

Assessment of the impact of latrine utilization on diarrhoeal diseases in the rural community of Hulet Ejju Enessie Woreda, East Gojjam Zone, Amhara Region

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Abstract

Background: The construction of latrine is a relatively simple technology that is used to prevent the spread of infectious diseases. While household access is important, community sanitation coverage is even more important to improve health through the regular use of well-maintained sanitation facilities.

Objective: Assessing the impact of latrine utilization on diarrhoeal diseases in the rural community in the district of Hulet Ejju Enessie Woreda, East Gojam.

Method: A community based descriptive cross-sectional study was conducted in a randomly selected 824 households that had 90% latrine coverage at the time data collection in 2006. A structured and pre-tested questionnaire complemented with observation was used to collect data. The study area is found in one of the districts of East Gojjam where the health services extension program was actively underway. Trained data collectors and supervisors were involved in the study. Data entry and cleaning was done using EPI INFO 6.04d, while SPSS version 11 was used for data analysis.

Results: Most (61%) households with traditional pit latrines had latrine utilization. In a bivariate analysis, the extent of latrine utilization was significantly associated with presence of primary or secondary school children in the house [AOR: 1.47, 95% CI: (1.04-2.06)], perceived reasons for latrine construction [AOR: 2.89, 95% CI: (1.24-6.72)] and learning from neighborhoods [AOR: 10.07, 95% CI: (1.97-51.56)], ecology of 'Kolla' [AOR: 0.47, 95% CI: (0.29-0.74)] and 'Woyna-Dega' [AOR: 0.55, 95% CI: (0.38-0.81)], and owning latrines for ≥ 2 years [AOR: 2.13, 95% CI: (1.57-2.89)]. The occurrence of childhood diarrhoea was not statistically associated with the extent of latrine utilization [AOR: 0.63, 95% CI: (0.22-1.81)]; however, only owning latrines for ≥ 2 years remained significant in a multivariate analysis [AOR: 0.28, 95% CI: (0.12-0.66)].

Conclusion: Utilization of latrine facilities was common among the majority of households. The duration of having latrines had impacted the occurrence of childhood diarrhoea. [*Ethiop. J. Health Dev.* 2010;24(2);110-118]

Introduction

Over 50 different infections are potentially transmitted from an infected person to a healthy one by various routes involving excreta (2). The use of sanitation facilities is known to interrupt the transmission of faeco-oral related disease (2-4). The construction of traditional pit latrine is relatively a simple technology that is available to control the spread of diarrhea that is prevalent in developing nations (5). However, 2.4 billion people, 40% of the total world population, lack improved sanitation and 80% of these people live in rural areas of the developing world (5-8). In the WHO African Region, a total of 631 million people, (40%), had no access to any kind of improved sanitation facilities in 2000 (9). This figure is about the same (36%) in 2002 for Sub-Saharan African nations (10). A very recent publication of WHO/UNICEF indicated Africa is lagging much to attain MDG goals in sanitation, that aims to achieve improving a coverage of 38% (in 2006) to a level of 66% (in 2015) (11).

In Ethiopia, according to Demographic and Health Survey 2005, about 62% of the households (12% in Urban and 70% in Rural) had no access to any type of

latrine facilities (12). The same data source indicated the proportion of households with private improved sanitation was only 6.8%. This is highly unacceptable given the national prevalence of diarrhea diseases, 18%, among under-five children (12) whose mortality is one of the decisive indicators in the MDG goals (13). Overall child mortality could be reduced by 55% with the provision of safe water, sanitation and hygiene (14). The prevalence of diarrhea in Ethiopia has wider variation, from 11% to 38% (15-17), that mainly depends on season, ecology, and water and sanitation coverage.

Health improvement comes from the proper use of sanitation facilities, not simply because of their merely physical presence (4). The proper use of latrines can reduce the risk of diarrhea to almost the same extent as improved water supplies, but generally the greatest benefit occurs when improvements in sanitation and water supply are combined and education is given on hygienic practices (14, 18-20). However, there is another view that the efficiency of controlling diarrhea could depend on a single intervention and not as a result of combined effort (21-23).

