

# Assessment of Latrine use and Associated Factors among Rural Community Members in Chiro Zuria Woreda Particularly in Kilinso and Nejebas Kebele

Getachew Gashaw Dagne<sup>1\*</sup>, Amare Fassil Abebaw<sup>1</sup>, Sisay Lemma Wake<sup>2</sup>, Abebe Getu Derso<sup>3</sup>

<sup>1</sup>Department of Biology, College of Natural and Computational Science, Oda Bultum University, Chiro, Ethiopia; <sup>2</sup>Department of Animal Science, College of Agriculture, Oda Bultum University, Chiro, Ethiopia; <sup>3</sup>Department of Dairy and Meat Technology, College of Agro-industry, Oda Bultum University, Chiro, Ethiopia

## ABSTRACT

Proper disposal of human excreta remains a challenge especially in low income countries including Ethiopia. About 80% of the disease burden is related to poor sanitation and hygiene in the country. Cognizant of challenges, health extension program has been widely implemented longer. Latrine facility coverage of study area was lower and its utilization remained also lower. Level of latrine utilization and factors associated with latrine utilization of the study area were not known. Therefore, evidences were required to show the current situation of latrine utilization in the study area. Taking in to account this the current study conducted to determine latrine use and associated factors among the rural community members in Chiro Zuria woreda. Latrine facility coverage is increasing since Health Extension Program started, whereas less attention to quality and utilization of latrine facilities in rural Ethiopia. This research was conducted at Nejebas and Kilinso Kebele in 2018. The data was collected through interviews and questionnaire. 69 SHHs were identified in random sampling technique from each Kebele for this research which also includes direct field observation. Qualitative data was collected through Key Informant Interviews to complement the household survey findings. The study revealed that the current sanitation situation in the study area is poor. Majority of privately owned latrine were made up of mud and wood, which are low quality creating bad smell to the surrounding areas. The daily demand and supply of the potable water is not balanced. Pit latrines are imposing negative impact of the environment and health of public. Among the community there is poor awareness about sanitation and health. Increasing of construction price and poor coordination between sectors are the problems related to the sanitation situation in the study area. The study concludes that all efforts geared towards up scaling latrine use in the study are must tackle the entire underlying barrier.

The aim of this study was settled out to determine latrine use and associated factors among the rural community members in Chiro Zuria woreda: Nejebas and Kilinso kebele.

**Keywords:** Latrine utilization; Hand washing facility; Hygiene; Sanitation

## INTRODUCTION

Sanitation is the United Nations declared human right and without access to it, many communities are left vulnerable to impacts on health, dignity, negative economic and education effects [1]. Lack of latrines mostly affects the poor, rural and marginalized communities as majority (71%) of those who do not use improved latrines live in rural areas where 90% of all open defecation takes place. The global health burden associated with these conditions is staggering, with an estimated 4,000–6,000 children dying each day from diseases associated with lack of access to sanitation [2].

Despite these realities, progress towards meeting the sanitation Millennium Development Goal (MDG) target for all by 2015 is woefully off track [3].

Globally, 15% of the world's population do not use improved latrine facilities forcing over 1 billion people to resort to open defecation. Overall, the global latrine coverage as at 2011, was estimated to be 64% implying that the world was set to miss the 75% sanitation MDG target by more than half a billion people if the current trends continued [4]. Sub-Saharan Africa remained the farthest behind in its progress towards accelerating access to

**Correspondence to:** Getachew Gashaw Dagne, Department of Biology, College of Natural and Computational Science, Oda Bultum University, Chiro, Ethiopia, Tel: +251912392435/922776040, E-mail: g.gashaw@gmail.com

**Received:** January 26, 2019; **Accepted:** April 01, 2019; **Published:** April 08, 2019

**Citation:** Dagne GG, Abebaw AF, Wake SL, Derso AG (2019) Assessment of Latrine use and Associated Factors among Rural Community Members in Chiro Zuria Woreda particularly in Kilinso and Nejebas kebele. J Microb Biochem Technol 11:2. doi: 10.4172/1948-5948.1000410.

