Socio-demographic, environmental and behavioural factors of diarrhoea among under-five children in Rural Ethiopia: further analysis of the 2016 Ethiopian demographic and health survey

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Research article

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Abstract

Background: Diarrhoea is one of the major contributors to deaths among under-five children in Ethiopia. Studies conducted in different countries showed that rural children are highly affected by diarrhoea than urban children. Thus, the purpose of this study was to identify the socio-demographic, environmental and behavioural associated factors of the occurrence of diarrhoea among under-five children in rural Ethiopia.

Methods: Data for the study was drawn from the 2016 Ethiopia Demographic and Health Survey. A total of 8,041 under-five children were included in the study. Data was analysed using SPSS version 23. Binary logistic regression was used for the analysis of the data to assess the association of occurrence of diarrhoea with socio-demographic, environmental and behavioural associated factors among under-five children.

Results: Children aged 6-11 months (AOR: 3.5; 95% CI: 2.58-4.87), 12-23 months (AOR: 3.1; 95% CI: 2.33-4.04) and 24-35 months (AOR: 1.7; 95% CI: 1.26-2.34) were significantly associated with diarrhoea. Diarrhoea was also significantly associated with male children (AOR: 1.3; 95% CI: 1.05-1.58), children in Afar region (AOR: 1.92; 95% CI: 1.01-3.64), Somali region (AOR: .42; 95% CI: (.217-.80), Gambela region (AOR: 2.12; 95% CI: 1.18, 3.81), households who shared toilet facilities with other households (AOR: 1.4; 95% CI: 1.09-1.77), fourth birth order (AOR: .1.81; 95% CI: 1.17-2.79), fifth and above birth order (AOR: 1.85; 95% CI: 1.22, 2.81) and the interaction of older mothers with three or more under-five children (AOR: 4.7; 95% CI: 1.64-13.45).

Conclusion: The age of a child, sex of a child, region, birth order, toilet facilities shared with other households and the interaction effect of number of under-five children with mother's current age are identified as associated factors for diarrhoea occurrence among under-five children in rural Ethiopia. The findings carry implications for the need for planning and implementing appropriate prevention strategies that target rural under-five children.

Background

According to WHO, diarrhoea is defined as the passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual) [1]. Diarrhoea is usually a symptom of an infection in the intestinal tract, which can be caused by a variety of bacterial, viral and parasitic organisms. Furthermore, severe dehydration and fluid loss were the main causes of diarrhoea deaths for most people. Diarrhoea can last several days and can leave the body without the water and salts that are necessary for survival. It depletes the body of fluids and can cause severe dehydration, which if not treated properly can lead to death [1].

Diarrhoea is a leading cause of malnutrition [2] and the second leading cause of death in children under five years old being responsible for killing around 525,000 children every year. Globally, there are nearly 1.7 billion cases of childhood diarrhoeal disease every year [1]. According to UNICEF, 88 per cent of all

diarrhoea deaths in 2015 were concentrated in South Asia and sub-Saharan Africa [2]. Low and lower-middle-income countries are home to 62 per cent of the world's under-five population but account for more than 90 per cent of global pneumonia and diarrhoea deaths [2]. In low-income countries, children under three years old experience on average three episodes of diarrhoea every year [1].

Ethiopia is one of the top 10 countries with the highest number of diarrhoea deaths. Based on UNICEF report, 15,500 diarrhoea deaths occurred among under-five children in Ethiopia in 2015 [2]. The 2005, 2011 and 2016 Ethiopia Demographic and Health Survey (EDHS) reports showed that the percentage of under-five children who had diarrhoea in the two weeks before the survey period were 18%, 13% and 12%, respectively [3]. Even though the magnitude of diarrhoea have reduced over the past periods, diarrhoeal disease is still the major cause of morbidity and mortality among children in Ethiopia.

Studies conducted in different countries showed that rural children are highly affected by diarrhoea than urban children [4, 5, 6]. The 2016 Ethiopia Demographic and Health Survey report showed that under-five children in rural Ethiopia had, relatively, more diarrhoea occurrence than urban ones [3]. Even though a high magnitude of diarrhoea disease in rural Ethiopia, there are limited pocket studies conducted at District/Zone/Town level to assess diarrhoea disease and associated factors. But, there is no study at country level, which focused specifically on the rural part of the country, using a nationally representative survey to show associated factors of diarrhoea occurrence among under-five children. So, evidence-based information is needed for a child's health improvement strategy by preventing and reducing the severity of diarrhoeal in under-five children in rural Ethiopia. Thus, this study was planned to fill this gap by achieving its aim that was to identify the socio-demographic, environmental and behavioural associated factors of the occurrence of diarrhoea among children age under-five years in rural Ethiopia.

