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SOCIAL-ECOLOGICAL AND BEHAVIOURAL DETERMINANTIS OF RURAL SANITATION: A STUDY INRURAL BECHO DISTRICT OF ETHIOPIA

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A DISSERTATION THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, ADDIS ABABA UNIVERSITY FOR THE FULFILMENT OF DEGREE OF DOCTOR OF PHILOSOPHY (PHD) IN WATER AND PUBLIC HEALTH PROGRAM

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This is to certify that the thesis presented by Ms **Fikralem Mezgebu Alemu** Entitles "**The Social-Ecological and Behavioural Determinants of Rural Sanitation. A case study in rural Becho District Of Ethiopia"** is submitted for the partial fulfilment of Degree of Doctor of philosophy (phd) in water and health, specialization public and health program complies with the regulations of the university, and meets the accepted standard with respect to originality and quality.

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1. Latrine ownership, latrine use and associated socio demographic determinants. (under review)
2. The role of psychological factors in predicting latrine ownership and consistent latrine use in rural Ethiopia: a crosssectional study: https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-018-5143-0.
3. A socio-ecological analysis of barriers to the adoption, sustainablity and consistent use of sanitation facilities in rural Ethiopia BMC Public Health, Published on September 2018. See the link: https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-017-4717-6/open-peer-review

ACRONYMS

AOR	Adjusted Odds Ratio
AWD	Acute Watery Diarrhea
CLTS	Community Led Total Sanitation
CLTSH	Community Led Total Sanitation and Hygiene
COR	Crude Odds Ratio
FGD	Focus Group Discussion
HEP	Health Extension Program
HEW	Health Extension Workers
HSDP	Health Sector Development Plan
IBM	Integrated Behavioral Model
IDI	Individual In-depth Interview
MDG	Millennium Development Goals
NGO	Non-Governmental Organizations
OD	Open Defecation
ODF	Open Defecation Free
SCT	Social Cognitive Theory
SD	Standard Deviation
SDG	Sustainable Development Goals
SEM	Socio-Ecological Model
SSA	Sub- Sahara Africa
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TNSB	Theory of Normative Social Behavior
VIP	Ventilated improved pit latrine
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WSP	Water and Sanitation Program

:

GLOSSARY

Consistent use of latrine	Among latrine owners, proportion of respondents who always used their latrine (more than 3/4th of their defecation) during the last one week.
Descriptive norm	It is people's perception of how other people actually behave.
Household	People who dwell under the same roof, and compose a family.
Improved latrine	Latrine facilities that ensure hygienic separation of human excreta from human contact. They include: flush or pour-flush toilet/latrine to: piped sewer system, septic tank, pit latrine, Ventilated improved pit (VIP) latrine, pit latrine with slab and composting toilet.
Injunctive norm	Ii is people's perception that their behavior is approved of or disapproved of by others.
Latrine owners	Latrine owners are participants that own latrine by the time of data collection.
Latrine ownership:	ownership of any types of latrine, including pit latrine, flush toilets, and pour flush toilets, ventilated improved pit (VIP) latrines, etc.
Latrine non-owners	Are those who did not own latrine during the data collection time, including those who used to own latrine in the past but did not have latrine during the study time.
Unimproved latrine	Latrine facilities that do not ensure hygienic separation of human excreta from human contact that include pit latrines without a slab or platform, hanging latrines and bucket latrines

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ABSTRACT

Background: Inadequate sanitation is one of the leading causes of disease in least developed countries.

Objective: The general objective of the current study wass to determine the psychosocial, technological and contextual factors associated with the adoption and consistent use of sanitation facilitates in rural Becho district of Ethiopia.

Methods: A mix method design cross sectional study was conducted that employed quantitative and qualitative data collection techniques. Quantitative data was collected using a structured questionnaire. Eight rural Kebele (clusters) were selected randomly from the total of 21 kebele in the district. Then every sixth households in the selected clusters were selected to be interviewed using systematic random sampling technique. A total of 1047 household heads (650 male) interviewed, and latrines were inspected. Data were entered using Epi info version 3.5.4 and analysis was conducted using SPSS version 20. Logistic regression analysis was used to assess associations between outcome variables with potential determinants. Statistically significant results with p-value are less than 0.05 were reported. The qualitative data was collected using in-depth interviews and Focus Group Discussions (FGD) to explore beliefs, contextual and technologulcal factors influencing the adoption, sustainability and consistent use of sanitation facilities at multiple levels. The socio-ecological model was employed for the design of the study and for the analysis of data. A total of 10 in-depth interviews were held, and 8 FGDs were undertaken with 75 participants. The FGDs and IDIs were tape-recorded, verbatim transcribed and translated into English. The analysis was supported using Nvivo version 10 software.

Results: Overall, 73% of participants owned some kind of latrine, while only 1.5% of participants used improved latrine. The percentage of households that used shared latrine, unimproved or practiced open defecation were 2.2%, 69.3%, and 27%, respectively. Among latrine owners, 79% reported using a latrine consistently, 48% of children's stool disposed in latrine. Only 11% of the observed latrines had handwashing facilities within 10 paces of distance. Among the psychosocial factors, attitude [(AOR 1.88: (95%CI: 1.4-2.5)]; and injunctive norm [(AOR 6.18; (95%CI: 4.46-10.44)] were significantly associated with latrine ownership. Among the demographic factors, households with family size of more than 6

compared to small size families [(AOR 1.43: (95% CI 1.01-1.97)]; households having a child attending school compared to those who did not have [(AOR = 1.88; (95% CI 1.17-3.02)] and, household head having high school education [(AOR 1.98: (95% CI: 1.34-2.87)] were more likely to be latrine owners. With respect to exposure to communication about sanitation (the cues to action), households that had a family member who took part in CLTSH triggering were 3.0 times more likely to be latrine owners than those who did not participate in CLTSH triggering (95% CI 1.92-4.78. Results from adjusted logistic regression analysis of potential predictors of consistent latrine use showed that having positive attitude [(AOR 7.00: (95% CI: 4.55-10.55)]; ownership of a latrine that had superstructure [(AOR 2.3 (95%CI: I1.47-3.48)]; cleanliness of a latrine [(AOR 1.69 (95%CI: 1.00-3.00)]; and latrines that had a protected door [(AOR 1.94 (95%CI: 1.10-3.48)] were significantly associated with consistent latrine use.

