኣዲስ ኣበባ ዩኒቨስቲ ክፍሊ ትምህርቲ ጥዕና ሕብረተሰብ፣ ቤት ፅሕፈት ወረዳ ላዕላይ ማይጨውን ዝምልከቶም ኣካላትን ፍቓድ ረኪቡ እዩ ። እትህብዎ ሓበሬታ ንመንግስትን ዝተፈላለዩ ግብረ ሰናይ ኣካላትን ናይ ጥዕና ትልሚ ንምዉፃእ ይጠቅም እዩ ።

እዚ ቃለ መሕትት እዚ ነዓኩም ኮነ ንቤተሰብኩም ዝኮነ ይኩን ጉደኣት ከምዘየ ምፅእ ከረጋግፀልኩም ይፈቱ፡ ፡ ዝኮነ ይኩን እትህብዎ ሓበሬታ ብዘይካ ምስቲ መፅነዓይ ኣካል ሚስጢሩ ዝተሓለወ እዩ፡ ፡

ኣብዚ መፅናዕቲ ንምስታፍ ብድልየትኩም እዩ፤ ኣብ ሞንጎ ደስ ዘይበለኩም ሕቶ አንተሃልዩ ናብ ከፋሊ ሕቶ ሕለፍ በሉኒ፡ ፡ እቲ ቃለ መሕትት ኣብ ደስ ዝበለኩም ግዜ ምቁራፅ ይከኣል እዩ፡ ፡

እትሓቱኒ ሕቶ ኣሎዶ?

ኣብቲ መፅናዕቲ ንምስታፍ ፍቓደኛ ዲኩም/ኪንን? አወ---------- ኣይፋል---------

ናይ ተሓታቲ ፈርማ---------- ዕለት----------

ናይ ሓታቲ ፈርማ---------- ዕለት----------

<u>መለለዪ</u>

Q101. ሽምቀበለ ----------

Q102. ኣድራሻ 1. ከተማ 2. ገጠር

Q103. ጠቕላላ በዝሒቤተሰብ----------

Q104. በዝሒትሕቲ ሓመሽተ ኣመት ----------

<u>ከፍሊ ሓደ፡ ማህበራውን ኢኮኖምያዉን ኩነታት ዝምልከት</u>

ተ.ቁ	ሕቶታት	ናይ መልሲ ኣመራፅ ታት
Q105.	እቲ መላሲ ምስቲ ህፃን ዘለዎ ርክብ	1. ኣዶ 2. ተንከባካቢት
Q106.	ናይቲ ህፃን ኣዶ/ተንከባካቢት ድፅመ	----------ኣመት

Q107.	ናይቲ ህፃን አዶ/ተንከባካቢት ናይ ሓዳር ኩነ ታት	1.በዓልቲ ሓዳር 2.ዝተፋተሐት 3.ሓዳር ዘይገበረት 4. ሰብኣያ ዝሞታ 5.ካሊእ /ይጠቐስ /
Q108.	ሃይማኖት	1.ክርስትያን 2. መስሊም 3.ካሊእ /ይጠቀስ /
Q109.	ናይቲ ህፃን አዶ/ተንከባካቢት ናይ ትምህርቲ ኩነ ታት	1.ዘይተመሃረት 2.ምፅሐፍን ምንባብን ትክእል 3.1-4 4.5-8 5.9-12 6. ልዕሊ 12

Q110.	ናይቲ ህፃን አዶ/ተንከባካቢት ናይ ስራሕ ኩነ ታት	1.መንግስቲ ሰራሕተኛ 2.ናይ ገዛ እመበት 3.ነጋዴ 4.ሓረስተይ 5.ካሊእ /ይጠቀስ /

Q111.	ናይቲ ህጻን ኣቦ ዕድመ	----------ኣ መት
Q112.	ናይቲ ህጻን ኣቦ ናይ ትምህርቲ ኩነታት	1.ዘይተመሃረ 2.ምዕሐፍን ምንባብን ዝኽእል 3.1-4 4.5-8 5.9-12 6. ልዕሊ 12
Q113.	ናይቲ ህጻን ኣቦ ናይ ስራሕ ኩነታት	1.መንግስቲ ሰራሕተኛ 2.ነጋዴ 3ሓረስታይ 4.መዓልታዊ ሰራሕተኛ 5.ካሊእ /ይጠቀስ /
Q114.	እዞ ምኣብ ታሕቲ ተዘርዚሮም ዘለዉኣብ ቤተሰብኩም ኣለዉዶ? ኢለክትሪክ? ኢለክትሪክ መነነ? ወንበር? ጠረጴዛ?	እወ የለዉን ኢለክትሪክ …… 1 2 ኢለክትሪክ መነነ 1 2 ወንበር …… 1 2 ጠረጴዛ ……. 1 2 ኣራት ምስ ፍራሽ … 1 2