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Cultural values towards sanitation facilities are key elements affecting the continued latrine utilization. Odour and fly problems are often quoted as deterrents to use latrine facilities (5, 12, 24). The only available KAP study undertaken by Ministry of Health in Ethiopia in 1996/97 indicated that the major reasons for not using latrines were lack of superstructure, poor hygiene and poor maintenance of latrines (25). The availability of such infrastructure, however, is not worth unless the readiness to use is guaranteed. The same reference showed that 69% of respondents did not know what diseases are associated with drinking water and 53% of respondents were not aware at all that communicable diseases can be transmitted through human excreta. On the average latrine availability was about 10%, of with self-reported utilization was 85%. Locally published work in areas of latrine utilization in Ethiopia is not available. Generally, drinking water, sanitation, and hygiene related articles published in the pioneering Ethiopian Journal of Health Development is less than 5% (26).

Given the provision of sanitation facilities were aggressively initiated in all parts of Ethiopia with interventions of health extension program since 2004, the impact of latrine utilization on the health of the community, particularly on under-five children, was not defined. This study was designed to show the benefits of latrine utilization and factors affecting utilization.

Methods

A cross-sectional study was carried out in the rural community of Hulet Ejju Enessie Wereda during September 2006. Wereda is a second hierarchy of local administrative unit which is equivalent to a district. The area is located in East Gojjam Zone of Amhara Regional State. It is located at about 370 Km from Addis Ababa, 120 Km from Bahir Dar, the regional capital and 210 Km from DebreMarkos the zonal capital city. The Wereda had 6 urban Kebeles and 41 rural Kebeles. Kebele is the smallest administrative unit acting as a local government.

The Wereda was purposely selected with the view that it had 90% latrine coverage at the time this study was conducted. The sample size was calculated using single proportion formula with the assumption of 95% confidence interval (two-sided), an expected proportion (latrine utilization) of 90% in the Wereda, marginal error of 3%, design effect of 2 and non-response rate of 10%. Accordingly, a total of 838 study subjects were calculated for the study.

A stratified cluster sampling was applied to select the study subjects. The Wereda was stratified by climatic condition in to 'Kolla', 'Woyna Dega' and 'Dega' assuming that diarrhoeal diseases vary with climatic zone. In addition, stratification by ecology was considered in order to improve the efficiency of sampling. Ten Kebeles (25% of the rural Kebeles) were selected randomly and

included in the study. Then 838 households with latrines were selected by using proportional allocation to the size of Kebeles. Eligible households were selected using a systematic sampling from the list of latrine owners registered by data collectors a week prior to the actual data collection date.

In order to avoid ambiguity of data collection, the following terms were operationally defined:

- **Satisfactory Latrine utilization** – households with functional latrines and the family disposed the faeces of under-five children in a latrine, no observable faeces in the compound, no observable fresh faeces on the inner side of the squatting hole and the presence of clear foot-path to the latrine is uncovered with grasses or other barriers of walking.
- **Functional latrine** - latrine with sub and super-structures and that provided services at the time of data collection even if the latrine required maintenance.
- **Occurrence of childhood diarrhoea** – the presence of diarrhoea (three and more loose or liquid stools per day) among under-five children in the house within two weeks period prior to survey, as reported by the caretaker of the child.

The pre-tested questionnaire was administered to a mother or guardian of the child. All study subjects were interviewed about latrine utilization and only those with both latrines and under-five children were interviewed about diarrhoeal diseases. Respondents were interviewed with a local language after ensuring the consistency and clarity of the English version.

A standardized and structured questionnaire was developed for the purpose of data quantitative collection. Ten health extension workers for data collection and two sanitarians for supervision were recruited before data collection. Field team members were trained for three days on the purpose, tasks and interviewing techniques with the provision of a field manual for data collection. Training for data collectors and supervisors were given for three days by preparing and using training manual that was purposely prepared for this study. Field supervisions and daily meetings during data collection were intense to ensure the quality of data collection.

All field questionnaires were first checked, and coded. Afterwards data were entered and cleaned using EPI ENFO software version 6.04. Analysis was conducted with SPSS software Version 11.0. A 10% of entered data was re-entered to check the consistency of originally entered data by clerks. Descriptive statistics was performed using frequency distribution and percentages that were displayed using tables and figures. Bivariate and multivariate analyses using odds ratio with 95% CI were performed to find out an association between the dependent and independent variables in concern. The multivariate analysis was meant to explore the effect of

latrine utilization on diarrhea by considering the hierarchical conceptual framework. In SPSS, "ENTER" method was used to assess the relative importance of the explanatory factors on diarrhea sickness. To avoid an excessive number of variables and unstable estimates in the subsequent model, only variables with p-value <0.30 were kept in the subsequent model analysis (27). The overall effect of the selected socioeconomic variables on childhood diarrhoeal disease was assessed in the first step of multivariate analysis. In the second step, the environmental variables were added, and their effect was assessed in the presence of socioeconomic variables that had p-value < 0.30. In the third step, the effect of the selected behavioral factors was assessed in the presence of both socioeconomic and environmental factors that had p-value <0.30. Variables with p<0.05 were considered for the condensed model.

