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# Prevalence of diarrhea among under-five children in health extension model households in Bahir Dar Zuria district, north-western Ethiopia

Desalegn Tesfa Asnakew, Mulat Gebrehiwot Teklu, Solomon Assefa Woreta

## ABSTRACT

**Aims: This study was carried out with an aim to assess the prevalence of diarrhea among under-five children and associated factors in health extensions model households in Bahir Dar Zuria district, North-western Ethiopia. Methods: Community based cross-sectional study was carried out from August 25 to September 30, 2015 in Bahir Dar Zuria district, North-western Ethiopia. A proportionate stratified random sampling technique was used to select 734 households that had at least one under-five child. Data was collected via face to face interview using a structured questionnaire. The questionnaire includes socio-demographic characteristics, behavioral and environmental factors. Data were analyzed using SPSS version 20.0 statistical software. Bivariate and multivariate logistic regression analyses were undertaken to identify predictors of childhood diarrhea. Results: In total, 715 women (model households) returned questionnaires, were valid for the analysis making a response rate of 97%. The two-week period prevalence of diarrhea among under-five children was 20%, which was associated with unimproved water source [AOR: 2.59, 95% CI: (1.71, 3.93)], with no functional latrine [AOR: 3.00, 95% CI : (1.95, 4.58)], animals living with human [AOR: 2.01, 95% CI: (1.33, 3.05)], partial practice of hand washing [AOR: 2.16, 95% CI; (1.38, 3.38)] and having two and more than two under-five children in the household [AOR: 2.31, 95% CI: (1.46, 3.65)]. Conclusion: This study revealed the two weeks' period prevalence of under-five diarrhea was relatively high. We noticed the availability of latrine, water source of the households, number of children in the households, hand washing methods of the mothers/caregivers and be housed with animals were significant predictors. Building improved water source and provide health education to the community about hand washing needs to be encouraged.**

**Keywords: Children, Diarrhea, Health extension model households**

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## INTRODUCTION

Diarrhea account for one in nine child deaths worldwide, making diarrhea the second leading cause of death among children under the age of five worldwide, there are nearly 1.7 billion children younger than five years of age suffering from diarrhea each year and the burden is high in developing countries. Of all child deaths from diarrhea, 78% occur in African and South-East Asian regions [1, 2].

From total under-five children death in 2010, diarrhea accounts 11% second to pneumonia which was 18% [3]. A systematic review in low and middle-income countries in 1990 and 2010 showed that, even though the incidence of diarrhea had been declined from 3.4 episodes/child year in 1990 to 2.9 episodes/child year in 2010, there were nearly 1.7 billion episodes of diarrheal disease in 2010 in 139 countries [4].

In 2011, Ethiopian demographic and health survey (EDHS) reported that, the two week prevalence of diarrheal disease was 13% nationally, and 13.7% in Amhara region [5]. But various studies in Ethiopia revealed that the two week prevalence of under-five diarrheal diseases was approximate to 30% [6–8] and it was also the second cause of morbidity in Bahir Dar Zuria district [9].

Diarrhea related death has been attributed to lack of exclusive breastfeeding for the first six months, unimproved water, inadequate sanitation and poor hygiene. 783 million people use unimproved drinking water source and 2.5 billion people use unimproved sanitation facility [10, 11]. Diarrhea due to infection is widespread throughout developing countries and the cause of death in children is from severe dehydration and fluid loss [10, 12].

Starting from 2003 Ethiopian government has been implementing the Health Extension Program, which is a comprehensive, universal, equitable and affordable approach based on 16 health packages [13]. Households who implement >75% of health extension programs graduated as a model household by health extension workers [14–16]. The health extension programs are implemented by full-time female health extension workers in the community. They train selected households, which are pro-change and influential community members to implement the packages fully. Those households that successfully implement all four components are labeled as “model households” and they are officially certified [17]. The goal of the health service extension program is to improve access and equity in health care and to bring positive behavioral change towards the maintenance of a healthy environment through the provision of house to house health awareness with active community participation. It is the main pillar of the Child Survival Strategy for increasing access to promotive, preventive and some basic essential curative health services to the majority of the underserved population [18, 19].