	ዓራት ምስ ፍራሽ? ሰዓት? ፍሪጅ? ፋኑስ?	ሰዓት ..... 1 2 ፍሪጅ..... 1 2 ፋኑስ 1 2
Q115.	ካብዞ ምዝስዕቡ ኣብ ቤተሰብኩም ዝዉን ንኣሎዶ? ብሽክለታ? ሞተር ሳይክል? ካረሳ/ጋሪ? መኪና?	እወ የለን ብሽክለታ..... 1 2 ሞተር ሳይክል..... 1 2 ካረሳ/ጋሪ ..... 1 2 መኪና 1 2
Q116.	ናይ ሕርሻ መረት ዝዉንን ኣብ በተሰብኩም ኣሎዶ?	1.እወ 2.የለን
Q117.	ናይ ቤተሰብኩም ዋና ናይ ገቢ ምን ጭኩም እንታይ እዩ?	1.ሕርሻ 2.ንግዲ 3.ደመወዝ 4.ካሊእ/ይተቀስ/
Q118.	ናይ ገዛ እንስሳት ኣለዉኩምዶ?	1.እወ 2.የብልናን ናብ Q120. ይዝለሉ

Q119.	ንሕቶ ቁፅሪ Q118.እወ እንተኾይኑ መልስኩም፤ በዝሉም ይፅሓፉ ናይ ፀባ ላሕሚ፣ ብዕራይ? ፈረስ፣ ኣድጊ፣ በቕሊ? ገመል? ጠል? በጊዕ? ደርሁ? ንህቢ?	ናይ ፀባ ላሕሚ፣ ብዕራይ ---------- ፈረስ፣ ኣድጊ፣ በቕሊ---------- ገመል ---------- ጠል ---------- በጊዕ ---------- ደርሁ---------- ንህቢ----------
Q120.	ዝኮነ ናይዚ ቤተሰብ ኣባል ናይ ማይክሮ ፋይናንስ ወይ ባንኪ መፅሓፍ ዘለዎ ኣሎዶ?	1.እወ 2.የለን

<u>ክፍሊ ክልተ፡ ናይ ከባብያዊ ጥዕና ዝምልከት</u>

Q121.	ናይ ዝነብሉ ገዛ ምድርበት ዓይነት(እቲ ገዛ ብምርኣይ ዝምለስ)	1.ሓመድ 2.ዕንጨይቲ 3.ስሚንቶ 4.ካሊእ /ይገለፅ
Q122.	ናይ ዝነብሉ ገዛ ሰርወ/ጣራ/ኣይነት (እቲ ገዛ ብምርኣይ ዝምለስ)	1.ዕንጨይቲ 2.ሳዕሪ 3.ቆርቆሮ

		4.ካሊእ /ይጠቀስ /
Q123.	እንስሳት ኣብ ዉሽጢ ዘኦምሓቢረን ድየን ዝነ ብራ? (እቲ ገዛ ብምርኣይ ዝምለስ)	1.እወ 2.ኣይኮናን
Q124.	በዝሒክፍሊ ናይቲ ገዛ	----------
Q125.	ናይ ኢድ መሕፀቢ ኣለዎምዶ?	1.እወ 2.የብልናን
Q126.	ሽንት ቤት/መፀዳጃ ኣለዎምዶ?	1.እወ 2.የብልናን ናብ ⟶ Q130. ይዝለሉ
Q127.	ናይቲ ሽንትቤት/መፀዳጃ ኣይነት?	1.ናብ ትቦ ዝፈስስ 2. ናብ ሰፕቲክ ዝፈስስ 3. ናብ ጉድጋድ ዝፈስስ 4.ሽታ መዉፅኢ ዘለዎ 5.ክዳን ዘለዎ ጉድጋድ ሽንትቤት 6. ክዳን ዘይብሉ ዘለዎ ጉድጋድ ሽንትቤት 7.ካሊእ
Q128.	ዋንነት ናይቲ ሽንትቤት/መፀዳጃ?	1.ናይ ግሊ 2.ናይ ሓባር