**Copyright:** © 2019 Dagne GG, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

improved latrine facilities [5-10]. Regional estimates indicated that only 30% of the population in Sub Saharan Africa used improved latrine facilities and an estimated 26% practiced open defecation due to lack of latrines [5]. Globally over 2.5 billion people are still without access to improved sanitation. In 2010, 15% of the population still practice open defecation [6]. In developing regions almost half the population does not have access to sanitary facilities an estimated 1.1 billion people practice open defecation, exposing themselves and their communities to major health risks [7] and [8]. In sub-Saharan Africa, only 24% of the rural population was using an improved sanitation facility [9-12].

In Ethiopia up to 60% of the current disease burden is attributable to poor sanitation where 15% of total deaths are from diarrhoea, mainly among the large population of under-five year's children. In addition to diarrhoeal diseases, there is a high prevalence of worm infestations causing contributing to the high levels of malnutrition [8]. According to Ethiopia Demographic and Health Survey 2011 report 62% of households have toilet facility, 84% urban and 55% rural households. The majority of households, 82% (91% rural and 54% urban) use non-improved latrine facilities. The coverage falls short of meeting the Millennium Development Goal target. In addition to that, level of handling and utilization status of existing latrines is not known [13].

In developing countries, 47% of the population has living in unhygienic environment, while in developed countries the proportion is only 1% [14]. The sanitation coverage of rural and urban was 39% and 71% respectively in developing countries [3]. Nowadays, globally 80% users of unhygienic sanitation facilities and 85.7% who practice open defecation were live in rural areas. The Ethiopian DHS survey in 2014 estimated that 82.5% of the urban and 97.5% of the rural population had no access to improved sanitation, and that 8.7% of urban and 37.5% of the rural population practiced open defecation [15]. Poor sanitation has great impact on public health because it facilitates transmission of infectious pathogens in the human excreta [3]. Globally about 1.5 million children die due to diarrhoeal diseases each year, 88% of these deaths occurring due inadequate sanitation, improper hygiene, and unsafe drinking water [16-18].

Ethiopia is one of Sub-Saharan countries in which still significant numbers of people are still living in unimproved hygiene and need rapid improvement of sanitation which call for detail research [5]. To improve sanitation and hygiene throughout the country, federal ministry of health settled the goal that every household should have access to latrine and large-scale interventions were implemented to increase sanitation coverage [8]. However, the strategy gives emphasis to the coverage without focusing on its use.

To address the rapidly increasing demand for sanitation, identifying current level of use and its predictors is the most important issue. Therefore, one major objective of this study was to assess latrine use and associated factors in southwest Ethiopia, where the Health Extension Program has been implemented.

A poor practice such as limited utilization of sanitary facilities contaminates the environment and water sources. This suggests that efforts to increase access to safe water and improved sanitation have to be joined with strategies to promote appropriate utilization of sanitary facilities [19]. Provision of sanitation facilities initiated in all parts of Ethiopia with interventions of health extension program and continued investments to increase access to safe water and improved sanitation [20]. The increasing coverage mainly achieved by campaign with less effort to change the attitudes of the households and most of the effort of health extension workers mainly focuses on new construction with less follow-up to utilization of existing latrine facilities. Therefore, it was necessary to carry out this study so as to establish baseline information on latrine utilization and factors affecting the proper utilization of latrine in Chiro town.

## MATERIALS AND METHODS

### Description of the study area

This research was conducted in Chiro town located in west Hararghe zone. Chiro town is found in west Harerghae zone attachment area. It is geographically located between 34°18'43" to 43°00'4" E Latitude and 10°09'24" to 30°18'43" N longitude. The study area located 328 km frame Addis Abeba Ethiopia with 40 kebele around the town and located in Amhar Mountain. It is found on altitude of 1826 m above sea level. It is administrative centre of the west Hararghae zone (West Harerghae zone district agricultural office) (Figure 1).

### Study design

A community based cross sectional study design was utilized among the randomly selected households in the study area. This research design was used to provide valuable information pertaining to the levels of a particular attribute of interest (in this case level of latrine use) in a defined population (Nejebas and Kilinso kebele).