The qualitative study revealed that latrine ownership was influenced by multi-level ecological barriers. The barriers to sustained adoption and use of sanitation facilities were categorized into 1)individual level (past latrine experience, perception of less health threat to unhygienic child faeces disposal, lack of knowledge and demand to improved latrine), 2) household level (unable to pay the cost of a latrine, lack of space and, absence of physically strong family member), 3) community level (lack of access to public latrine, lack of shared rules against open defecation, lack of financial access for the poor) and, 4) societal level factors (flooding, soil condition and lack of appropriate sanitation technology that can adopt the environment, lack of promotion and demand creation for improved latrine, and the lack of strong leadership at the local level).

Conclusions and recommendations: The very limited access to improved latrine needs ctirtical attention. Attitude and perceived social norm were the psychosocial predictors of latrine ownership, which suggests normative and persuasive behaviour change approach are relevant. Sanitation facilities were valued not only for health benefit, but also for providing protection, privacy, and dignity, which needs consideration by policy makers and sanitation programmers. It is critical to increase access to environmentally feasible, affordable and safe toilet options. Multiple level barriers to sustained adoption of sanitation facilities indicating the need to consider interventions that address multi-dimensional and multi-level factors concurrently. Interventional research recommended to investigate the effectiveness of the suggested normative and persuasive approaches in changing behaviour to increasing latrine adoption and use.

Key words: latrine ownership, consistent latrine use, psychosocial factors, technological factors, contextual, socio-ecological analysis, rural, Ethiopia.

1. INTRODUCTION

1.1 Background of the study

Human excreta contains a very high concentration of pathogens which are dangerous to health (1). The use of improved sanitation facilities prevents excreted pathogens from entering the environment and interrupts the transmission of most of the excreta-related diseases (2). An improved sanitation facility is defined by the World Health Organization as a facility that hygienically separates human excreta from human, animal and insect contact that includes flush/pour-flush toilets or latrines connected to a sewer, septic tank or pit, ventilated improved pit latrines, pit latrines with a slab or platform of any material which covers the pit entirely except for the drop hole, and composting latrines (3).

Lack of adequate sanitation is the primary cause a high disease burden in developing countries (4-6). According to WHO 2009 estimate, inadequate sanitation and poor hygiene was the fourth leading cause of deaths and the second leading cause of diseases in developing countries, from which diarrhoea is the most important one (6) . An estimated 1.7 billion cases of diarrhoea occur every year, claiming the lives of approximately 800,000 children less than 5 years old, more than 88% of diarrheal disease is attributed to inadequate hygiene, water and poor sanitation (7). Lack of sanitation is also a major contributor to an estimated 1.2 billion Ascaris infection, 800 million trichuris trichiura (whipworm) and 750 million hookworm infections globally (8). Evidence suggests lack of access to WASH and poor practice contribute to undernutrition as a result of repeated diarrhea, by propagating worms and malaria, ,and causing environmental enteropathy.The lack of sanitation also results in long-term cognitive impairment (9, 10) . Adequate sanitation is recognized not only for the positive health effects but it is a basic human right, economic and development concern (11). During the United Nations General Assembly meeting, it was indicated that the issues of affordability, quality, reliability, and non-discrimination need to be addressed in the provision of basic sanitation (11, 12).

Studies suggested that improved sanitation reduces the rate of diarrheal incidence by 32% to 37% (13, 14), and when combined with handwashing with soap, it can result in up to 45% reduction (15) . A review of literature also indicated that access to, and the use of improved sanitation reduce the rate of intestinal parasite up to 50% (16). As per the WHO/UNICEF Joint Monitoring Program (JMP) 2017 report, nearly 2.3 billion people lack access to improved sanitation, and the majority lives in Asia and sub-Saharan Africa (17). Efforts have been executed to improve sanitation in developing countries over the past two decades. However, a

large number of the population remained with limited access to improved sanitation, failed to sustain it or don't use it (18-20).

Several studies in Ethiopia and other African countries reported that socio-demographic factors such as, households who had any education, who had a larger family size or men were more likely to be owners of latrine (21-26). Similarly, contextual barriers to latrine adoption such as the high cost of building materials were reported influencing latrine adoption (27-29). Researchers indicated the role of psychological factor such as knowledge, health risk (risk awareness), perceived social pressure and perceived control over the performance of a certain behaviour (30) . Prior studies reported several motivational factors of larine adoption include convenience, safety, and privacy, prestige, and health considerations such as preventing disease (21-25).

Researchers have suggested that interventions that target multiple levels factors can be resulted in a change which is more sustainable compared to individual base intervention (31) . However, most prior studies on sanitation were focused on a single level analysis, and limited evidence available about multi-dimensional barriers that can inform programmers and policy makers for a sustainable sanitation solution (21-26). Socio-ecological model has been widely recognized for providing in a comprehensive approach to designing research, analysing data and designing programmes that target multi levels of influence (32). The model explains that a specific behaviour is influenced by factors that exist at intrapersonal, interpersonal, community, societal/policy levels; and there can be interaction of factors across levels (33-35).

1.2 Statement of the problem

A growing body of evidence have indicated that to achieve positive health results from sanitation. Achieving the health impacts of sanitation requires the larger population own sanitation facilities, functional latrines sustained over time, and latrine are consistently used (36-38). Despite the efforts, sanitation strategies and programs in developing countries have often been challenged by the emerging complex nature of individual, social and environmental barriers, and a large number of a population lack access to improved latrine (39) . In many cases built latrines could not be sustained by communities or couldn't progress up the sanitation ladder (19, 40).

Ethiopia has the lowest access to impoved sanitatiaton in the world. The 2017 WHO/UNICEF JMP report showed that 93% of Ethiopian population still lacking access to improved latrine, and very little progress has been made to move up onto the sanitation ladder (17). Despite the efforts to expand latrine coverage, sustainability of sanitation has been a challenge in Ethiopia.