Little was known about the magnitude of under-five diarrheas in Bahir Dar Zuria district and the real factors contributing to diarrhea; which might help for managers, clinical and police makers to plan effective interventions to alleviate the problem in the district. Hence, this study aimed to assess the prevalence of diarrhea and associated factors among under-five children in health extensions model households in Bahir Dar Zuria district.

## MATERIALS AND METHODS

### Study design and setting

A community based cross-sectional study was carried out from August 25 to September 30, 2015 in Bahir Dar Zuria district, North-Western Ethiopia. Bahir Dar is the capital of Amhara National, Regional State located North-western Ethiopia, approximately 578 km from Addis Ababa. In 2007, Central Statistical Agency reported that this district has 215,851 total populations of which 33,999 are under-five children. The total populations are estimated to live in 50,198 households, in which 23,023 households had under-five children and 22,658 households were model households for health extension program. The health service of the district was rendered through seven health centers, 32 health posts and eight different privately owned clinics were reported by district health office in the 2014 fourth quarter report.

### Sample size and sampling procedure

The sample size was calculated using an EPI info version 3.5.3 assuming that the estimated proportion of prevalence of diarrhea from a previous study done in Debrebirehan Town, North Shoa Zone as 31.7% [6], 95% level of confidence, and 5% of margin of error. The calculated sample size was 334 but by considering a 10% non-response rate and design effect the final required sample size was taken to be 734.

The study included mothers/caregivers who had children aged less than five years and permanent residents of selected kebeles (small villages). Mothers who come to visit their parents were not included. The survey included questions concerning sociodemographic, children and maternal characteristics, environmental health conditions, child feeding practices, water source and hand washing practice.

### Data quality control measures

The data collection tool was first prepared in English and translated to the local language, Amharic and back translated to English by language experts to check for consistency. Pre-test was done on 5% of the respondents prior to the actual data collection period in a similar setting, which was not selected for the study and revision was done as necessary. Training was given for both data

collectors and the supervisor on the data collection tools and techniques of interviewing. Daily supervision was done by the supervisor and principal investigator.

## Operational definitions

**Diarrhea** In this study, diarrhea was defined as a child with loose or watery stool for three or more times during a 24-hour period in the household within a two-week period prior to the survey as reported by the mothers/caregivers of the child.

**Water source** defined as improved-water sources if the sources were either of the following: household connections, public standpipes, protected dug wells, rain and protected springs. Unimproved-water sources included unprotected dug wells, unprotected springs and rivers.

**Proper waste disposal** defined as a way of disposing refuses which included burning, burying in a pit or storing in a container, and disposing in the designed site whereas disposing in open fields was considered as an improper disposal method.

**Home based water treatment** defined as methods employed for the purposes of treating water in the home using boiling, filtration, and chlorination.

**Hand washing** defined as if a mother/ caregivers had a practice of hand washing after toilet, before child fed, and before having contact with food or any contaminated utensils using clean water and soap or ash which was considered as "All practice" if not "partially practice".

## Data processing and analysis

Data was cleaned for completeness and consistencies, coded and entered into Epi info version 3.5.3 and transported to SPSS version 20 for analysis. The results were organized, summarized and presented using appropriate descriptive measures such as text, tables, frequencies and percentage. Associations between the outcome and independent variables were assessed by using odds ratio with 95% confidence interval. Bi-variable logistic regression was used to screen variables that had significant association with the outcome variable with p-value ≤ 0.2. These variables were entered into multivariable logistic regression to assess the independent predictor for diarrhea. Variables which were significant at *p*-value 0.05 level and adjusted odds ratio (AOR) with 95% CI were considered to be the determinant factors of childhood diarrhea.

## Ethical considerations

Ethical clearance was obtained from the Institutional Review Board of University of Gondar, College of Medicine and Health Sciences. Permission letter was obtained from Bahir Dar Zuria district health office and all selected study Kebele's (small villages). Informed verbal consent was obtained from each study participant after explaining the aim of the research. Individual participant records were coded on each respective questionnaire and accessed only by research team members. Confidentiality was maintained at all levels of the study.