### Population of the study area

The total population is 223,887 and from this 109,705 is men and 114,182 are women. The dominant ethnic groups are Oromo people but the total populations are mixture of different ethnic group. The majority of the populations are follower of Muslim religion (Chiro woreda health office).

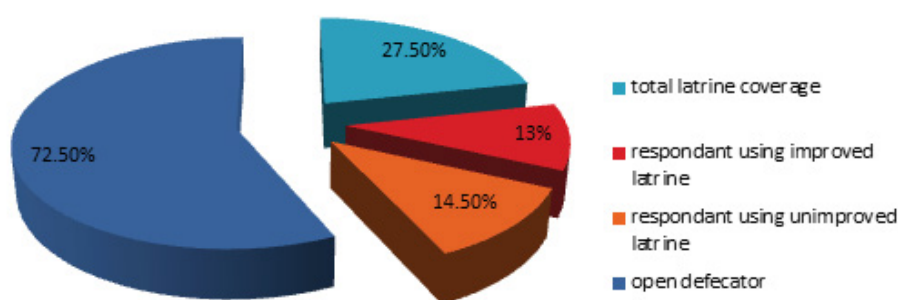


Figure 1: Latrine coverage in Nejebas kebele (N=138).

## Sample size

In this woreda there are about 27 kebele but due to different factors the study was conducted only in two kebele those are Nejebas and Kilinso. Nejebas kebele has total population number of 6479 and the house hold of 1350 and Kilinso kebele has also total population number of 3469 with the total households of 725 (Chiro woreda health office). From the total population 138 were purposely selected for data collection.

## Climate and topography

The dominant climate of the study area and its surrounding kebele and woreda is most of the year hot condition. The main annual rain fall is range between 910-1800 mm. The mean annual sea level is 1600-21500 mm and also the mean annual temperature is 25.5°C-38.50C. Agro-climate condition of the study area is 10% Dega, 53% Weyinadega, and 43% Kola. Topography of Chiro town and its surrounding area is hilly and mountain with altitude varies from 970 m-141 m. The total land use type is 42,936 or which the largest is agricultural crop.

## Data collection methods

Data was collected through interviews, questionnaire and field observation. Structured questioners are employed together information at household level. The questioners was first prepared in Affan Oromo then translated in to English by the researcher. The Affan Oromo version of questionnaire was pretested on the respondents in similar Communities. Face to face interviews was conducted with key informants and Transect walks and the observation checklists were used to assess the various latrine hygiene practices in the study area.

## Data analysis methods

All field questionnaires were first checked for completeness, and use both descriptive and inferential statistic. The descriptive findings to describe data for the study are presented in the form of numerical summaries, tables and charts and percentage was applied to analysis the qualitative and quantitative data and inferential statistic used to generalize sample to population.

## Variables

**Dependent variable:** The dependent variable for the study was latrine use which was defined as the use of improved latrine facilities for the safe disposal of human waste (faeces and urine).

**Independent variables:** 1) Factors that promote latrine use such as latrine use knowledge and good hygiene practices, high income levels, suitable hydro-geological conditions, literacy, latrine sanctions or law enforcement, possession of latrine construction skills, access to latrine construction materials, strong social support among others.

2) Factors that hinder latrine use such as lack of latrine use knowledge, poor hygiene practices, lack of latrine construction skills and materials, poverty, illiteracy, negative attitudes on latrine use, socio-cultural taboos, inadequate financing for the sanitation sector, lack of support from local leadership and key policy makers among others.

## RESULTS

### Socio-demographic characteristics of the respondents

Overall, a total of 138 respondents participated in the study. In

both Kebele male (75%) respondents greater than the female (25%), majority (74%) of respondents age between 20-40, most (82%) of respondents are farmer, 80% of respondents are illiterate, the annual income of respondents is less than 5000, majority of the house hold has size of 1-8 people. Results in Table 1 present the socio-demographic characteristics of the study respondents.