A study in Ethiopia has reported that after villages declared open defecation free status, there was a high rate of reversion to open defecation (OD) (41). Collapsing toilets, and the lack of availability of durable and affordable toilet options and materials for construction on the market were identified as key reasons for this reversion.Only 33.5% dispose children's faeces hygienically (42), and Ethiopia held up a high global burden of diseases associated with poor sanitation (4, 43). Diarrhoea remains the second leading cause of death among children under 5 years (44) with very little progress over a decade, from 18% in 2005, to 13% in 2011, and 12% in 2016 (45-47). However, limited studies identified barriers for latrine adoption and consistent use in Ethiopia.

Inconsistencies of figures reported by various sources, associated with the use of different indicators for measuring latrine coverage and latrine use in Ethiopia, which is extremely a challenge for national monitoring purposes. For instance, there is a big discrepancy of data between reported by JMP (39), and Ethiopia demographic health survey (46).

There is a dearth of evidence that can inform the design of sanitation behaviour change interventions in Ethiopia. Most hygiene and sanitation behavioural change interventions in Ethiopia were focused on educating people about risks of a disease despite the evidence suggests that knowledge does not necessarily change behaviour (48). As a result, little progress has been made in increasing the adoption and use of improved sanitation in Ethiopia.

Theories has shown the role of psychological and social factor such as knowledge, attitude, perceived health risk, perceived social pressure and perceived control over performance of the behaviour in determining whether an individual practice or not a desired behaviour (30). Studies on sanitation conducted in Ethiopia and other African countries reported that motives for latrine adoption and latrine use include convenience, safety, privacy, prestige, and disease prevention (21-25). However, the studies didn't provide a clear understanding of the relationship between latrine adoption/latrine use with knowledge, and the other behavioural attributes (49), which is important for designing behaviour change interventions approaches to increase sanitation adoption and use (50).

As the review of literature shows that there is a dearth of evidence in Ethiopia that can inform policies and programs to design evidence-based target focused sanitation. Limited researches conducted in Ethiopia to show the role of behavioural, contextual and technology related factors that determine the adoption of sanitation facilities at multiple level. For designing successful sanitation programs, it needs improved research methodologies that can effectively capture

sanitation coverage, and the multiple underlining factors that influence the adoption and sustainable use of latrine.

This study was designed to address these gaps. First, the study examined the level of latrine ownership, consistent use of latrines, safe disposal of children's stools, and handwashing after latrine use. This study determined the percentage of a population that used improved, shared, unimproved and open defecation (3, 45). For triangulation with previous studies conducted in Ethiopia, we added indicators latrine utilization (51), latrine in use (52), and consistent use of latrine (51). Second, the study investigated the individual psychosocial and demographic determinants of latrine adoption. The study explored what salient beliefs determine attitude towards latrine or using a latrine, and the psychological factors that determine the adoption of and consistent use of a latrine in rural Becho district of Ethiopia. Third, using socio-ecological qualitative analysis, the study explored barriers to the adoption, sustainability and consistent use of sanitation facilities at societal, community, household and individual levels.

1.3 Significance of the study

This study explored multi-level and multi-dimensional factors that influenced the adoption, sustainability and consistent use of latrine in rural Becho district of Ethiopia. The finding of this research can contribute to the evidence-based design of interventions and strategies in a way which is sensitive to the local dynamics of the community. The study can contribute the design and implementation of multi-component interventions, which is likely to effective than intervention which is designed based on a single level analysis. The study findings can be used to identify a range of potential intervention points based on understanding barriers at individual, household, community, and societal level. The study can also contribute to the design of a more inclusive approach that can address barriers at various levels concurrently.

This study explored individuals' beliefs related with choosing open defecation, their reasons for not using available facilities, motivation and inhibiting factors for latrine adoption and latrine use. The use of a standardized Likert scale measurement that is adapted from theoretical behavioural models provides a better methodology for understanding of behavioural predictors of latrine ownership, which was a gap in previous studies. Evidence has shown that identifying the right factor helps to design evidence based intervention such as information interventions if the factor is disease risk perception; persuasive interventions if it is attitudinal factors; infrastructure and ability interventions if it is ability factor (53-55) . Findings from study can be used for the design of specific intervention on rural sanitation.

2. LITERATURE REVIEW

2.1 Introduction

Human excreta contain a very large number of infectious agents. Evidence have shown that one gram of human excreta feaces can contain up to 10^6 viral pathogens, up to 10^6 to 10^8 bacterial pathogens, 10^4 protozoan cysts, and 10–10^4 helminthes eggs (56). Unsafe disposal of human excreta can contaminate the soil, ground water, agricultural products, and thereby it can cause diseases that transmit by fecal-oral route such as diarrhoea, cholera, typhoid and parasitic infection (5) . The use of improved sanitation facilities prevents transmission of pathogens that originate in faeces of an infected person. A growing body of evidence have shown that sanitation effectively prevent the transmission of diseases that transmit through faeco-oral route (2, 13, 57) . Figure 1 shows pathways of fecal disease transmission and the barriers that can prevent infection.

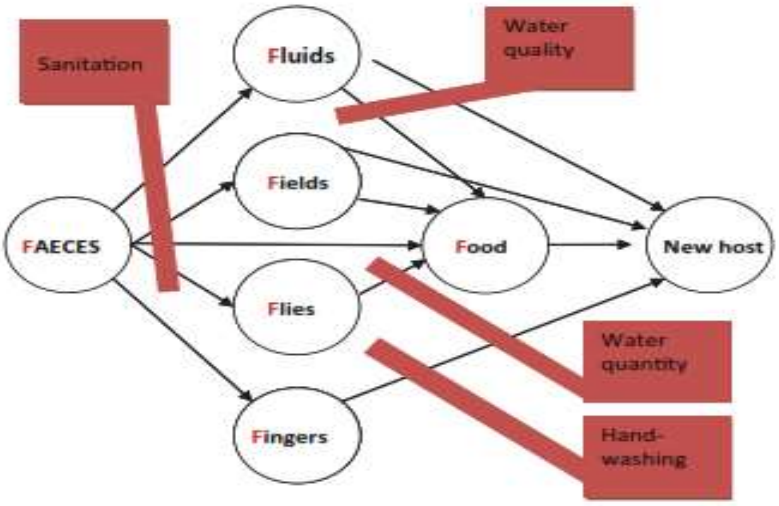

Figure 1. F-diagram showing faeco-oral transmission

(Source: Wagner & Lanoix, 1958) .(58)