The ethical approval was obtained from Medical Faculty of Addis Ababa University. Permission for data collection was obtained from respective local administrative bodies. Interview was carried out only with full consent of respondents. Confidentiality and privacy were maintained anonymously. Advising about home made therapy or appointment to bring children to health posts was made when children with diarrhoea were found during data collection.

Results

Socio-economic characteristics: A total number of 824 (98.3 %) households with latrines were included in the study. The majority, (94.3 %) of respondents was Orthodox Christians and almost all (99.9%) belong to Amhara ethnicity. Most, 494 (60.0%), households had a family size of ≤ 5 persons, with a mean (SD) family size of 4.96 (± 1.99). There were under-five children in 370 (45%) households with a total of 447 children. One hundred two (22.8 %) under-five children were within 36-47 months age category and 234 (52.3 %) under-five children were females.

Six hundred nineteen (75.1%) mothers and 512 (71.4%) fathers were illiterate. Five hundred thirty three (64.7%) households had children attending either primary or secondary school. Majority (86.2%) of respondents were married. Seven hundred seventeen (87.0%) households were predominantly headed by fathers. Majority of fathers (98.3%) were engaged in farming. Fifty five percent mothers were housewives. Majority of the households (89.3%) had at least one kind of domestic animals. Five hundred seventy five (59.5 %) households had 1-2 hectares of land, with a mean (SD) of 1.13 hectares (± 0.57) that is used for agricultural purpose (Table 1).

Table1: **Socio-economic characteristics of study subjects in the rural community of Hulet Ejju Enessie Woreda, September 2006**

Characteristics	Frequency	Percent
Family Size (n=824)		
≤5	494	60.0
>5	330	40.0
Educational status of mothers Size (n=824)		
Illiterate	619	75.1
Read and write	140	17.0
Literate	65	7.9
Educational status of the Father (n=717)		
Illiterate	512	71.4
Read and write	140	19.5
Literate	65	9.1
HHS with elementary or secondary school children		
Yes	533	64.7
No	291	35.3
Marital status Size (n=824)		
Married	710	86.2
Unmarried	14	1.7
Divorced/separated/Widowed	100	12.1
Occupational status of mothers Size (n=824)		
House wife	454	55.1
Farmer	349	42.4
Others	21	2.6
Occupational status of Father (n=717)		
Farmer	705	98.3
Others	12	1.7
Head of households Size (824)		
Father	717	87.0
Mother	106	12.0
Others	1	0.1
No. of under-five children in the household (n=370)		
One	305	82.4
Two to Three	65	17.5
Water source for domestic purpose (n=370)		
Protected	161	43.5
Unprotected	209	56.5

Sanitation facilities: Almost all (99.8%) types of available latrines were pit latrines. Majority (63.5%) of latrines were constructed before 2 years and longer prior the study. The mean (SD) duration of having a latrine was 29.01 (\pm 10.05) months. Seven hundred fourteen (86.7%) latrines were functional, of which 389 (54.5%) latrines required maintenance. The remaining non-functional (13.3%) latrines required rehabilitation works.

Only 6 (0.8 %) latrines had no superstructure. Majority (93.4 %) of latrine slabs were made of mainly mud, few cemented. About 66% of latrines had no cover on the squatting hole. About 57% of latrines were located >6 meters far away from houses. Four hundred ninety four (69.2%) households with latrine had no any kind of hand washing facilities (Table 2).