Methods

Study Design and Setting

This study was based on a national community-based cross-sectional study, EDHS 2016, in Ethiopia. The EDHS 2016 was conducted from January 18, 2016, to June 27, 2016. The survey was the fourth survey in the country. More details can be accessed from the EDHS 2016 report [3].

Sampling Design and Data

The sampling frame used for the 2016 EDHS was the frame of the Population and Housing Census conducted in Ethiopia in 2007 and provided by the Central Statistical Agency (CSA). The 2016 EDHS samples were selected using two stages stratified sampling procedure. Each region was stratified into urban and rural areas, which yielded 21 (11 urban and 10 rural) sampling strata. Samples of enumeration areas (EAs) were selected independently in each stratum in two stages. In 2016 EDHS, a sample of approximately 10,641 under-five children representing the number of live births born to the interviewed mothers in the period of five years preceding the date of the survey were included. Out of these children, 9,916 children's interviewed mothers/caregivers gave a complete response about the two-week

occurrence of diarrhoea among their under-five children in Ethiopia. Among them, 1875 children were from urban residences. Hence, after excluded those under-five children whose mothers/caregivers didn't respond about the diarrhoea case and those from urban parts of Ethiopia, 8041 under-five children with complete information were used as the data for this study.

Thus, for this study, all under-five children in rural parts of Ethiopia were extracted from the EDHS 2016 data. EDHS 2016 was retrieved from Major DHS after describing the objective of the study.

Study Variables

The response variable was the reported occurrence of diarrhoea. The respondent/primary caregiver was asked if the child had diarrhoea in the last two weeks.

The independent variables included in the study were identified from literature conducted earlier and associated with the occurrence of diarrhoeal occurrences among children under five years of age[4, 7-10]. These are the Socio-demographic variables(respondents current age, sex of child, current age of child, child lives with whom, region, respondents educational level, respondents religion, birth order, respondents work status, household wealth index, number of children under five in the household, current marital status, current breastfeeding status, number of household members), Environmental and behavioural variables (source of drinking water, type of toilet facility, if toilet facility is shared with other households, disposal of youngest child's stools when not using toilet and main floor material).

Data Analysis Methods

After the extracted data were checked for completeness and coded, the analyses were done using both SPSS Version 23. Both descriptive and inferential data analysis methods were used in the study. Data were described and summarized through frequencies and percentages.

To study the effect of the different predictor variables on the outcome variable, bivariate and multivariable analysis were used. In bivariate analysis, Chi-square test of association and Crude odds ratio were estimated to assess the association between each of the predictor variables and the outcome variable. Significant variables at P-value < 0.25 in the bivariate analysis were only used in the multivariable analysis. The backward stepwise method was used to select variables for the best reduced model and Wald-test was used to test individual significance of the coefficients of the model.

A multivariable binary logistic model was used to identify associated factors of diarrhoea occurrence among under-five children. The overall goodness of the final model was checked using the Hosmer-Lemeshow goodness-of-fit test. Interpretations of the strength of the associations between factors and the response variable were based on significant Adjusted Odds Ratios (AOR) with 95% confidence intervals at 5% level of significance (P-value <0.05).

Results

Descriptive results of socio-demographic, environmental and behavioural characteristics

The study included 8,041 under-five children. Out of these 3938(49.0%) were females, 891(11.1%) were less than 6 months and 3265(40.6%) were age greater than 35 months [Table 1]. The majority of the children 5459(67.9%) were currently breastfeeding at the time of the survey. Around 4774(60%) of children's households had six and above family members. Regarding mothers/caregivers, 5801(72.1%) had no formal education and 7659(95.2%) were married.

Concerning the environmental and behavioural characteristics of the respondents, 3713(46.7%) of mothers/caregivers have used unimproved source of drinking water [Table 2]. There were 3262(41%) unimproved toilet facility and 4103(51.6%) no toilet facility in the household. Furthermore, around 3171(61%) of the mothers/caregivers were not properly removed the youngest child's stools.