Sanitation is a public health priority of low and middle-income countries, where diseases that transmit by fecal-oral routes such diarrhoea, intestinal helminthiases, giardiasis, schistosomiasis, trachoma are the major diseased burden of these countries (4). Substantial body of evidence documented the relationship between the use of improved sanitation, and decreased incidence of these diseases (13-16, 59, 60). For instance, evidence also show that sanitation is an efficient way to reduce trachoma transmission by reducing fly breeding sites (59). A review of research on effect of sanitation on soil-transmitted helminths infection

indicated that the availability of sanitation facilities was associated with significant protection against infection with soil-transmitted helminthes (16). Evidence show that sanitation intervention are more cost-effective compared with other health intervention that include combating malaria, tuberculosis and HIV/AIDS (61).

Sanitation ladder

Since 1990 to 2006, the JMP classification and benchmarking of sanitation as a four-step ladder, open defecation the bottom of the ladder, and unimproved, shared, and improved sanitation facilities, moving in the steps of the ladder reflecting progress (3) . According to JMP 1990-2016, the classification and definitions of sanitation were:

- Improved sanitation facilities: Facilities that ensure hygienic separation of human excreta from human contact. They include: Flush or pour-flush toilet/latrine to: piped sewer system, septic tank, pit latrine, Ventilated improved pit (VIP) latrine, Pit latrine with slab and Composting toilet.
- Shared sanitation facilities: Sanitation facilities of an otherwise acceptable type shared between two or more households, including public toilets.
- Unimproved sanitation facilities: Facilities that do not ensure hygienic separation of human excreta from human contact that include pit latrines without a slab or platform, hanging latrines and bucket latrines, and
- Open defecation: Defecation in fields, forests, bushes, bodies of water or other open spaces, or disposal of human faeces with solid waste.

The WHO/ UNICEF Joint Monitoring Programme (JMP) continued with an official mandate to monitor global progress on SDG 6. In 2007, JMP introduced updated water and sanitation ladders which build on established indicators, with additional criteria relating to service levels. According to JMP 2017, improved sanitation facilities are classified into three categories: limited, basic and safely managed services. The population using improved facilities that are shared with other households are classified as limited rather than shared; and improved facilities that are not shared count as either basic or safely managed services, depending on how excreta are managed (17). The revised ladder of sanitation is shown in figure 2.

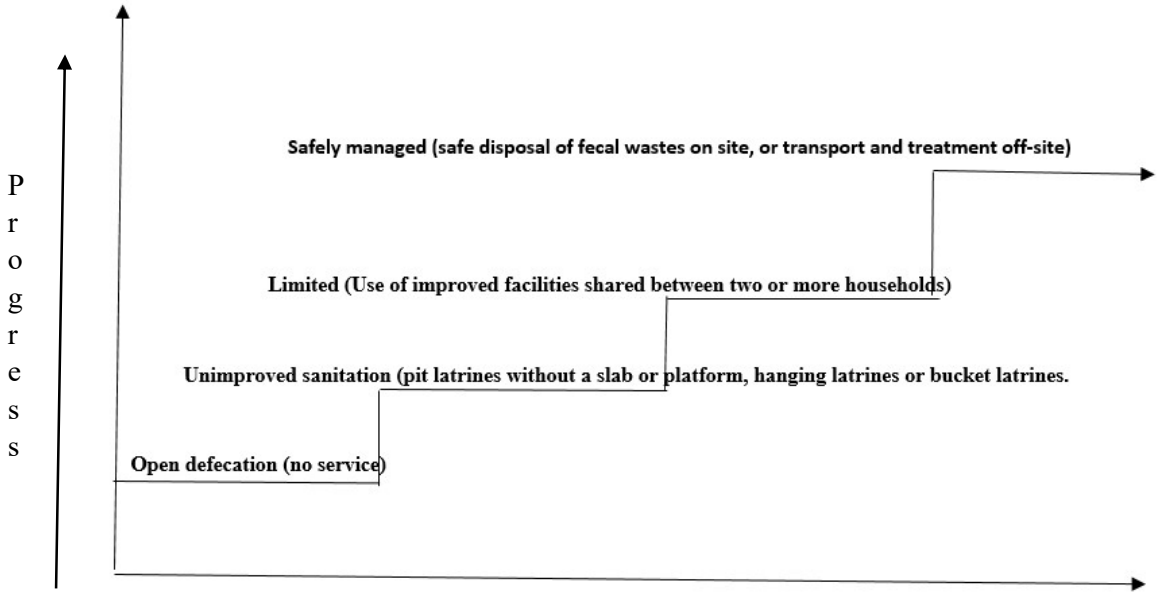

Figure 2. The revised ladder of sanitation services, JMP 2017

2.2. Global regional and national sanitation coverage

2.2.1 Sanitation in the era of Millennium Development Goals

The Millennium Development Goal (MDG) on WASH targeted to halve the proportion of people without sustainable access to safe drinking water and basic sanitation between 1990 and 2015 (62). The World Health Organization and United Nations Children's Fund Joint Monitoring Programme (JMP) for Water and Sanitation had been the official mandate to monitor global progress on drinking water and sanitation. Most of the Sub Sahara African (SSA) countries have failed to achieve the Millennium Development Goal (MDG) targets on access of improved sanitation. Only 6% increment was achieved by SSA countries from the baseline level 24% (63). With big disparities between rural and urban, 82 per cent of the urban population uses improved sanitation facilities, compared with 51% of the rural population (17).