# RESULTS

## Socio-demographic characteristics of participants

A total of 734 model households with <5 children were included in the study and 715 gave a complete response making the response rate 97.41%.

About 378 (52.9%) under-five children were more than 24 months old. Among children who were currently breastfeeding, 144 (20.1%) were exclusively breastfeeding and the age range of mothers was from 25 to 34 years with a mean (SD) of 31.37 (±6.75). The majority of mothers 655 (91.6%) were married. More than two-thirds 427 (59.7%) of households had a family size more than four people. The majority of mothers 476 (66.6%) did not attend formal education. Farming 528 (73.8%) was a source of income. Similarly, monthly income of 490 (68.5%) families was less than 600 birr (<30 US dollars). All the respondents were Amhara ethnicity and Orthodox Christian (Table 1).

Table 1: Demographic characteristics of the study population (n=715)

| Characteristics | Frequency | % |
|---|---|---|
| Relation of respondent | | |
| Mother | 701 | 98 |
| Care taker | 14 | 2 |
| Maternal age | | |
| 15–24 | 98 | 13.7 |
| 25–34 | 377 | 52.7 |
| >=35 | 240 | 33.6 |
| Mean maternal age | 31.37(SD+6.75) | |
| Marital status | | |
| Married | 655 | 91.6 |
| Single | 14 | 2 |
| Divorced | 34 | 4.8 |
| Widowed | 12 | 1.7 |
| Educational level of the | Mother/care taker | |
| No education | 476 | 66.6 |
| Read and write | 122 | 17.1 |
| Primary | 76 | 10.6 |
| Secondary and above | 41 | 5.7 |

| | | |
|---|---|---|
| Occupation of the mother | | |
| House wife | **107** | **15** |
| Farmer | **528** | **73.8** |
| Daily worker | **75** | **10.5** |
| Government employ | **5** | **0.7** |
| Occupation of the child father | | |
| Farmer | **611** | **85.5** |
| Daily worker | **52** | **7.3** |
| Merchant | **44** | **6.2** |
| Government employ | **8** | **1.1** |
| Owner ship of radio | | |
| No | **339** | **47.4** |
| Yes | **376** | **52.6** |
| House hold size | | |
| 1–3 | **92** | **12.9** |
| 4–6 | **427** | **59.7** |
| >=7 | **196** | **27.4** |
| Mean house hold size | **5.51(SD+1.71)** | |
| Become model | | |
| <2004 | **314** | **43.9** |
| >2004 | **401** | **56.1** |
| Wealth breakdowns | | |
| Very poor | **156** | **21.8** |
| Poor | **223** | **31.2** |
| Middle | **267** | **37.3** |
| Better of | **69** | **9.7** |
| Number of under five children | | |
| 1 | **557** | **77.9** |
| >2 | **158** | **22.1** |
| Age of the index child | | |
| 0–5 months | **90** | **12.6** |
| 6–11 months | **121** | **16.9** |
| 12–23 months | **126** | **17.6** |
| >=24 | **378** | **52.9** |
| Sex of the index child | | |
| Male | **381** | **53.3** |
| Female | **334** | **46.7** |
| Place of child borne | | |
| Health institution | **187** | **26.2** |
| Home | **528** | **73.8** |
| Maternal history of diarrhea | | |
| No | **609** | **85.2** |
| Yes | **106** | **14.8** |

## Environmental characteristics

More than two-third 461 (64.5%) of the households collected drinking water from improved water sources; and 507 (70.9%) of households had latrine, of which 126 (24.9%) were shared. Almost all households 713 (99.7%) were living in a house made of mud floor. The findings of the study also showed that, more than two-thirds 501 (70.1%) of the households dispose their refuse properly, and 445 (62.2) walk > 30 minutes to fetch water. More than a quarter 569 (79.6%) of model households stored the water in Jerrican. Also less than half 294 (41.1%) of the households share same houses with domestic animals (Table 2).