Q129.	ስ ገ ራ/ፍ ታ ን ኣ ብ ቲ ና ይ ሽ ን ት ቤ ት/መ ፀ ዳ ጃ ቀ ዳ ዳ ኣ ሎ ዶ? (ብ ም ር ኣ ይ ዝ ም ለ ስ)	1.እ ወ 2.የ ለ ን
Q130.	ስ ገ ራ/ፍ ታ ን ኣ ብ መ ረ ባ ኣ ሎ ዶ? (ብ ም ር ኣ ይ ዝ ም ለ ስ)	1.እ ወ 2.የ ለ ን
Q131.	ሽ ን ት ቤ ት/መ ፀ ዳ ጃ እ ን ድ ሕ ር ዘ ይ ብ ል ኩ ም ኣ በ ይ ት ጥ ቀ መ?	1.ኣ ብ መ ዳ 2.ካ ሊ እ /ይ ገ ለ ፅ /
Q132.	ደ ረ ቕ ጋ ሓ ፍ ከ መ ይ ተ ወ ግ ዱ?	1.ና ብ ጉ ድ ጋ ድ ብ ም ድ ፋ እ 2.ኣ ብ ሜ ዳ 3.ብ ም ቅ ፃ ል 4.ኣ ብ ኣ ቕ ሓ ብ ም ጥ ር ቃ ም ካ ል እ ግ ዘ ይ ድ ፋ እ 5.ካ ል እ /ይ ገ ለ ፅ /
Q133.	ዝ ስ ተ ማ ይ ካ በ ይ ይ ጥ ቀ መ?	1.ካ ብ ቡ ን ባ 2.ካ ብ ዝ ተ ሓ ለ ወ ጉ ድ ጋ ድ/ም ን ጪ 3.ካ ብ ዘ ይ ተ ሓ ለ ወ ጉ ድ ጋ ድ/ም ን ጪ 4.ካ ብ ወ ራ ዲ ማ ይ 5.ካ ሊ እ /ይ ገ ለ ፅ /
Q134.	ካ ብ ገ ዛ ኩ ም ና ብ ቲ ማ ይ እ ተ ም ፅ እ ሉ ዘ ሎ	----------ደ ቒ ቓ

	ደርሶ መልስ ከንደይ ይወስድ?	
Q135.	ዝስተ ማይ ኣብ ምን ታይ የጠራቕምዎ?	1.ዕትሮ 2.ባልዲ/ነ ማ 3.ባልዲ/ብረት 4.ጀሪካን 5.ካሊእ /ይጠቀስ
Q136.	ትማሊ ንምስ ታይ ዝከዉን ማይ ምስ ቀዳሕኩም ንገዛ ብከመይ ኣምጺእኩምዎ?	1.ክዳን ብዘለዎ ኣቕሓ 2.ክዳን ብዘይብሉ ኣቕሓ 3.ካሊእ /ይጠቀስ
Q137.	ትማሊ ንምስ ታይ ዝከዉን ማይ ከንደይ ግዜ ቀዲሑም/ኣመላሊሶም?	-------ግዜ
Q138.	ትማሊ ማይ ዝቕዳሕኩሙሉ መጠራቕሚዝሕዞ ማይ መጠን ?	-------ሊትሮ
Q139.	እትሰትይዎ ማይ ፅሩይ ንምግባር ብዝኮነ ይኩን ዓይነት ትሕክምዎ ዶ?	1.እወ 2.ኣይንሕኩሞን ናብ Q138. ይዝለሉ
Q140.	መብዛሕቲኡ ግዘ እትሰትይዎ ማይ ፅሩይ	1.ምፍላሕ 3.ብክዳን ነፃርዮ 2.ክሎሪን 4.ካሊእ /ይጠቕስ

	ን ምግባር እንታይ ትጥቀመ?	