Table 2: **Distribution of respondents by environmental factors in the rural community of Hulet Ejju Enessie Woreda, September 2006**

Characteristics	Frequency	Percent
Years since latrines constructed (n=824)		
<2 yrs	301	36.5
2-3 yrs	345	41.9
\geq 3 yrs	178	21.6
Functional latrines (n=824)		
Yes	714	86.7
No	110	13.3
Status of latrines (n=824)		
Need reconstruction	110	13.3
Need no maintenance	325	39.4
Need maintenance	389	47.2
Parts of latrine requiring maintenance (n=389)*		
Superstructure	231	59.4
Slab	53	13.6
Roof	200	51.4
Latrine pit	17	4.4
Materials of latrine superstructure (n=714)		
No superstructure	6	0.8
Only with wood	53	7.4
Wood plastered with mud	652	91.3
Other	3	0.4
Sealed or cemented latrine slabs (n=714)		
Yes	667	93.4
No	47	6.6
Location of hand washing facilities from latrine (n=714)		
Next to latrine	176	24.6
Within walking distance	15	2.1
Inside the house	29	4.1
No facility	494	69.2
Distance of latrine from the house (n=714)		
<6 meters	307	43.0
6-10 meters	365	51.1
\geq 10 meters	42	5.9

* had multiple responses

Behavioral Factors: Most (76.1%) of the respondents who had latrines explained that they were advised by extension health workers to construct latrines. Only 43 (5.2%) respondents complained that they were imposed by other bodies like local administrators. Six hundred eighty nine (96.5%) respondents explained that all family members of \geq 5 years old were using latrines. Reported utilization was 93% among respondents. There were observable faeces in the compound of 14.7% of the households. Six hundred fifty seven (92%) households were observed with the presence of fresh faeces inside the pit of the latrine (an indication of utilization) and only

13.6% of the foot-paths to the latrines were covered with grasses.

The extent of latrine utilization among 500 (60.7%) households with latrines was satisfactory. Only 46 (12.4 %) households responded that there were under-five children who used latrines. More than one-third of them began to use the latrine by the age of three years and 67% by the age of four years. One hundred and eight (38.9%) households disposed their children's faeces improperly by disposing out of houses somewhere either in the backyard or in the nearby bush (Table 3).

Table 3: Distribution of respondents by the behavioral factors in the rural community of Hulet Ejju Enessie Woreda, September 2006

Characteristics	Frequency	Percent
Latrine use by ≥5 years old (n=714)		
Males only	20	2.8
Females only	5	0.7
All family members	689	95.5
Frequency of latrine use (n=714)		
Rarely	27	3.8
Mostly	25	3.5
Always	662	92.7
Observable faeces in the compound (n=824)		
Yes	121	14.7
No	703	85.3
Presence of fresh faeces in the pit of latrine (n=714)		
Yes	657	92.0
No	57	8.0
Latrine foot-path covered with grass (n=714)		
Yes	97	13.6
No	617	86.4
Extent of latrine utilization (n=824)		
Satisfactory	500	60.7
Unsatisfactory	324	39.3
Latrine use by under-five children (n=370)		
Yes	46	12.4
No	324	87.6
Starting age of latrine use by <5 children (n=46)		
At 2 years old	1	2.2
At 3 years old	14	30.3
At 4 years old	31	67.4
Disposal means of faeces of children (n=340)		
Pit latrine disposal	224	65.9
Disposal by burying	8	2.3
Disposing faeces out of houses	108	31.8

The reasons given by respondents for why under-five children did not use the latrines were: being just a child (38.1%), large squatting hole (17.4%), and floor was not safe to stand on (15.5%). Majority of the respondents (84.2%) reported to always use latrines because of their understanding about the danger of excreta to health. Among the reasons given by the respondents, non-functionality of latrines (80%), and staying out for work (7.3%) were the main reasons for not utilizing a latrine.

Predictors of latrine utilization: Selected variables that were significantly associated at the bivariate analysis were further examined in the logistic regression to see their relative effects on the extent of latrine utilization (Table 4). The presence of primary or secondary school children in a household increased latrine utilization [OR: 1.43, 95% CI: (1.05-1.95)]. The extent of latrine utilization was about 5 times more satisfactory in the house that constructed latrine by learning from peer groups than being imposed by other bodies [OR: 5.38, 95% CI: (1.53-18.94)]. Even though perceived reason of self initiation to construct latrine by the household had no significant association in the bivariate analysis, its association appeared in the multivariate analysis and the extent was 2 times more satisfactory than being imposed by other bodies to construct latrine [OR: 2.20, 95%

CI:(1.01-4.76)]. The extent of latrine utilization was about 2 times more satisfactory in the households owning latrines for ≥ 2 years than owning < 2 years [OR: 1.82, 95% CI: (1.33-2.51)]. The extent of latrine utilization were also less likely satisfactory both in 'Kolla' [OR: 0.47, 95% CI: (0.29-0.74)] and 'Woyna Dega' [OR: 0.55, 95% CI: (0.38-0.81)] than 'Dega' Zone.