## Behavioral characteristics

Among 571 children who started an additional supplementary food, 513 (89.8 %) children whose age was more than six months and 540 (75.5%) children currently found on breastfeeding. This study finding indicated that 342 (48.1%) children on breastfeeding for more than 24 months. Hand washing was reported among 541 (75.7%) of the mothers/caregivers. More than a quarter of 552 (77.25) children took measles' vaccine. About 552 (77.3%) of the children took measles vaccine (Table 3).

## Factors Associated with Childhood Diarrhea

Significant variables ($p$-value ≤ 0.20) during bivariate analysis were further considered for multiple logistic regression analysis.

The odds of developing diarrhea were about two times higher among children whose mothers' had partially practice hand washing [AOR: 2.16, 95%CI: (1.38, 3.38)] compared to children whose mothers practice hand washing.

The odds of developing diarrhea were about three times higher among children whose family used an unimproved water source when compared to those families who used improved water source [AOR:2.59,95%CI:(1.71,3.93)]. Similarly, diarrhea was three times more likely among children whose disposal system of feces was by throwing out feces when compared to households who used pit latrine disposal [AOR: 3.00, 95% CI :(1.95, 4.58)].

Developing diarrhea was about twice higher among children who were living with animals when compared with the children were not living with animals [AOR: 2.01, 95%CI:(1.33, 3.05)] (Table 4).

# DISCUSSION

This community based cross sectional study was attempted to assess the prevalence of diarrhea and identify factors associated with diarrhea in those health extension model households in Bahir Dar Zuria district,

Table 2: Environmental characteristic Childhood diarrhea among extension worker households in Bahir Dar Zuria district, Ethiopia (n=715)

| Characteristics | Frequency | % |
|---|---|---|
| Having functional latrine (715) | | |
| No | 208 | 29.1 |
| Yes | 507 | 70.9 |
| Owner ships of latrine (507) | | |
| Private | 381 | 75.1 |
| Shared | 126 | 24.9 |
| Refuse disposal method (715) | | |
| Proper | 501 | 70.1 |
| Improper | 214 | 29.9 |
| Water source (715) | | |
| Unimproved | 254 | 35.5 |
| Improved | 461 | 64.5 |
| Distance to water source (715) | | |
| <=30 minute | 270 | 37.8 |
| >30 munities | 445 | 62.2 |
| Animal live in the same house (715) | | |
| No | 421 | 58.9 |
| Yes | 294 | 41.1 |
| Why animal live in the same house (294) | | |
| No problem | 25 | 8.5 |
| Lack of money to build house | 55 | 18.7 |
| the thief steal animals | 214 | 72.8 |
| Number of rooms in the House (715) | | |
| 1 | 259 | 36.2 |
| 2 | 280 | 39.2 |
| >3 | 176 | 24.6 |
| Water collection container (715) | | |
| Pot/plastic bucket | 146 | 20.4 |
| Jerry can | 569 | 79.6 |
| Faces around the house (715) | | |
| No | 585 | 81.8 |
| Yes | 130 | 18.2 |
| Floor material of the house (715) | | |
| Mud | 713 | 99.7 |
| Cement | 2 | 0.3 |

Table 3: Behavioral characteristic among extension worker households in Bahir Dar Zuria district, Ethiopia (n=715)