Magnitude of Diarrhoea

The overall occurrence of diarrhoea among under-five children was 11.2% (95% CI: 10.5%-11.9%) in rural Ethiopia. The result displayed in Tables 1 and Table 2 showed that the occurrence of diarrhoea was the highest among children age 6-11 months (18.9%) and 12-23 months (18.1%). Figure 1 also shows that the occurrence of diarrhoea, on average, was high among children aged from 6 to 23 months. The highest magnitude of diarrhoea was also observed on children lives in SNNPR Region (14.3%), whose household shared toilet facility with other households (13.9%), protestant followers' children (13.5%) and widowed/separated respondents' children (13.1%). Table 1 and Table 2 also shows that there are other socio-demographic, environmental and behavioural categories of children that the occurrence of diarrhoea was above the overall average (11.2%).

Results of bivariate and multivariable logistic regression analysis

In Bivariate analysis, the chi-square test results in Tables 1 and Table 2 and the estimated crude odds ratios in Table 3 showed that there were a significant association between occurrence of diarrhoea and respondent's current age, sex of child, current age of child, region, number of under-five children, wealth index of the household, religion, number of household members, current breastfeeding status, type of toilet facility and toilet facilities shared with other households at 5% level of significance.

In multivariable analysis, a multilevel binary logistic model was proposed to identify associated factors of diarrhoea occurrence by handling the effect of variations of the outcome occurrence at regional level and individual child level in rural Ethiopia. However, during the analysis, the variation of diarrhoea across regions was not significant in the random intercept model. So this result suggests that the variation of occurrence of diarrhoea among under-five children due to regional difference was zero. Hence, I conclude that the regional difference did not contribute to the variation in the occurrence of diarrhoea among under-five children in rural parts of Ethiopia. As a result, the fixed effect multivariable binary logistic regression model was used instead to study the overall effect of the socio-demographic, environmental and behavioural associated factors on the response variable (occurrence of diarrhoea).

The Hosmer-Lemeshow goodness-of-fit test result (P-value = 0.763) showed that the final multivariable binary logistic regression model was a good fit to the data. In the final model, the estimated crude odds ratio (COR), adjusted odds ratio (AOR) and their 95% confidence interval are included.

The result showed that current age of child [6-11 months (AOR: 3.5; 95% CI: 2.58-4.87), 12-23 months (AOR: 3.1; 95% CI: 2.33-4.04) and 24-35 months (AOR: 1.7; 95% CI: 1.26-2.34)], sex of child[male (AOR: 1.3; 95% CI: 1.05-1.58)], region [Afar (AOR: 1.92; 95% CI: 1.01-3.64), Somali (AOR: .42; 95% CI: (.217-.80) and Gambela (AOR: 2.12; 95% CI: 1.18- 3.81)], birth order [4th (AOR: .1.81; 95% CI: 1.17-2.79), 5th and above (AOR: 1.85; 95% CI: 1.22-2.81)], toilet facilities shared with other households (AOR: 1.4; 95% CI: 1.09-1.77) and the interaction of number of under-five children with mother's current age (AOR: 4.7; 95% CI: 1.64-13.45) were statistically significant associated factors of diarrhoeal occurrence among under five children at 5% level of significance [Table 3].

Discussion

This study was intended to identify demographic, environmental and behavioural associated factors of the occurrence of diarrhoea among under-five children in rural Ethiopia based on 2016 EDHS data.

In this study, the variables current age of a child, sex of a child, region, birth order, toilet facilities shared with other households and the interaction effect of number of under-five children with mother's current age were identified as associated factors for under-five diarrhoea disease occurrence.