### Latrine use factors

**Human waste disposal methods:** As indicated in Figure 2, the study showed that the latrine coverage or use of latrine varies among the two kebele which means in Nejebas kebele there was different finding almost all 50 (72.5%) are open defecator especially in the area far from the town but there was some latrine in that kabele near to the town. Over all only 19 (27.5%) of house hold use latrine from that 10 (14.5%) were unimproved and only 9 (13%) are improved.

On the other hand since kilinso found near to the town this kabele have good latrine coverage which is opposed to that of the first kabele numerically more than half have latrine 55 (79%) with 45 (65.2%) improved and 10 (14.5%) were unimproved and the rest are open defecator (Figure 3).

**Latrine construction skills:** Majority 100 (72.4%) of the respondents reported that they have the necessary skills for constructing latrines in both kebele as presented in Figure 3 below. According to the study this is why because 2 years ago extensions were teaching them the way they construct latrine. On the other hand 38 (27.5%) of the respondents replied that they do not have necessary skills for constructing latrines. This study was similar with Awoke W and Muche S [2]. Majority of the household's members who were using latrines had construct to prevent diarrhoeal diseases. These findings differed with those of Jenkins [7], which indicated that a household's decision to adopt the use of latrines had little to do with the prevention of faecal-oral diseases. In addition, these findings resonate well with the health belief model that indicates that a person is more likely to adopt new behaviours in this case construct and use latrines if the benefits outweighed the perceived risks [6].

### Gender responsible for latrine construction and cleaning:

Table 1: Socio-demographic characteristics of the study respondents.

Socio Demographic variables (N=138)		Frequency	Percentage (%)
Area of residence	Nejebas kebele	69	(50%)
	Kilinso kebele	69	(50%)
Gender	Male	104	(75%)
	Female	34	(25%)
Age	20 to 40 years	104	(74%)
	More than 40 Years	34	(25%)
Occupation	Farmer	110	(82%)
	trading business (merchant)	28	(20%)
Level of education	None	110	(80%)
	Primary and Secondary	28	(20%)
Income annually	Less than 5000	100	(72.5%)
	Greater than 5000	38	(27.5%)
House hold size	1 to 8 people	100	(72.5%)
	9 and more people	38	(27.5%)

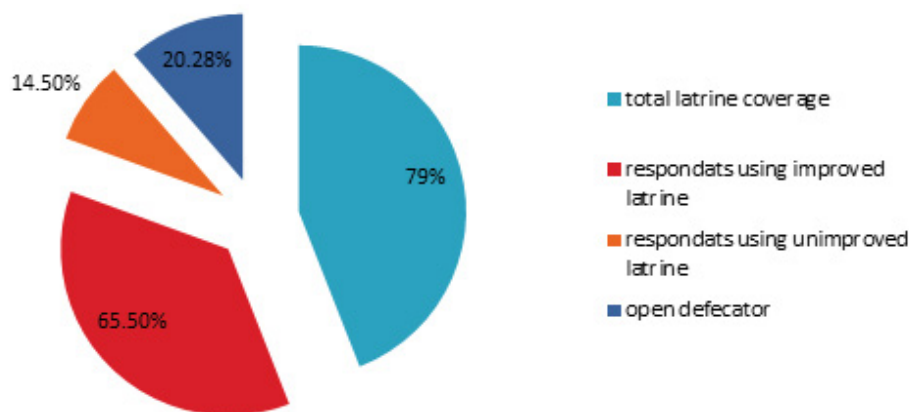


Figure 2: Latrine coverage in Kilinso kebele (N=138).

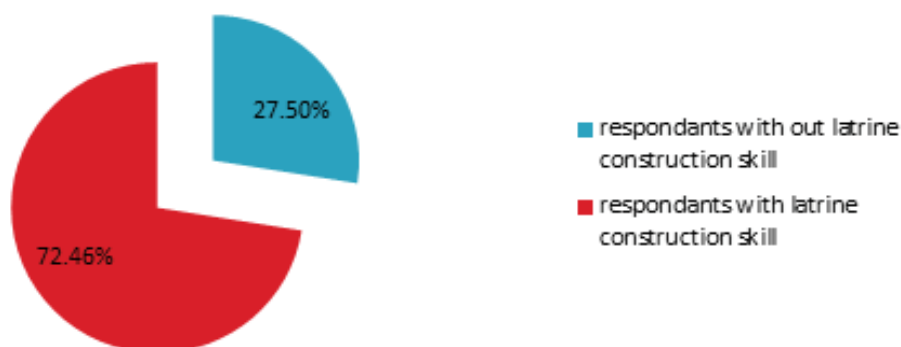


Figure 3: Latrine construction skills in both kebeles (N=138).