Occurrence of childhood diarrhea: The two-week prevalence of diarrhea among under-five children was 6.5% prior the study period. From all variables entered in all steps of multivariate analysis, only duration of owning latrine by the household remained significant after adjusting socioeconomic, environmental and behavioral factors. Households owning latrines for ≥ 2 years had a more likely protective effect (close to 70%) of the occurrence of childhood diarrhoea [OR: 0.28, 95%CI: (0.12-0.66)] in final model of multivariate analysis than owning with in 2 years. Even though number of under-five children in a family, functional latrines, status of latrine, extent of latrine utilization, and observable faeces in the compound and in the neighborhoods showed significant association in the bivariate analysis, their significance disappeared in all steps of the multivariate analysis (Table 5).

Table 4: Summary of logistic regression on predictors of the extent of latrine utilization in the rural community of Hulet Ejju Enessie Woreda, September 2006

Characteristics	Crude OR (95% CI)	Adjusted OR (95% CI)
Households with elementary or secondary school children		
Yes	1.35 (1.01-1.81)*	1.43 (1.05-1.95)*
No	1.00	1.00
Reasons given for latrine construction		
Advise from health workers	1.38 (0.74-2.57)	1.44 (0.76-2.72)
Self initiation	1.93 (0.91-4.01)	2.20 (1.01-4.76)
Peer pressure	4.57 (1.34-15.55)**	5.38 (1.53-18.94)**
Imposition from others	1.00	1.00
Duration of owning latrine by household		
≥2 years	1.99 (1.49-2.66)***	1.82 (1.33-2.51)***
<2 years	1.00	1.00
Climatic zone		
'Kolla'	0.31 (0.20-0.47)***	0.47 (0.29-0.74)**
'Woyna Dega'	0.50 (0.35-0.72)***	0.55 (0.38-0.81)**
'Dega'	1.00	1.00

Significant at P<0.05*; P<0.005**; P<0.001***

Table 5: Summary of logistic regression on the predictors of the occurrence of childhood diarrhea in the rural community of Hulet Ejju Enessie Woreda, September 2006

Characteristics	Crude OR (with 95 CI)	Adjusted OR (with 95% CI)		
		Model 1	Model 2	Final Model
Model 1 (socio-economic variables)#				
Family size of the household				
≤5 members/>5 members*	0.51 (0.23-1.14)	0.69 (0.26-1.88)		
Households with elementary or secondary school children				
Yes/No*	1.84 (0.76-4.45)	1.38 (0.47-4.08)		
Occupational status of mother				
House wife/Other*	1.08 (0.49-2.38)	1.16 (0.52-2.59)		
Number of <5 children in a house				
>1 children/One child*	2.42 (1.04-5.62)**	2.18 (0.92-5.21)	2.78 (1.15-6.77)**	2.31 (0.91-5.86)
Model 2 (socio-economic + environmental variable)#				
Functional latrines				
Yes/No*	0.37 (0.15-0.89)**		0.47 (0.18-1.23)	0.69 (0.23-2.07)
Status of latrine				
Need/No need of reconstruction*	2.71 (1.13-6.52)**		0.34 (0.15-0.78)**	0.28 (0.12-0.66)***
Duration of owning latrine by household				
≥2/<2yrs*	0.29 (0.13-0.65)**		0.34 (0.15-0.78)**	0.28 (0.12-0.66)***
House shared with domestic animals				
Yes/No*	1.96 (0.77-4.96)		1.58 (0.60-4.18)	
Climatic zone				
'Kola'/'Dega'*	4.94 (0.05-23.26)**		1.31 (0.55-3.12)	
Model 3 (socio-economic + env. + behavioral variables)#				
Extent of latrine utilization				
Satisfactory/unsatisfactory*	0.38 (0.17-0.87)**			0.63 (0.22-1.81)
Observable faeces in the Compound				
Yes/NO*	2.61 (1.15-5.94)**			1.40 (0.48-4.09)
Observable faeces in the neighborhood yard				
Yes/No*	2.47 (1.06-5.75)**			1.51 (0.58-3.96)
Latrine use by under-five children				
Yes/No*	0.24 (0.03-1.84)			0.23 (0.03-1.88)
Per capita water consumption				
<10 lits/>10 lits*	2.55 (0.86-7.54)			2.72 (0.87-8.46)
Supplementary feeding practices				
Bottle/cup feeding*	0.43 (0.01-1.87)			0.43 (0.09-2.05)
Vit. A supplemented children				
Yes/No*	3.48 (0.46-26-29)			3.25 (0.40-27.26)