The result indicated that child's age group 6-11, 12-23 and 24-35 months were 3.5, 3.1 and 1.7 times more likely to be affected by diarrhoea than child's age greater than 35 months respectively when adjusting the effect of other variables. In general, children age greater than 35 months had a lower risk of having diarrhoea than children whose age between 6-35 months. This may be due to the fact that children whose age between 6 and 23 months begin supplementary foods and also they start crawling and can touch contaminated materials in unclear environment and immediately return their hand to mouse, so it may cause them to easily vulnerable to diarrhoea. The 2016 Ethiopian Demography and Health survey also reported that diarrhoea prevalence remains high (18%) at age 12-23 months, which is the time when children begin walking and are at increased risk of contamination from the environment [3]. Recent studies and scientific knowledge also show that a lot of diarrhoea in this age is due to rotavirus. For instance, a study conducted in Farta Woreda, North West Ethiopia showed that children whose age 6-11 months and not vaccinated for Rotavirus are highly affected by diarrhoea [11]. Therefore, the role of vaccines is important. Moreover, increased risk of disease in younger children more likely to be due to developing immune system and waning of maternal antibodies. This finding is in line with studies done in Benishangul region, Eastern Ethiopia, Enderta Woreda, and Wolitta Soddo [4, 7, 12, 13].

Sex of a child had a significant association with diarrhoea occurrence. Male children had 1.3 times more likely affected by diarrhoea than female children. A study conducted in Dhaka, Bangladesh by Angela et al in 2018 concluded that significantly more boys presented with acute diarrheal illness than girls. It is

possible that there is a sex-based difference in the pathophysiology of acute pediatric diarrhoea that we do not yet understand [14].

The study also revealed that the occurrence of diarrhoea was significantly associated with region of the respondent. Children in rural Afar and rural Gambela regions had around 2 times more affected by diarrhoea as compared to children in rural Tigray region. However, under-five children from rural Somali region were 45% less likely to be affected by diarrhoea than those from rural Tigray region.

Households those shared toilet facility with other households had a significant association with diarrhoeal disease. Children from households with shared toilet facility had around 39% more risk for having diarrhoea than those from households who did not share toilet facilities. Thus, children under the age of five face an increased risk of contracting diarrhoea when they share a toilet with just one or two other households. Epidemiological studies have identified an increased risk of diarrheal diseases associated with using shared sanitation facilities. A study conducted to assess the association between shared sanitation and the prevalence of diarrhoea in young children using data from Demographic and Health Surveys conducted in 51 countries found that shared sanitation appears to be a risk factor for diarrhea although differences in socioeconomic status are important [28]. An analytical review study conducted by Ramlal et al in 2019 also found that the use of shared sanitation showed a significant increase in diarrhoeal disease, with an overall OR of 2.39 (85% CI 1.15-8.31) [29].

Children whose birth order 4th and 5th and above were around 1.8 times more likely affected by diarrhoea than 1st order children. This result was in line with the findings in the Benishangul Gumuz region [7]. The odds of the occurrence of diarrhoea was 4.7 times more likely to be higher among household with three or more under-five children and with older mothers as compared with two or less under-five children of younger mothers. The 95% confidence interval also suggest that the rate (relative risk of being affected by the diarrhoeal disease) for a household with three or more under-five children interacted with older mothers could be as low as 1.64 and as high as 13.45. Older mothers/caregivers, on average, can have a higher number of children as compared to younger ones. As a result, it may be difficult to give care effectively when the number of under-five children becomes large in a household and then it may be a cause for the children to be exposed to diarrhoea. Therefore, to control the number of under-five children the role of family planning is important. Effective family planning can also reduce the number of high birth ordered children in the household. This finding is consistent with a study done in the Benishangul Gumuz region [7] and eastern Ethiopia [4].

Limitations

This study did not include all modifiable associated factors like rotavirus, hand washing, malnutrition status, and others. For the reason that the data used was secondary which was obtained from EDHS 2016 and these variables are included in the dataset with high missing values, more than half of the sample.

Conclusion

The age of a child, sex of a child, region, birth order, toilet facilities shared with other households and the interaction effect of number of under-five children with mother's current age are identified as associated factors for diarrhoea occurrence among under-five children in rural Ethiopia. The findings carry implications for the need for planning and implementing appropriate prevention strategies that target rural under-five children. Providing family planning education properly to reduce the number of under-five children and birth order in the household is important. Supportive strategies about household sanitation facilities (toilet facility and its usage), and women education on appropriate child care practice respective to their age, which can be integrated with the existing national health extension program are also essential to minimize the magnitude of diarrhoea in rural Ethiopia. Further research is recommended to investigate the determinants of diarrhoea using primary data including all modifiable associated factors like Rotavirus, hand washing, malnutrition status, and others in rural Ethiopia.