Among households who had latrines, all respondents (100%) reported that women were responsible for cleaning latrines in their household while a majority 130 (94%) of the respondents reported that men were responsible for constructing latrine facilities in their community as indicated in Figure 4. One of the Factors that promoted latrine use in the study area is clearly defined gender roles. In most communities in Ethiopia, cleaning of latrines is largely a women's affair, results which were not any different from this study as all respondents reported that women were responsible for cleaning latrines. Similarly, in most communities, the more labour intensive roles are often assigned to men. The same to that among this study community, it was noted that the more labour intensive work of constructing latrines rested solely on men. So there may be need for more gender awareness to advocate for shared responsibilities in order to increase the participation of all segments of the population in matters related to latrine construction and cleaning at the household and community levels for increased latrine use.

**Motivation for constructing and using latrines:** Two main motives were reported for constructing and using latrines as presented in Figure 5. The findings indicate that majority 11 (57.9%) Nejebas kebele and 50 (90.9%) Kilinso kebele of the respondents reported that their main motivation for constructing and using latrines was to prevent diarrhoeal diseases while others 8 (42.1%) Nejebas and 5 (9.1%) Kilinso of the respondent reported that they constructed latrines as a result of the health education they had received as well as influence from their neighbours.

**Diseases suffered by household members in the past time:** Majority 100 (72.46%) of the diseases that members of the study population had suffered from in the past time were sanitation related (diarrhoea, typhoid, skin and eye infections) especially in

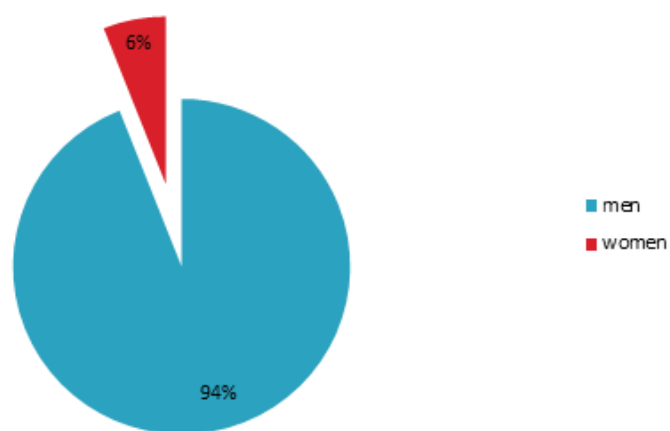


Figure 4: Gender responsible for Latrine construction (N=138).

Nejebas kebele water born disease are high around 89% (Chiro woreda health office, 2010) this is because they are open defecator and there source of water is river (Appendix 1.1).

**Promoters of latrine construction and use in the study area:** The household survey findings indicated that there was low 28 (22%) involvement of the Government in promoting latrine construction and use in the study area. The same to that Non-Governmental Organizations (NGOs) were also have low involvement in promoters of latrine construction and use in the study area because their involvement limited on the teaching the society 2 years ago but currently there is no any promoter either governmental or non-governmental organization.

**Latrine construction financing:** All of the latrines in the study area were constructed with their own recourses or income which means there is no any support from external bodies.