2.2.2 Sanitation from MDGs to Sustainable Development Goals (SDG)

In 2015 the MDGs ended, and Sustainable Development Goals (SDG) compromising 17 agendas took its place (64). The SDGs targets to ending open defecation (SDG 6.2), achieving universal access to basic services (SDG 1.4), and achieving universal access to safely managed services (SDG targets 6.1 and 6.2) (39). SDG are more ambitious than the previous MDG target 7c because a) SDG call for universal and equitable access for all; b) SDG incorporated hygiene, which was not addressed in MDGs; c) additional criteria's added such as drinking water should be safe and affordable, and that sanitation should be adequate; and c) SDG specified to ending open defecation, to address the needs of women and girls and those in vulnerable situations(65).

According to JMP 2017 report, an estimated 2.3 billion people still lacked basic sanitation service, about 600 million people used a limited sanitation service (improved facilities shared with other households), and about 900 million people worldwide still practiced open defecation (17). (Figure 3)

Figure 3. Estimates of sanitation services for the world and the SDG regions, 2017
Source: WHO/UNICEF JMP 2017 report (17)

2.3. Sanitation in Ethiopia

2.3.1 Sanitation trend in Ethiopia

At a growing rate of 2.6% per annum, and an estimated population of 100 million in 2017, Ethiopia is the second-most populous country of Africa after Nigeria (70). Most of the population (84%) lives in rural areas (66).

Ethiopia has made a remarkable progress in decreasing the number of people practicing open defecation. According to the Ethiopian demographic survey reports 2005-2016, open defecation practice reduced rapidly from 82% in 2000 to 32% in 2016 (45, 47, 66, 67). This could be the result of the effort of Ethiopian government through health extension program, and theough rapid scale up of CLTSH in rural areas, both were focused on encouraging hosueholds to construct a low cost pit latrine using local materials (42). This is a laudable first step in moving up the sanitation ladder (42). However, Ethiopia has made little progress in stepping up the sanitation ladder. Access to improved sanitation increased only to 6% in 2015 from 0.6% in 2000, while shared sanitation facilities remained same between 2000 and 2015. These

achievements are far from the target set by both MDG and the Growth and Transformation Plan (GTP) (42), that targeted to achieve access to improved sanitation to 50 percent (68), and 82 percent of the population (42) consequatively, Figure 4 shows trends of sanitation ladder in Ethiopia from 2000 to 2015 according o JMP 2017 report (17).

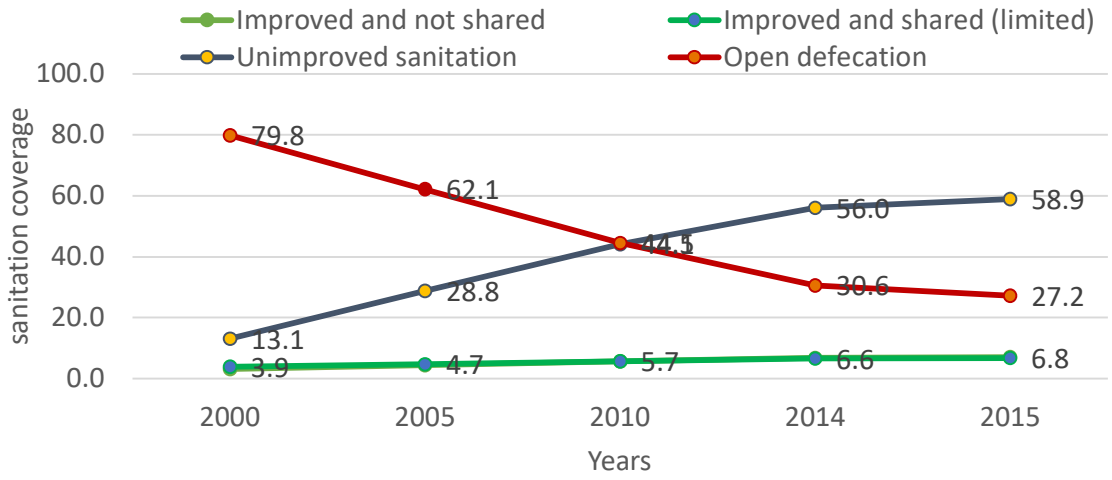

Figure 4. The trend of sanitation in Ethiopia according JMP estimates, 2000-2015

2.3.2 Challenge to track sanitation progress in Ethiopia

The inconsistent use sanitation indicators in Ethioia has been a challenge for tracking progress made on access to sanitation. For instance, for administration purpose, latrine was defined as "improved" if it meets the criteria that the latrine is closer to the house; has washable floor; has a wall and door must provide safety and privacy; a roof that prevents from rain and sun; and the toilet should have a lid to cover (42). .On the other hand, the national WASH monitering and evaluation framework manual defined a latrine that meets minimum standards should have a covered hole, there is a screen for any ventilation pipe, it is clean, maintained and has a latrine house (69). While JMP report is based on extracted data from DHS, there was a big disparity of data between the reports of DHS and JMP from 2000 to 2015. The reasons for the discrepancy was due to the assumption used by JMP's calculation which considered 50% of "pit latrines without slab" in Ethiopia are improved facilities, was far from the real data. Similarly, the FMOH health indicator report by the government shows a much higher sanitation coverage data compared with the JMP or DHS data. For instance, according to the 2013 government report, latrine coverage in Ethiopia was estimated to be 86% (70) while JMP 2013 shows 55% access to total sanitation (71). Table 1, which is taken from a recent indicator review on sanitation and hygiene in rural Ethiopia that compares the definition used by different sanitation monitering systems (72) .