Declarations

Ethics approval and consent to participate

Ethical clearance for the 2016 EDHS was provided by the Ministry of Health ethics committee, the National Research Ethics Review Committee (NRERC), the Institutional Review Board of Inner City Fund (ICF) at DHS program internationally, and the Government of Ethiopia. All respondents to the survey provided verbal informed consent. The Author obtained the 2016 EDHS data by written request from the Central Statistical Agency in Ethiopia. Furthermore, the Author also obtained the 2016 EDHS data in different reading format by online request at the DHS program, USAID (www.DHSprogram.com).

Consent for publication

Not applicable.

Availability of data and materials

The general datasets are available from the Central Statistical Agency or and the DHS Program data home, USAID. Specifically, the data used for this study are available from the corresponding author on reasonable request.

Competing interests

The author declares that he has no competing interests.

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Author's contributions

The Author, MMF, designed the study, data acquisition, performed the statistical data analysis, interpreted the results and prepared the manuscript. The author also read and approved the final manuscript.

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Abbreviations

AOR: Adjusted Odds Ratio

CI: Confidence interval

COR: Crude odds Ratio

CSA: Central Statistical Agency

DHS: Demographic and Health Survey

EAs: Enumeration Areas

EDHS: Ethiopia Demographic and Health Survey

SNNPR: Southern Nations, Nationalities, and People's Region

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Tables

Table 1: Socio-demographic characteristics of respondents among under-five children and their bivariate analysis with the occurrence of Diarrhoea in rural Ethiopia

Variables	Counts (%)	Had Diarrhoea recently		-test
		No (%)	Yes (%)	P-value
Current Age of respondent (year)				**0.004**
15-24	1972(24.5)	1724 (87.4)	248 (12.6)	
25-34	4080 (50.7)	3610 (88.5)	470(11.5)	
35-49	1989(24.7)	1803(90.6)	186(9.4)	
Sex of child				**0.042**
Male	4103(51.0)	3613(88.1)	490(11.9)	
Female	3938(49.0)	3524(89.5)	414(10.5)	
Current Age of child				**0.000**
<6 month	891(11.1)	816(91.6)	75(8.4)	
6-11	801(10.0)	650(81.1)	151(18.9)	
12-23	1517(18.9)	1243(81.9)	274(18.1)	
24-35	1567(19.5)	1378(87.9)	189(12.1)	
>35 month	3265(40.6)	3050(93.4)	215(6.6)	
Education of Mother/caregiver				**0.05**
No formal education	5801(72.1)	5182(89.3)	619(10.7)	
Primary	1912(23.8)	1667(87.2)	245(12.8)	
Secondary	270(3.4)	235(87.0)	35(13.0)	
higher	58(0.7)	53(91.4)	5(8.6)	
Region				**0.000**
Tigray	820(10.2)	726(88.5)	94(11.5)	
Afar	879(10.9)	787(89.5)	92(10.5)	
Amhara	838(10.4)	725(86.5)	113(13.5)	
Oromia	1414(17.6)	1250(88.4)	164(11.6)	
Somali	1106(13.8)	1032(93.3)	74(6.7)	
Benishangul	765(9.5)	692(90.5)	73(9.5)	
SNNPR	1104(13.7)	946(85.7)	158(14.3))	
Gambela	491(6.1)	431(87.8)	60(12.2)	
Harari	364(4.5)	320(87.9))	44(12.1)	
Dire Dawa	260(3.2)	228(87.7)	32(12.3)	
Number of under 5 children in h.h.				**0.001**
2 or less	6342(78.9)	5589(88.1)	753(11.9)	
3 and above	1699(21.1)	1548(91.1)	151(8.9)	
Wealth index of the household				**0.015**
Poor	5194(64.6)	4649(89.5)	545(10.5)	
Middle	1332(16.6)	1167(87.6)	165(12.4)	
Rich	1515(18.8)	1321(87.2)	194(12.8)	
Birth order number				0.185
1st order	1362(16.9)	1195(87.7)	167(12.3)	
2nd	1224(15.2)	1103(90.1)	121(9.9)	
3rd	1152(14.3)	1011(87.8)	141(12.2)	
4th	1062(13.2)	935(88.0)	127(12.0)	
5th and above	3241(40.3)	2893(89.3)	348(10.7)	
Religion of the respondent				**0.011**
Orthodox	2108(26.20)	1859(88.2)	249(11.8)	
Catholic	46(0.6)	40(87.0)	6(13.0)	
Protestant	1492(18.6)	1291(86.5)	201(13.5)	
Muslin	4232(52.6)	3801(89.8)	431(10.2)	
Traditional/other	163(2.0)	146(89.6)	17(10.4)	
Respondent's Current work status				**0.053**