Only variables with p-value <0.3 were kept in the subsequent analysis and displayed in the table

* Reference group; Significant at P0.05**; P<0.005***

Discussion

The findings of this study revealed that self-reported usage of latrine by adults was about 97% which is nearest to the report in Lesotho (99%) (28). However, the use of latrines by children was not encouraging. Few children began to use the latrine at the age of 3 years in this study. In Kenya although children began to use the latrine as early as 2 years, most of them start at the age of 5 which is consistent with the present study. The methods of handling of faeces of under-five children varied among respondents: 65.9% disposing faeces in the latrine, 2.3 % burying while 31.8% disposing around the house either in the bush or in the garden. This behavior is entirely unacceptable practice of handling faeces. The use of latrine for safe disposal of children faeces in the present study was better when compared with the reports in Kenya (53%) (29), Lesotho (50%) (28) and Philippines (39%) (30). However, disposing faeces out of the house was higher than the reported in Kenya (12%) (29).

The presence of primary or secondary school children in the house was associated with the extent of latrine utilization. The fact that students were more exposed to hygiene information in the school environment, their presence positively favored the persuasion of latrine utilization in the home environment. The Wereda Health Officer reported (personal communication) that health extension program was closely linked to the promotion of school health, which was an additional opportunity for students to learn healthy lifestyles. Maternal education was not associated with the extent of latrine utilization, although a more likely increase of latrine utilization was observed among literate mothers than illiterate mothers. Mother's education was known to encourage latrine use (31) and protect a child from diarrhea (32-33). The Ethiopian DHS has also indicated variations in the prevalence of diarrhea by education and presence of improved latrine (12).

Peer pressure was also associated with the extent of latrine utilization. This is due to the fact that people can learn to accept, adopt and utilize latrine facilities easily by following role model individuals and observing model latrine facilities than mere advice and enforcement. The health extension program in Ethiopia is known for the provision and promotion of role models, which serve being a springboard for public health education. Duration of owning latrine by household was also associated with the extent of latrine utilization. The process of behavioral changes towards appreciating the advantages of latrine facilities require some threshold time that may require for the modification of individual's behavior. The extent of latrine utilization was also significantly different by climatic zones. Residents in "Kola" were less likely to use latrines than residents in other climate zones. The wide spread open defecation practice in Kola agro-ecology might be linked to fear of odour and flies that are inherent problems of traditional pit latrines. There is also a taboo among respondents that faecal matter under

sunlight dries up quickly and becomes harmless in the open space in such hot climate as "Kola".

Knowledge on the danger of excreta and the perceived advantage of using latrines, particularly for girls and women in a community where defecation during the day time is shame, were key factors that facilitated latrine use by the household members (34). Major reasons that deter latrine use by the households were non-functional latrines, staying out for farming, and the absences of superstructure. These are about similar to the survey conducted in 1997 (25). Mother's education (Kenya), latrine design, accessibility, and maintenance (Nepal), user being women (India) were important determinants for latrine use (34).

In the present study, the two-week prevalence rate of under-five diarrhea was 6.5%, which is much below the 2005 Ethiopian DHS report (18%) (12). The difference in sample size, time of the study, and the difference in the background of study areas might explain these variations. Diarrhea morbidity rates were found to be highest (65.5%) in children with 6-23 months age compared to other age groups, which is consistent with the 2005 EDHS (57.6%) and other studies (35-38). The occurrences of childhood diarrhoea were not significantly associated with family size, annual family income, educational status of parents and children, and occupation of mothers. Their contribution to the occurrence of childhood diarrhoea was small in comparison to the environmental and behavioral factors. Studies in Nepal (28) showed that an apparent increased risk of diarrhoea in children of literate mothers, probably due to improved recognition of the condition in the child, seemed to be consistent with this study. The occurrence of childhood diarrhoea did not differ by occupation of mothers, which is inconsistent with other findings (39).

The occurrence of childhood diarrhoea was also associated with the extent of latrine utilization, presence of faeces in the backyard as well as in the neighborhood's yard in the bivariate analysis. A study in Ghana indicated similar findings (40). Open field defecation is a primary practice to easily acquire diarrhea related infections. The only factor that contributed to the increased risk of diarrhea among children in the multivariate logistics regression analysis was the duration of owning latrine for a longer period by households. This indicates that a behavioral change towards sanitation is not a matter of an overnight goal. It requires long-term sustained effort of health promotion that aims the utilization of latrine facilities.