Table 1. Comparision of indicators and their definitions used by different national WASH monitering systems

Tyep of sanitation facilities	DHS and JMP	Welfare Monitoring Survey	HMIS	National Sanitation & Hygiene Strategy	National WASH Inventory	WASH M&E Framework and Manual
Improved Latrines	Flush/pour flush to piped sewer system − Flush/pour flush to septic tank − Flush/pour flush to pit latrine − Ventilated improved pit (VIP) latrine − Pit latrine with slab	Flush toilet −Pit latrine (ventilate) Hand washing facility − Slab − Ventilation pipe Superstructure		− *Not Used*	Covered or VIP − Cement slab/ sand plate − Cleanable, even surface − Flies cannot Exit	*Not Used*
Shared latrine		*Not Used*	*Not Used*	*Not Used*	*Not Used*	*Not Used*
Minimum standard latrine	*Not Used*	*Not Used*	*Not Used*	Terminology used but no definition provided	Covered − Basic slab − No gaps − Cleanable, even surface − Flies cannot Exit	− Screen for any ventilation pipe, − Clean and maintained, − Latrine house.
Unimproved Latrines	− Flush/pour flush not to sewer/septic tank/ pit latrine − Pit latrine without slab/open pit − Hanging toilet/ hanging latrine − No facility/bush/field − Other − Missing	Pit latrine (not ventilated) − Bucket − Field/forest	Simple pit latrine without ventilation	*Not Used*	Uncovered Pit − Rudimentary − Uneven, difficult to clean 'slab' − Allows flies to exit *NB referred to as "Traditional Pit Latrine"*	*Not Used*

Several studies conducted in various parts of Ethiopia shows the inconsistent use of sanitationindicators. For instance, studies conducted in Ethiopia used the indicator "satisfactory latrine utilization" (25, 51, 73). This indicator was developed by merging four different sanitation behaviours which is vague to understand such as the ownership of functional latrine, the presence of sign that indicate latrine is being used, safe disposal practice of child stool, and the sanitary condition of the latrine. Using this indicator, a conducted in Hulet Ejju Enessie distinct (51), in Bahirdar Zaria (74), in Denbia district (75) , and in Hawzen district (73) reported 45-68%. The national health moniering information system (HMIS) has defined the criteria for latrine use such as i) a stool in pit, absence of stool around household or the pit latrine, well maintained superstructure, absence of spider webs, and visible access. This classification has a

better clarity compared with the indicator “latrine utilization”. However, still it has some limitations that include, 1) the presence of well maintained structure can not be directly measure latrine usage. Rather, it is one of the latrine qualities might increase its usage. 2) the indicator “visible access” is very subjective, and it has to be clearly defined in terms of its distance from the house, or other specific parameters. All of the listed indicators used to measure latrine usage are proxy-indicators, and there is a need to have an indicator that measures the latrine use behaviour of individual family members. In addition to checking the latrine for the signs of usage, it is important to measure the latrine use behaviour of individuals within a certain time period. The status of sanitation and the progress in Ethiopia remained controversial, indicating the need for a harmonized indicator definition and a consistent use standard definition.

2.3.3 Child faeces disposal in Ethiopia

The WHO and UNICEF joint monitering program on WASH defines safe disposal of child stool when the child uses the toilet/latrine; the faeces is put/rinsed in the toilet/latrine or buried; and unsafe if the stool is put/rinsed in a drain/ditch, thrown in the garbage, left or buried in the open (76). A meta-analysis of observational studies in 2004 reported that non-hygienic child faeces disposal was associated with a 23% increase in the risk of diarrheal diseases (77). There was a steady progress on safe child stool disposal practice in Ethiopia. According to the Ethiopian DHS reports, safe child stool disposal practice has increased only by 9%, from 33% in 2005 (47) to 34% in 2011(45), and 42% in 2016 (67).

Several studies reported that safe child stool disposal practice is associated with access to improved sanitation facilities. The analysis data from DHS 2011 has shown that safe hygienic child stool disposal was positively associated with having access to an improved latrine, and other socio demograohic factors that include urban residency, being in the poorer, middle, richer and richest wealth quartile, and being a caregiver with secondary and higher educational status; child age of above 4 years (78) . A study conducted in Tygrai region of Ethiopia also reported that elder mothers with age catagory 24-34 were more likely to practice safe disposal of child stool compared with younger mothers with age 15-24, employed mothers were more likely to dispose child stool compared with housewives, and urban dweller mothers were more likely to practice safe stool disposal compared with rural mothers (79). Consistently, a study conducted in India reported that safe disposal of child faeces was more likely to occur in households that own latrine than those who didn’t own latrine (80) . Despite the evidence that indicates child faeces is more likely to contain enteric pathogens than those of adults (81) , a perception that children faeces is less infectious than that of adults as it was reported by studies conducted in India , (82), and in Cambodia (83). Evidence show that products and materials used in the child

stool management vary between countries. A study in Cambodia reported that the main sites of children's defecation were the latrine, a potty, the yard, a disposable diaper, or a reusable diaper (83). A study in Peru suggested that latrines are not a suitable technology for children under four, and that diapers and potties should be promoted as a part of children's sanitation projects (84). There is limited evidence available in Ethiopia about the use of child stool management options such as child latrines, potties, dippers, and about the factors that determines the use of such options.

2.3.4 Handwashing after larine use in Ethiopia

Evidence shows that handwashing with soap after faecal contact, before handling food, and before child feeding reduces about 30% to 47% of the incidence of child diarrhoea (57) . However, globally handwashing practice after these events remains low. Ethiopia is among the countries that had very low handwashing practice. Study conducted in Ethiopia reported 5-7% handwashing practice (74) (85). Among the motivation factors to handwashing in Ethiopia, knowledge, attitude, disgust, and social norm were positively associated with good handwashing practice (86, 87). However, there is limited evidence about facilitating and inhibiting factors influencing handwashing practice in Ethiopia.

2.3.5 Prevalence of diseases related to sanitation in Ethiopia4y

An encouraging progress in health status of Ethiopians shown over the past two decades (88) . For instance, under five years age childhood mortality has declined to 67 deaths per 1,000 live births in 2016, from 166 deaths per 1,000 live births in 2000; the prevalence of stunting has decreased from 58% in 2000 to 38% in 2016; life expectancy at birth has increased by 16 years for men from 45.5 in 1990, and for woman it rose by 10 years (88). However, Ethiopia is still carrying a high burden of infectious diseases attributed to the lack of adequate water, sanitation and hygiene. The 2016 Demographic and Health Survey estimated that 12% children under the age of 5 years experienced diarrhoea within a 2-week period (67). Under-nutrition, which is linked to inadequate water, hygiene and sanitation, is the underlying cause of 57 % of child deaths in Ethiopia(6), and around 38% of under-5 children in Ethiopia are stunted (67). Despite evidence that show increased access to water, hygiene and sanitation is associated with decreased likelihood of infection with any Soil Transmitted Infections (STH), and specifically with Ascaris lumbricoides and Trichuris trichiura (16, 89) , more than 26 million Ethiopians are infected with ascariasis, 11 million infected with hook worm and 21 million Ethiopians are infected with trichuriasis (90) . Even though several researches reported the role of sanitation in reducing the prevalence of trachoma (91), , Ethiopia still carries 30% of the burden of trachoma among sub-Saharan countries (92) , and the prevalence of active trachoma (either TF

or TI) among children in the age group 1-9 years is 40.14 (93, 94). An estimated 64,540 children in Ethiopia could be saved every year by improving water, sanitation and hygiene (95).