Not working	6046(75.2)	5390(89.1)	656(10.9)	
Working	1995(24.8)	1747(87.6)	248(12.4)	
Respondent's Marital status				0.242
Married/Living with partner	7659(95.2)	6805(88.8)	854(11.2)	
Widowed/separated/never in union	382(4.8)	332(86.9)	50(13.1)	
Number of household members				**0.046**
5 and fewer	3267(40.6)	2872(87.9)	395(12.1)	
6 and above	4774(59.4)	4265(89.3)	509(10.7)	
Child lives with whom				0.141
Respondent	7904(98.30)	7010(88.7)	894(11.13)	
Someone else/Lives elsewhere	137(1.70)	127(92.7)	10(7.3)	
Currently breastfeeding				**0.002**
No	2582(32.1)	2333(90.4)	249(9.6)	
Yes	5459(67.9)	4804(88.0)	655(12.0)	

χ^2 = Chi-square

Table 2: Environmental and behavioural characteristics of respondents among under-five children and their bivariate analysis with the occurrence of diarrhoea in rural Ethiopia

Variables	Counts (%)	Had Diarrhoea recently		-test
		No (%)	Yes (%)	P-value
Source of drinking water				0.689
improved water	4241(53.3)	3763(88.7)	478(11.3)	
unimproved	3713(46.7)	3305(89.0)	408(11.0)	
Type of toilet facility				**0.034**
improved toilet facility	589(7.4)	530(90.0)	59(10.0)	
unimproved toilet facility	3262(41.0)	2863(87.8)	399(12.2)	
No Facility/bush/field	4103(51.6)	3675(89.6)	428(10.4)	
Toilet facilities shared with other h.h.				**0.041**
No	2986(77.5)	2648(88.7)	338(11.3)	
Yes	865(22.5)	745(86.1)	120(13.9)	
Disposal of youngest child's stools	2013(38.8)	1754(87.1)	259(12.9)	**0.07**
proper disposal	3171(61.2)	2816(88.8)	355(11.2)	
improper disposal				
Main floor material				
Natural floor	7413(93.2)	6594(89.0)	819(11.0)	0.634
Rudimentary floor	72(0.9)	63(87.5)	9(12.5)	
Finished floor	469(5.9)	411(87.6)	58(12.4)	

χ^2 = Chi-square

Table 3: Multivariable binary logistic regression analysis of the effects of socio-demographic and environmental associated factors of occurrence of diarrhoea among under-five children in Rural Ethiopia (the final reduced model)

Variables	COR(95% CI)	AOR(95% CI)	P-value for AOR
Current age of respondent (15-24)	---	---	.000
25-34	.90(.77, 1.07)	.66(.47, .93	**.016**
35-49	.72(.59, .88)**	.36(.23, .58)	**.000**
Sex of child (Female)	---	---	
Male	1.15(1.00, 1.33)*	1.29(1.05, 1.58)	**.013**
Current age of child (>35 month)	---	---	.000
<6 month	1.30(.99, 1.71)	1.34(.91, 1.99)	.140
6-11	3.30(2.63, 4.13)**	3.54(2.58, 4.87)	**.000**
12-23	3.13(2.59, 3.78)**	3.07(2.33, 4.04)	**.000**
24-35	1.95(1.58, 2.39)**	1.72(1.26, 2.34)	**.001**
Region (Tigray)	----	---	.000
Afar	.90(.67, 1.22)	1.91(1.01, 3.64)	**.047**
Amhara	1.20(.90, 1.61)	1.51(.93, 2.46)	.095
Oromia	1.01(.77, 1.33)	1.24(.80, 1.91)	.338
Somali	.55(.40, .76)**	.42(.22, .80)	**.009**
Benishangul	.81(.59, 1.12)	.95(.60, 1.52)	.844
SNNPR	1.290(.98, 1.69)	1.39(.90, 2.15)	.134
Gambela	1.07(.76, 1.52)	2.12(1.18, 3.81)	**.012**
Harari	1.06(.72, 1.55)	.89(.49, 1.62)	.698
Dire Dawa	1.08(.71, 1.66)	.72(.31, 1.65)	.440
Birth order number (1st order)	---	---	.003
2nd	.78(.61, 1.01)	.91(.62, 1.34)	.647
3rd	.99(.79, 1.27)	1.48(.98, 2.22)	.059
4th	.97(.76, 1.24)	1.81(1.17, 2.79)	**.007**
5th and above	.86(.71, 1.05)	1.85(1.22, 2.81)	**.004**
Toilet facilities shared with other households (No)	---	---	
Yes	1.26(1.01, 1.58)*	1.39(1.09, 1.77)	**0.008**
No. of under 5 children*Age of Mother ((2 or less)*(15-24))		---	.014
NoChildU5( ) by ageM(25-34)		2.46(.96, 6.30)	.060
NoChildU5( ) by ageM(35-49)			**.004**