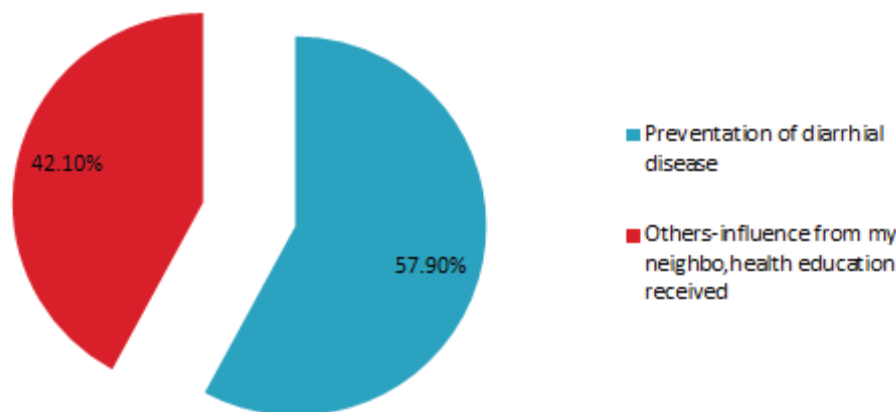


Figure 5: Motivation for constructing and using latrines in Nejebas (N=19).

### Knowledge and attitudes on latrine use

**Knowledge on causes and transmission of diarrhoea:** Overall, 100% of the study respondents reported that human faeces were the principal source of diarrhoea. Regarding the link between open defecation and diarrhoeal diseases, majority (72%) reported that open defecation caused diarrhoeal diseases and a further 100% of the respondents believed that they were at risk of getting diarrhoea if their neighbour did not use a latrine.

Most (67%) of those interviewed reported that the correct causes of diarrhoea such as eating food or drinking fluids contaminated with faeces, not washing hands, not using latrines among others compared to the others (33%) who mentioned incorrect causes such as mosquito bites, witchcraft, rain among others. The findings related to knowledge on cause and transmission of diarrhoea is summarized in Table 2. These findings similar with those of [13] that identified poverty as a key contributor to latrine inequalities, those by the [14] that showed limited financial ability to be major hindrances to up scaling latrine use as well as those of [9], Awoke and Muche [2] that indicated that a household's monthly income positively promoted use of latrine facilities. The "perceived poverty" mentality requires further de-mystifying. The concept of "perceived poverty" among the communities is not new, however what is lacking is raising the awareness among the study population on how to convert their livestock into real cash which can ultimately be utilized to construct latrines as opposed to provision of subsidies.

**Knowledge on prevention of diarrhoea:** Majority (60%) of the respondents reported the correct methods of diarrhoea prevention such as good food and water hygiene practices, hand washing and using latrines compared to the others (40%) that mentioned incorrect diarrhoea prevention methods such as use of mosquito nets and washing clothes. In addition, majority (74.3%) of the study respondents reported that hand washing with water and soap or if not available using ash everyday could prevent diarrhoea.

**Latrine use hygiene practices:** Observations were made to assess the level of latrine cleanliness, privacy and availability of a hand washing facility with water and soap for hand washing. As presented in Table 3, slightly more than half (57.9%) in Nejebas and almost all (90.9%) in Kilinso of the responding households had latrines that hygienically separated human excreta from human contact, almost all of all observed latrines had no a convenient source of water and soap for hand washing and all observed latrines were not found to be clean during the study but there are some cleaned latrine because they constructed hard by and 100% of the households had latrines that offered adequate conditions of privacy in both kebele

(Appendix 1.2).

### Factors associated with hindering latrine use

**Cultural beliefs and traditions:** Respondents that mentioned cultural factors as the major obstacle to latrine use had lower latrine use compared to those who mentioned lack of tools, money and skills as the main obstacles.

**Perceived poverty levels:** There was a significant relationship between level of income and latrine use. The study found out that latrine use was higher among the high income earners compared to the low income earners.

**High illiteracy level:** The study findings revealed that there was a statistically significant relationship between education level of household head and latrine use. The study found out that latrine use was higher among respondents with either primary or secondary level of education compared to those who have no formal education.

**Lack of latrine construction skills:** The study observed that respondents that lacked latrine construction skills had statistically lower latrine use compared to those who had latrine construction skill.

**Low government involvement in promoting latrine use:** Respondents mentioned there is low involvement of both non-governmental and governmental organization and the government of those kebele does not promote the society to use latrine even, some respondents mentioned that there are some people who work on government level who had no latrine.