In conclusion, this study showed encouraging practice in latrine use. The presence a school children in a household, duration of owning a latrine, peer pressure, and self initiation to owe latrine due to the promotional activity of health extension workers were the major factors affecting utilization of latrines. The mere latrine

utilization did not impact the occurrence of childhood diarrhoeal diseases, while the duration of utilization was a strong predictor to bring visible changes in future. Strengthening the link between sustained utilization and continued hygiene education should remain prudent. The involvement of health extension workers in data collection in a program they are involved might have biased the results, specifically the occurrence of diarrhea, despite the study involved intensive daily supervision during data collection. In addition, a one-time survey undefined seasonal variability were limitations of this study to demonstrate strong evidence for the impact of latrine utilization on diarrhea. Availability of literature addressing our research questions was also a limiting factor to discuss our findings.

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References

- Grosvenor Press International LTD. Developing world health: Water supply and sanitation in developing countries; 1986.
- World Health Organization. World Water Day 2001: Sanitation: Controlling Problems at Source. Available from: URL: <http://www.worldwaterday.org/wwday/2001/thematic/control.html>.
- World Health Organization. PHAST step by step Guide: Participatory approach for the control of diarrhoeal diseases; 2000.
- World Health Organization. Healthy villages: A guide for communities and communities health workers. Geneva; 2002.
- Mc Conville J. Field engineering in the developing world: How to Promote the Use of Latrines in Developing Countries; 2003. Available from: URL: www.cee.mtu.edu/peacecorps.
- Jabu G. Assessment and comparison of microbial quality of drinking water in Chikwawa; 2006. Available from: URL: <http://www.poly.ac.mw/centres/washted/images/pdfs/irish.post-graduate.conference.paper.pdf>.
- World Bank. Water supply and sanitation. Hygiene and sanitation promotion: why promote sanitation? 2002.
- United Nations Environment Program, United Nations Children's Fund, World Health Organization. Children in the new millennium: Environmental impact on health; 2002.
- World Health Organization, UNICEF. African Regional water supply and sanitation assessment Report; 2000. Available from: URL: http://www.who.int/water_sanitation_health/monitoring/globalassess/en/.
- World Health Organization, UNICEF. Meeting the MDG drinking water and Sanitation: a mid-term Assessment of Progress; 2002. Available from: URL: http://www.who.int/water_sanitation_health/monitoring/jmp04.pdf.
- World Health Organization, UNICEF. A Snapshot of Sanitation in Africa A special tabulation for Africa San. Based on preliminary data from the WHO/UNICEF. Joint Monitoring Program for Water Supply and Sanitation. Africa San: Second African Conference on Sanitation and Hygiene Durban, South Africa; February 18-20,2008. Available from: URL: http://www.who.int/water_sanitation_health/monitoring/africansan.pdf2008.
- Central Statistical Agency Ethiopia, ORC Macro USA. *Ethiopia Demographic and Health Survey 2005*. Addis Ababa; 2006.
- United Nations. The Millennium Development Goals Report 2005. United Nations report. New York; 2005.
- Esrey SA, Potash JB, Roberts L, Schiff C. Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. *Bulletin of the WHO* 1991;69(5):609-21.
- Charles P, Lulseged S, Kitsela T. Child hood diarrhoea. In: Berhane Y, Haile Mariam D, Kloos H, editors. *Epidemiology and Ecology of Health and Disease in Ethiopia*. Addis Ababa: Shama Books; 2006.
- Mulugeta T. Socio-economic, environmental, and behavioral factors associated with the occurrence of diarrhoeal disease among under-five children, Meskanena-Mareko Woreda, Southern Ethiopia [MPH dissertation]: Addis Ababa University; 2003.
- Eshete WB. A stepwise regression analysis on under-five diarrhoeal morbidity prevalence in Nekemte town, western Ethiopia: maternal care giving and hygiene behavioral determinants. *East Afr J Public Health* 2008;5(3):193-8.
- World Health Organization. Prevention of diarrhea (unit 8) - Medical Education: Teaching Medical Students about diarrhoeal diseases; 1993.CDD/SER/93.3. Available from: URL: <http://www.who.int>.
- Fewtrell L, Kaufmann R, Kay D, Enanoria W, Haller L, Colford JJ. Water, sanitation, and hygiene interventions to reduce diarrhea in less developed countries: a systematic review and meta-analysis *Lancet Infectious Diseases* 2005;5(1):42-52.
- Esrey S, Feachem R, Hughes J. Intervention for the control of diarrhea diseases among young children: improving water supplies and excreta disposal facilities. *Bulletin of the WHO* 1985;63:757-72.
- Fewtrell L, Colford JJ. Water, sanitation, and hygiene in developing countries: interventions and *Ethiop. J. Health Dev.* 2010;24(2)