		4.70(1.64, 13.45)	

The reference categories are those indicated in brackets
*Statistically significant variables at $p < 0.05$; **statistically significant variables at $p < 0.01$

Figures

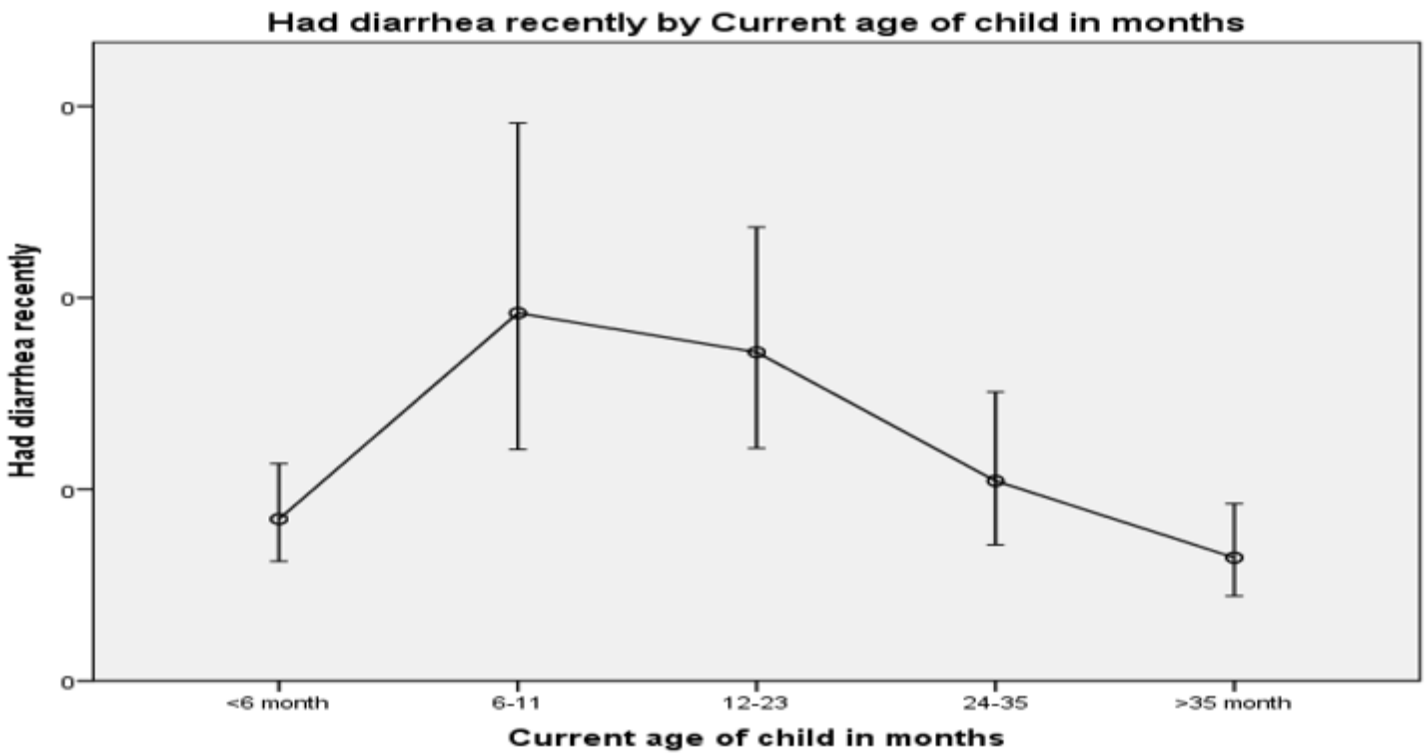

Figure 1

Estimated Marginal Means of age of children on diarrhoea occurrence. An output estimated for top significant fixed effects in the logistic regression analysis. The line with its boundary shows the occurrence of diarrhoea, on average, highly increases among children