2.3. 6 Ethiopia's strategies and programs on sanitation

In response to sanitation challenges, the government of Ethiopia has designed and implemented strategies to expand hygiene and sanitation services in the country (42, 96). Ethiopia launched the Health Extension Program (HEP) a decade ago. The HEP comprised of sixteen packages, seven of them were dedicated to hygiene and sanitation that include promoting household toilet, handwashing with soap (or ash) at critical times, and safe drinking water handling and treatment in the home (97). More than 34,000 rural Health Extension Workers (HEWs) were trained and deployed. It has been acknowledged that HEP contributed to the decreased incidence of communicable diseases as a result of improved hygiene and sanitation practices (88).

Community-Led Total Sanitation (CLTS), a participatory behaviour change approach to rural sanitation, was introduced in Ethiopia by NGOs in 2007. Later in 2011 CLTS was adopted as a national hygiene and sanitation promotion strategy with an added hygiene promotion (H) component (42). CLTSH was scaled-up in rural Ethiopia since 2013. Sanitation marketing is in its initial stages in Ethiopia. The national sanitation marketing guideline was developed in 2013 (96) and a pilot sanitation marketing project was implemented recently, which is currently in its initial stage of implementation (98).

In rural Ethiopia, the community members were organized by the government into groups called the "Health Development Army (HDA)". The main purpose of HAD is to create a community network so that they can discuss their own social, security and health problems. Each group comprises of up to 30 households residing in the same neighborhood, and each HAD group is further divided into smaller groups of five members, commonly referred as one-to-five networks. The leaders of the health development teams and the one-to-five networks are selected by the team members. The main criteria for selection of the leaders are being a model family and having the trust of the members in mobilizing the community (88). The government linked the leadership of CLTSH implementation with HAD structure. However, little is known about the implementation of CLTSH techniques with HAD structure; and what barriers and facilitators influenced the effectiveness of CLTSH implemented with HAD structure towards declaring open defecation free in their village.

2.4 Factors associated with the sustained adoption and consistent use of latrine

2.4.1 The behavioral perspective

2.4.1.1 Theories and theoretical models of health behavior

Health theories have described and predicted the role of individual psychological factors for engaging in a particular health behaviour (30, 99). Theories and models can explain factors that determine the likelihood of engaging in sanitation and hyegine behaviour that include latine adoption, consistent latrine use and hanwashing.

The Health Belief Model (HBM) describes that the likelihood of a person engaging in a specific behaviour is determined by the extent to which she/he believes that she/he is susceptible to a particular illness; her/his perception of the severity of the illness consequences; perceived barriers/costs of adopting a health behaviour; perceived benefits of adopting the targeted health behaviour (100). The theory of normative social behaviour (TNSB) describes perceived norm, differentiate it in to descriptive norm, which is individuals' beliefs about how others behave, example the perception that others are practicing open defecation, can contribute to the person to practice open defecation, and Injective norm, the beliefs about what important others expect them to behave influences individual's behaviour. According to TSNB, social sanctions should be simultaneously present with the norm to influence behaviour (101) . The TRA/TPB explains that attitudes, subjective norms and perceived behavioural control (Self Efficacy) to predict "intention", and a person's intention when combined with perceived behavioural control will help predict behaviour (102-104). According to the TRA/TPB, the affective component of attitude (feelings arising when performing or thinking of the behaviour) (105, 106) is influenced by the beliefs about consequences of the behaviour (perceived benefits) and outcome evaluations (107, 108). Several studies reported perceived benefits, beliefs, and attitudes that influence the adoption.

These theories describe how intentions, attitudes, values and other factors shape the behaviour of people. These behavioural theories commonly employed to explain, predict and facilitate health behaviours contain a wide variety of components. Many share identical or overlapping characteristics and have evolved from common roots because of an evolutionary process of development (Armitage and Christian 2003, Noar and Zimmerman 2005). Normative influences on behaviour are not explicitly covered with the exception of the TSNB and TPB which includes the subjective norm construct and underlying normative beliefs. In the HBM. Normative influences are simply listed as one of many potential cues to action. HBM focuses on the notion of threat as measured by perceived susceptibility and perceived severity (Table

2). As it is indicated in the table below, these theories have an overlapping concept, or they used different name for the same behaviora attribtes.

Concept fields	Concept tenets	HBM	TRA	TPB	TSNB
Attitudinal Beliefs	The perceived positive benefits must outweigh the perceived negative costs of	Benefits, barriers and health motivation	Behavioral beliefs and derived attitudes	Behavioral beliefs and derived attitudes	-
Self-efficacy, control beliefs	Belief in one's ability to perform behavior is often necessary for its execution	Self-efficacy	_	Perceived behavioral control components	-
Normative beliefs and norm related activity influences	Belief that significant others desire one to adopt a behavior Beliefs that peers have adopted the behaviour. Positive- enforcements, behavioral reminders	Cues from family, friends and media _	Normative beliefs and motivation to comply _	Normative beliefs and motivation to comply _	have to do what people actually do (descriptive norms)
Risk related beliefs and emotional influences	One feels at-risk of a defined disease/condition, with will inflict negative	Perceived Susceptibility	_	_	-
Intention setting and commitment planning	One has formed intentions and/or commitments in relation to achieving specific behaviour	_	Behavioral Intentions	Behavioral Intentions	-

Table 2. Comparision of the concepts defined by different health behavior theories

This study applied an adopted model by selecting important behavioural from HBM, TRA/TPB, and TSNB to investigate the individual psychological factors that determine latrine adoption. The study answered the questions: What salient beliefs determine attitude towards a latrine and using a latrine? Which psychological factors determine the adoption and consistent use of latrine in rural Becho district of Ethiopia? Accordingly, a mixed model was used for the study as it is summarized in Table 3 below.