| Characteristics | Frequency | % |
|---|---|---|
| Child starting supplementary food (571) | | |
| Before six months | 58 | 10.2 |
| After six months | 513 | 89.8 |
| Current feeding status of the child (715) | | |
| Exclusive | 144 | 20.1 |
| Mixed | 396 | 55.4 |
| Food only | 175 | 24.5 |
| If the child was on supplementary food, what do you use to feed (571) | | |
| hand and bottle | 492 | 86.2 |
| cup and spoon | 79 | 13.8 |
| Duration of breast feeding (715) | | |
| <12 months | 219 | 30.6 |
| 12–23 month | 152 | 21.3 |
| >24 months | 342 | 48.1 |
| Hand washing practice of the mother (715) | | |
| Partial practice | 174 | 24.3 |
| All practice | 541 | 75.7 |
| Water treatment at house hold level (715) | | |
| No | 646 | 90.3 |
| Yes | 69 | 9.7 |
| Methods used to treat water (69) | | |
| Boiling | 14 | 20.3 |
| Strain on close | 14 | 20.3 |
| Chlorine | 41 | 59.4 |
| Mode of taking drinking water from Storage (715) | | |
| Pouring | 586 | 82 |
| Dipping | 129 | 18 |
| Does the child take measles vaccine (715) | | |
| No | 162 | 22.7 |
| Yes | 553 | 77.3 |
| Water consumption/person/day (715) | | |
| <7.5 litter | 289 | 40.4 |
| >7.5 litter | 426 | 59.6 |

Table 4: Factors associated with childhood diarrhea among health extension model households in Bahir Dar Zuria district, Ethiopia (n = 715)

| Characteristics | Occurrence of diarrhea | | COR (95%CI) | AOR (95% CI) |
|---|---|---|---|---|
| | Yes | No | COR | |
| Hand washing practice of the mother | | | | |
| Partial practice | 53 | 121 | 2.17(1.46-3.21)* | 2.16(1.38-3.38) |
| All practice | 91 | 450 | 1 | 1 |
| Having functional latrine | | | | |
| No | 69 | 139 | 2.86(1.96-4.18)* | 3.00 (1.95-4.58)* |
| Yes | 75 | 432 | 1 | 1 |
| Water source | | | | |
| Unimproved | 78 | 176 | 2.65 (1.83-3.85)* | 2.59(1.71-3.93)* |
| Improved | 66 | 395 | 1 | 1 |
| Animal live with the family | | | | |
| No | 59 | 362 | 1 | 1 |
| Yes | 85 | 209 | 2.50 (1.72-3.62)* | 2.01(1.33-3.05)* |
| *=p value <0.05 | | | | |

West Gojjam, Amhara National Regional State, Ethiopia. The study showed the prevalence of under-five childhood diarrhea was 20%. It was in line with studies conducted in rural area of Shebedinco district, Southern Ethiopia 19.6% [20], in Dejen district East Gojjam 23.8% [5], and in Mecha district, West Gojjam 18% [21], which have similar socioeconomic, environmental and behavioral characteristics. It was higher when compared to the regional (13.7%) and national (13%) figures [7, 8, 22]. This figure was also higher than rates reported by other studies [23, 24]. The possible explanations might be due to lack of close supervision by the health extension workers towards model households. However, a lower prevalence rate reported for under-five children in Hulet Ejju Enessie district (6.5%), this could be due to difference in the study populations and the data collection period, in which this study conducted in a district with 90% latrine coverage and during dry season [25]. Diarrhea prevalence become low compared to rainy and winter season where the bacterial and viral infection is high respectively [26–28]. Nonetheless, the prevalence of under-five diarrhea in this study was lower when we compared with studies done in Arba Minch district (30.5%) [7], Tanzania (32.7%) [24], Burundi (32.6%) [29] Pakistan (31.1%) [30], and Uganda (23.8%) [31]. The existing socio-demographic, behavioral and environmental variations might contributed to the inconsistency.

In this study, under-five children who were from the household reported partial hand washing practice were more likely to experience diarrhea. Contaminated hands are one of the most common modes for transmitting human pathogens [32]. This was consistent with findings of previous studies in Arba-Minch [7], Shabdeno [33], Dejen district [5], and Bangladesh [34]. This designated improve water sanitation and hygiene (hand washing) have the potential to reduce rates of diarrhea by preventing exposure to infectious pathogens. Studies also indicated the proper hand washing before feeding had great role in the prevention of diarrhea. It is well documented that mothers'/caregivers child care and hygiene practices have important impacts on the occurrence of diarrhea in children [34, 35].