age from 6 months to 11 months, and gradually decreases to age 35 months and above.

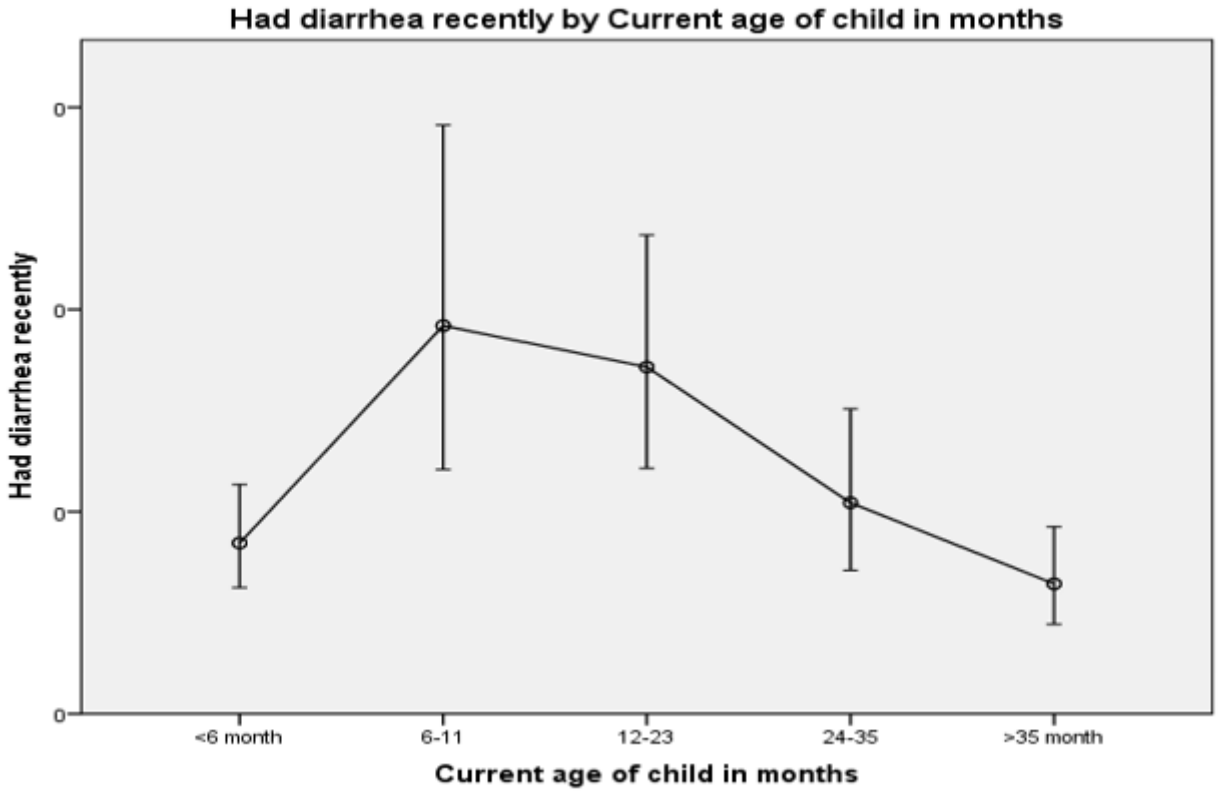

Figure 2

Estimated Marginal Means of age of children on Diarrhea occurrence. An output, estimated for top significant fixed effects, obtained in the multilevel logistic regression analysis. The line with its boundary shows the occurrence of diarrhea, on average, highly increases among children age from 6 months to 11 months, and gradually decreases to age 35 months and above.