- doiarrhoea: a review. *Water Sci Technol* 2005;52(8):133-42.
22. Van Derslice J, Briscoe J. Environmental interventions in developing countries: interactions and their implications. *Am J Epidemiol* 1995;15;141(2):135-44.
 23. Mertens TE, Fernando MA, Cousens SN, Kirkwood BR, Marshall TF, Feachem RG. Childhood diarrhoea in Sri Lanka: a case-control study of the impact of improved water sources. *Trop Med Parasitol* 1990;41(1):98-104.
 24. Kumie A, Ali A. An overview of environmental health status in Ethiopia with particular emphasis to its organization; A literature survey of drinking water and sanitation. *Ethiop J Health Dev* 2005;19(2):89-101.
 25. Ministry of Health Ethiopia, Environmental Health Department. KAP study on water supply, environmental sanitation and hygienic practice in the selected Woredas of Ethiopia 1997.
 26. HailevMariam D, Haidar J. A brief overview of issues addressed by EJHD publications (including index). *Ethiop J Health Dev* 2009;23(Special Issue):187-223.
 27. Victoria C, Huttly S, Fuchs S, Olinto M. The role of conceptual frameworks in epidemiological analysis: A hierarchical approach. *Int J Epidemiol* 1997;26(1):224-7.
 28. Daniels D, Cousens S, Makoae L, Feachem R. A case control study of improved sanitation on diarrhoea morbidity in Lesotho. *Bulletin of the WHO* 1990;68(4): 455-63.
 29. Moi University FoHS. Field Attachment: A report on Kapuonja Community and Chulaimbo provincial rural health training center in Maseno division, Kisumu district: html Document; 2006
 30. Van Deslice J, Popkins B, Briscoe J. Drinking water quality, sanitation and breast feeding: their interactive effects on infant health. *Bulletin of the WHO* 1994;72(4):587-601.
 31. Siziya S, Muula A, Rudatsikira E. Diarrhoea and acute respiratory infections prevalence and risk factors among under-five children in Iraq in 2000. *Riv Ital Pediatr* 2009;35(1):8-13.
 32. Manun'ebo M, Haggerty P, Kalengaie M, Ashworth A, Kirkwood B. Influence of demographic, socioeconomic and environmental variables on childhood diarrhoea in a rural area of Zaire. *Trop Med Hyg* 1994;97(1):31-8.
 33. Swami H, Thakur J, Gupta M, SP B. Improving environmental conditions of a slum in Chandigarh by an awareness campaign. *J Environ Sci Eng* 2004;46(3):252-6.
 34. IRC International Water and Sanitation Centre. INCO : International Scientific Cooperation Projects Final Report (1998-2002): Sustaining changes in hygiene behavior. Available from: URL: <http://www.irc.nl/index.php/content/view/full/2882002>.
 35. World Health Organization. Indicators to improve children's Environmental Health: Diarrhoeal diseases. Geneva; WHJO, 2003.
 36. Snyder J, Merson M. The magnitude of the global problem of acute diarrhoeal diseases: a review of active surveillance data. *Bulletin of the WHO* 1982;69(4):605-13.
 37. Bern C, Mertines J, deZonysa I, Glass R. The magnitude of the global problem of diarrhoeal diseases; a ten year update. *Bulletin of the WHO* 1992;70(6): 705-14.
 38. Nepal NMIS Cycle 3: Diarrhoea, Water and Sanitation. Results from Nepal on diarrhoea and sanitation, 1996. Available from: URL: http://www.npc.gov.np/unicef/nmis/3rd_cycle/executive_summary.htm.
 39. Saran M, Gaur S. Epidemiologic correlates of diarrhea in a slum community in Varanasi. *Indian Journal of Pediatrics* 1981;48(393):441-6.
 40. Boadi KO, Kuitunen M. Childhood diarrhoea morbidity in the Accra Metropolitan Area, Ghana: Socio-economic, environmental and behavioral risk determinants in Developing Countries/URL 2005;March:31-44.