Eighty-eight percent of diarrhea cases worldwide are linked to unsafe water, inadequate sanitation or insufficient hygiene. These cases result in 1.5 million deaths each year, mostly in young children [36]. Most cases of diarrheal illness and death occur in developing countries because of unsafe water, poor sanitation, and insufficient hygiene [37]. The present study findings illustrate diarrhea were three times higher among households fetching water from unimproved water source compared to households fetching water from improved water source. This finding was comparable with the reports from EDHS 2011 [22], Derashe district [38], Dejen district [5], Burundi [29], and Nepal [39]. Unimproved water source is among the potential sources of water born diarrheal diseases transmission [40]. On the other hand, this finding contradicted with other studies [6, 8, 41] that the sole use of improved water sources had no impact on diarrhea prevalence rather treating water mitigate the occurrence by 61% [29].

Our study clearly illustrates latrine possession and sanitation facilities used by model households in which under-five children dwell in were unimproved, which is

far from national expectation of 100%. Lack of functional latrine significantly associated with under-five diarrhea and this finding similar with the studies conducted in Nekemte, Southern Ethiopia [42], Mecha district, West Gojjam Ethiopia [21] and Dejen district East Gojjam Ethiopia [5]. Lack of access to basic sanitation and latrines depreciates environmental sanitation and upsurge the possibility of diarrhea causative pathogen transmission through fecal contamination [18].

This study noticeably indicated that children reside in households, where animals be housed in with the family were the most vulnerable to diarrhea. The odds of having diarrhea morbidity were two times higher [AOR: 2.01, 95%CI: (1.33, 3.05)] in households where animals reside in with the family compared to those households without animals. Surprisingly 72.8% of the respondent lodged their animal with their family to protect from burglary. This finding inconsistent with the studies in Debre birhan Ethiopia [6]. Similarly, a study done by WHO revealed that the presence of animals in a house also can be used as a measure of exposure to diarrhea causing organisms [43]. However, this finding was in disagreement with the study done in Hulet Ejju Enessie district [25]. This may be due to proper animal faces disposal method, number of animals and type of animals living in the household.

WHO recommend proper hand washing is a critical and cost effective mechanism to decrease diarrheal disease by 45% [35, 44]. In this study, the odds of having childhood diarrhea in mothers practicing partial hand washing two times higher compared to mothers all practice hand washing [(AOR :2.16:CI:95%:(1.38-3.38)]. This finding supported by studies conducted in Arba-Minch Ethiopia, [(AOR: 2.33, 95%CI: (1.80, 4.15)] [41], and Shabdeno, Ethiopia, [AOR: 2.21, 95% CI: (1.41, 3.46)] [33]. Proper hand washing is the simplest and least expensive means of preventing infections and the spread of germs. Parents and caregivers should wash their hands as they can pass the germs to their children. The 2005 World Health Report mentions that households can prevent illness by washing hands after defecation, before preparing meals and before feeding children. Keeping hands clean is a form of social responsibility that helps in reducing the risk of infections [45, 46].

Other socioeconomic factor significantly associated in this study was the number of under-five children in the house [AOR: 2.31, 95%CI: (1.46, 3.65)] this in line with studies conducted in Shebdino district, Ethiopia [20]. When two and more children in the house create overcrowding, increase the chance contact to different causative pathogens and computes mothers' time to give appropriate child care [47].

The validity of the study may be limited by a cross-sectional rather than the longitudinal design of the study. Though, this is the first study in the study area and we believe, it creates awareness in Ethiopia that will add valuable information to the existing healthcare service.

## CONCLUSION

This study revealed that the prevalence of under-five diarrhea in model households was relatively high and the availability of latrine, water source of the households, number of children in the households, hand washing methods of the mothers/care takers and sharing a house with animals were significant predictors. Hence, building improved water source, awareness training concerning availability of latrine, giving health education to the community about hand washing and future interventions must assure systematic and regular hygiene education in the household and community level were recommended.

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### Author Contributions
Desalegn Tesfa Asnakew – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Mulat Gebrehiwot Teklu – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published
Solomon Assefa Woreta – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

### Guarantor
The corresponding author is the guarantor of submission.

### Conflict of Interest
Authors declare no conflict of interest.



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