ክፍሊ ሰለስተ፡ ኣተሓሕዛ ህፃን ዝምልከት

Q141.	እቲ ሕፃን ካብ ጡብ ኣዶ ወፃኢ ካሊእ ይወስድ ዶ?	1.እወ 2.ኣይወስድን ናብ Q142. ይዝለሉ
Q142.	ነቲ ሕፃን ንበይኑ ምግቢ የዳልዋሉ ዶ?	1.እወ 2.ኣየዳልወሉን
Q143.	እቲ ሕፃን ካብ ጡብ ኣዶ ወፃኢ ካሊእ ዝወስድእንተኾኑ፤ እንታይ ኣይነት ምግቢ የዳልዋሉ?	1.ናይ ላሕሚፀባ 2.ናይ ሕሩጭፀባ 3.ገዓት 4.ናይ ዓበይቲ ምግቢ 5.ካሊእ /ይገለፅ
Q144.	ነቲ ህፃን ብምን ታይ የልብዐኦ?	1.ብኢደን 2.ብኩባያን ማንካን 3.ብጥሮ 4. 5.ካሊእ /ይገለፅ
Q145.	ትማሊ ኢደን ተሓፂበን ነይረን ዶ?	1.እወ 2.ኣይፋል ናብ Q145. ይዝለሉ
Q146.	መኣስ መኣስ እየን ዝሕፀባ?	1.ቅድሚ ምግቢ ምድላወይን ምምጋበይን 2.ድሕሪ ምግቢ

		3.ድሕሪ መልሲ ሽንትበት 4.ድሕሪ ህፃን ምፅርራይ 5. ካሊእ /ይገለፅ
Q147.	ኢደን ብምታይ እየን ዝሕፀባ?	1.ብማይን ሳመናን 2.ብማይን ሓመኻሽትን 3.ብማይ ጥራሕ 4. ካሊእ /ይገለፅ

ክፍሊ ኣርባዕተ፡ ሓበረታ ናይቲ ንመፅነናዕቲ ዝተመረፀ ሕፃን

Q148.	ዕድመ	---------- ወርሒ
Q149.	ፆታ	----------
Q150.	እቲ ህፃን ነታ ኣዶ መበል ክንደያ እዩ?	----------
Q151.	እቲ ህፃን ፀባ ጡብ ኣዶ ጠብዩ ዶ ይፈልጥ?	1.እወ 2.ኣይፋሉን ናብ Q153. ይዝለሉ
Q152.	ንክንደደ ዝኣክል እዩ ፀባ ጡብ ኣዶ ጠብዩ?	----------ወርሒ
Q153.	ኣብዚ ሒጂ እዋን ኩነታት ፀባ ጡብ ኣዶ	1. ፀባ ጡብ ኣዶ ጥራሕ ይጥቀም 2.ብከፊል ፀባ ጡብ ኣዶ ጥራሕ ይጥቀም

	ናይቲ ህፃን እንታይ ይመስል?	3.ፈሚ ሙፀ ባ ጡብ ኣ ዶ ኣ ይጥቀምን
Q154.	እቲ ህፃን ኣ ብ ከንደይ ዕድሚኡ እዩ ተወሳኪ ምግቢ ጀሚሩ?	----------ወርሒ
Q155.	ናይ ንፍዮ ክትባት ተከቲቡ ዶ? (ንልዕሊ ትሽዓተ ወርሒዝኮኑ ጥራሕ)	1.እ ወ 1.1 ብሓበረታ እቲ መላሳይ 1.2 ካርዲ ብምርኣይ 2.ኣ ይተከተበን
Q156.	ናይ ሮታ ቫይረስ ክትባት ተከቲቡ ዶ?	1.እ ወ RVV1 RVV2 1.1 ብሓበረታ እቲ መላሳይ 1.2 ካርዲ ብምርኣይ 2.ኣ ይተከተበን
Q157.	እቲ ህፃን ኣ ብ ዝሓልፈ ክልተ ሰሙን ዉፃኣት ነይርዎ ዶ?	1.እ ወ 2.ኣ ይነ በሮን → ወዲኣን

ናይቲ ቃለ መሕትት መዓልቲ----------

እቲ ቃለ መሕትት ዝመልኡ ኣካል ሽም---------- ፈርማ----------

ሽም ናይ ሱፐርቫዘር ---------- ፈርማ ----------

Addis Ababa University

Faculty of Medicine

School of Public Health

Prevalence and associated factors of acute diarrhea among under-five children in Laelay-Maychew district, northern Ethiopia: cross-sectional study

BY

Teklit Angesom (BSc)

Department of Preventive Medicine

Faculty of Medicine, Addis Ababa University

Approved by Examining Board

Wakgari Deressa ----------
Chairman, Dean of SPH

Negussie Deyessa ----------
Advisor

Samson Wakuma ----------
Co-advisor

Abera Kumie ----------
Examiner

Wondimu Ayele ----------
Examiner

Declaration

I the undersigned, declare that this thesis is my original work, has never been presented in this or any other university, and that all resources and materials used for the thesis have been duly acknowledged.

Name Teklit Angesom

Signature _____

Place Addis Ababa, Ethiopia

Date of submission _____

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

Advisor: Name Negussie Deyessa (Dr)

Signature _____

Date _____