**Low involvement of men in latrine related matters:** Overall, there was no latrine use in all households who mentioned that men were responsible for constructing latrines in their communities for instance some households who lacked latrine because they have no husband this indicate that men have major responsible of constructing latrine.

**Low self-initiation of latrine construction:** Households that had initiated the construction of their latrines using their own resources had statistically significant lower latrine use for example most of households who live especially in Nejebas far to town have latrine in the past means almost 2 years ago because at that time the extension teach them highly but know they haven't this indicate those community have force or promoters. It is suggested that self-initiation of latrine construction should be explored as a more sustainable way of increasing latrine use as opposed to provision of subsidies that often leads to dependency syndrome among

Table 2: Knowledge on causes and transmission of diarrhea.

Knowledge Variable(N=138)		Frequency	Percentage (%)
Human faces is the principle source of diarrhea	Yes	138	100%
	No	0	0%
Effect of open defecation	Shame & Disgust	38	28%
	Diarrheal disease	100	72%
Risk of getting diarrhea if neighbor practices open defecation	Yes	138	100%
	No	0	0%
Causes of diarrhea	Correct causes mentioned	93	67%
	In correct causes mentioned	46	33%

Table 3: Latrine use hygiene practices at the household level.

Latrine hygiene practice variables		Nejebas(N=19)	Kilonso(N=55)
Latrine hygienically separates human excreta from contact	Yes	11(57.9%)	50(90.9%)
	No	8(42.1%)	5(9.1%)
Latrine has water and soap for hand washing	Yes	0(0%)	10(18.2%)
	No	19(100%)	45(81.2%)
Latrine presents adequate conditions of cleanliness	Yes	0(0%)	10(18.2%)
	No	19(100%)	45(81.8%)
Latrine presents adequate conditions of privacy	Yes	19(100%)	55(100%)
	No	0(0%)	0(0%)

communities. Unless communities prioritize latrine use on their own, all future external support will be futile. The study notes that constructing latrines alone will not solve the sanitation challenge in the study area, empowering local communities to solve their own problems is the best way to improve latrine use and ultimately the health of communities [21].

## CONCLUSION

There was an apparent gap between the knowledge on latrines and the practice of using latrines in the study area. This is because, although the study observed that the knowledge levels related to latrine use, causes and prevention of diarrhoea were high, majority of those interviewed were not using latrine facilities. Adoption of good latrine hygiene practices such as keeping the latrine clean, providing water and soap for hand washing and providing adequate conditions of privacy enhanced use of latrine facilities. The study identified clearly defined gender roles, main motives for latrine construction and use, provision of subsidies in latrine construction and living in close proximity to urban area as factors that promoted latrine use in the area of study. The study established that high poverty and illiteracy rates, lack of latrine construction skills, low government and men involvement in promoting latrine construction and use and low initiation of latrine construction as the main hindrances to latrine use in the study area.

Rural community in developing countries face health problems related to sanitation and hygiene. This is not naturally given to the poor but due to associated factors. The problem cannot be basically reduced unless all community members utilize latrine facility. But the challenge is on identifying factors that make people to or not to utilize latrine. Thus this study was contributed its part on identifying such factors.

The study was help to show how to maximize benefits of latrine utilization for health of community so that the policy makers and

concerned bodies could take appropriate measures considering gaps. This study was therefore, be vital to identify level of latrine utilization and associated factors in the study are. It provides evidences for the zone to take action in reducing open defecation through different strategies.

## RECOMMENDATIONS

The study recommends that:

- Proactive efforts need to be taken by all actors to bridge the apparent gap between knowledge and practice pertinent to up scaling latrine use. Targeted and thematic sanitation campaigns can be conducted to promote the construction and use of latrine facilities focusing on latrine construction skills enhancement.
- The local stakeholders should identify households with good latrine hygiene practices to become model homes for other community members to learn from and emulate the good latrine hygiene practices observed. Villages that shall be identified to have eliminated open defecation can be recognized and celebrated to motivate them to maintain their Open Defecation Free (ODF) status.
- Since the main motivation for using latrines was observed to be prevention of diarrhoeal diseases, more awareness needs to be created on the impact of open defecation to motivate communities to construct and use latrines to prevent diarrhoeal diseases and other factors
- To accelerate progress towards attainment of sanitation targets in the area of study, existing latrine construction and use barriers need to be addressed. Specifically there is need to equip communities with latrine construction skills, address social cultural barriers to latrine use and increase the participation of men in latrine related matters as they can be key champions and agents of change in promoting latrine use. The Government should provide matching resources to tackle

the sanitation disparities in the Sub-County while utilizing socio-culturally appropriate technological options suitable for the study community. Communities should also be encouraged to initiate the construction of their own latrines as opposed to waiting for external help in the form of subsidies as this may not be sustainable in the long term.

## ACKNOWLEDGEMENT

We are grateful to Oda Bultum University, Department of Biology, College of Natural and Computational Sciences for offering us such an opportunity to conduct this research. We would like to thank all the respondents participated in this study, data collectors and Chiro Zonal Health Office. We also thank the anonymous reviewers for their great help, and the editor for their constant support.

## REFERENCES

1. Akter T, Ali RA, Dey CN. Transition overtime in household latrine use in rural Bangladesh: A longitudinal cohort study. *BMC Public Health*. 2014;14:721.
2. Awoke W, Muche S. A cross sectional study: Latrine coverage and associated factors among rural communities in the District of Bahir Dar Zuria, Ethiopia. *BMC Public Health*. 2013;13:99.
3. Bartram J, Cairncross S. Hygiene sanitation and water: Forgotten foundations of health. *PLoS Med*. 2010;7(11):e1000367.
4. Bartram J, Lewis K, Lenton R, Wright A. Focusing on improved water and sanitation for health. *Lancet*. 2005;365(9461):810-812.
5. Beyene A, Hailu T, Faris K, Kloos H. Current state and trends of access to sanitation in Ethiopia and the need to revise indicators to monitor progress in the Post-2015 era. *BMC Public Health* 2015;15:451.
6. Family Health International. Behavior Change- A summary of four major theories: Health belief model, AIDS risk reduction model, stages of change and theory of reasoned action. 2002.
7. Jenkins M, Scott B. Behavioral indicators of household decision-making and demand for sanitation and potential gains from social marketing in Ghana. *Soc Sci Med*. 2007;64(12):2427-2442.
8. Ministry of Health. National Hygiene and Sanitation Strategy 2005.
9. The United Nations Children's Fund/World Health Organization. Diarrhea: Why Children are still dying and what can be done. 2009; p: 68.
10. <http://www.un.org/millenniumgoals/pdf/report-2013/mdg-report-2013-english.pdf>
11. United Nations Children's Fund: World Health Organization. Progress on Sanitation and Drinking-Water 2013 Update. 2013; p: 40.
12. UNICEF. High Impact Nutrition Intervention Baseline Surveillance Report for Marsabit, Samburu and Isiolo Districts. 2011.
13. <https://www.unicef.org/sowc2013/>
14. <http://www.undp.org/content/dam/undp/library/corporate/HDR/2006%20Global%20HDR/HDR-2006-Beyond%20scarcity-Power-poverty-and-the-global-water-crisis.pdf>
15. <https://pdfs.semanticscholar.org/473d/606fd3c4b4cbc0d8ef82fc10e5e9eca9cb43.pdf>
16. Water and Sanitation Program. Economic impacts of poor sanitation in Africa 2012.
17. Water and Sanitation Program. Scaling up rural sanitation: What does it take to scale up rural sanitation. 2012.
18. World Health Organization. The sanitation challenge: Turning commitment into reality. 2004.
19. World Health Organization. Safer water, better health: Costs, benefits and sustainability of interventions to protect and promote health. 2008; p: 53.
20. World Health Organization. Global costs and benefits of drinking water supply and sanitation interventions to reach the MDG target and universal coverage. 2012; p: 67.
21. World Health Organization. UN-water global annual assessment of sanitation and drinking-water (GIAAS) 2012 report: The challenge of extending and sustaining services. 2012; p: 112.