Table 3. Mixed theory model for investigating psychosocial factors for the adoption and consistent use of latrine

Mixed theories	Salient beliefs	Risk perception	Perceived behavioural control	Attitude towards the act	Norm perception
Latrine adoption and latrine use model.	- Perceived positive or negative beliefs on latrine use and its benefit.	-Perceived vulnerability. -Perceived severity.	-Perceived ease to construct or use a latrine.	-Attitude towards latrine.	- Perception that significant others approve/disapprove contracting and using latrine. - Perception that significant others contracted/used latrine.

Behavioural models derived from health theories provided guidance for researchers to predict the individual psychological factors associated with a sanitation behaviour (30, 99) The Risk, Attitude, Norm, Ability, Self-regulation (RANAS) model has provided a comprehensive understanding of the individual psychological factors that determine WASH behaviour (38) .The RANAS model also proposed that specific intervention strategies for specific factors: information intervention for the low perception of health risk, persuasive intervention for changing attitude, normative interventions for changing norm factors, Infrastructural and other ability support for ability factors, planning, and relapse prevention intervention for self-regulation factors (38).

2.4.2 Multi-dimensional and multi-level perspective

2.4.2.1 Multi-level factors: Socio-ecological Model (SEM)

Socio-ecological model (SEM) is a widely-recognized framework for guiding research and intervention based on a broadened perspective of the determinants of health and emphasizing the complex interaction among individuals, groups, and their environment (33-35). There has been a growing interest in the use of socio-ecological model in the past two decades among researchers and program managers of various disciplines (35). Evidence showed that the socio-ecological model approach has been effective and it provides a comprehensive program approach that includes multiple intervention strategies aimed not only at the individual-level determinants of health, but also, it helped to address the various level determinants (i.e., social networks, community and societal levels) across a variety of dimensions (33, 35).

There are four core principles of the socio-ecological model (35).

- Multiple levels of factors influence health behaviours: the socio-ecological model describes that behaviour can be influenced by factors that exist at multiple levels such as intrapersonal, interpersonal, community, societal/policy; these factors include the socio-cultural, physical environment, policy etc.
- Interaction among multi-level factors: The model postulates that as there are multiple levels of influence on specific behaviour, and it is more likely to have multiple variables at each level, and there can be the interaction of variables across levels.
- Multi-level interventions are effective: As per the ecological models, a single level intervention like health education is not effective in bringing a sustained change of behaviour on a specific health problem. Rather, interventions are effective when it

targets multi-level influence at a time such as the availability of supportive environments and policy.

- Behaviour-specific research/interventions: As per the ecological models, research or intervention that implements the SEM can be effective if it is tailored to specific health behaviours unless lessons learned from one behavioural intervention might apply to others.

Researchers suggested the need for interventions designed based on the comprehensive understanding of factors inhibiting or facilitating the adoption and consistent use f sanitation facilities. Several researchers recommended the need of research for a clear understanding of the interrelationship between the multiple level influences. The SEM framework can be used for identifying factors that influence the adoption of sanitation at multiple levels: individual, intrapersonal, community and public/ societal level (32).

2.4.2.2 The Integrated Behavioral Model (IBM)

The Integrated Behavioral Model (IBM) was adopted from the socio-ecological model to be used for investigating the compex factos of water, hyegine and santitation and for designing interventions that targets multi-level factors. The IBM-WASH framework has been recommended for designing studies that aimed to explore factors that influence the adoption and use of sanitation ***(18)*** . As per the IBM WASH model, there are three dimensions that influence the adoption and sustainable use of latrine: psychological, contextual and technological. These three dimensions exist at the levels of societal/structural, community, interpersonal / household, individual and habitual. As it is shown in figure 5, there is an overlap among the three dimensions.

This study was designed focused on three dimensions at multiple levels: societal, community, household and individual levels.

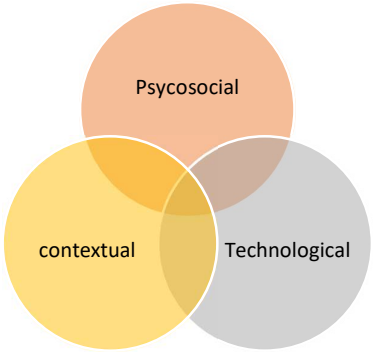

Figure 5. The IBM WASH model showing the interacting dimensions of barriers to the adoption, sustainability and consistent use of sanitation facilities

The psychosocial factors

The term psychological factors is used interchangeably with the behavioural facrors. Many of prior studies conducted in the least developed countries on sanitation and behaviour reported psychosocial factors for adoption and use of sanitation facilities.

Social reasons: social reasons such as avoiding damaging intra-village social relation, fear of embarrassment, and need of being respected by the community members were reported as the motivation factors people to adopt a latrine and to use a latrine (23, 24, 27, 109-111).

Convenience and comfort: Convenience and comfort were frequently reported by many studies as reasons for latrine ownership. A qualitative study conducted in Ghana in 2005 (24) , a study conducted in Amhara region of Ethiopia (25), and in Kenya (23, 111), reported that convenience is reported as the reason for latrine ownership and latrine use.

Privacy, security, and safety: studies reported that among the primary reasons for adopting a latrine, provides privacy, and security/safety from attack by strangers, animals and supernatural power were most frequently listed (21, 24, 28, 110). A study conducted in Ghana, 2007 reported that latrine was valued because it offers safety at night (110)). A study in Amhara region of Ethiopia also found the reason for latrine ownership for reduction from danger (23). A qualitative study conducted in four countries (Ethiopia, Sierra Leone, and Uganda) reported that privacy and security as a motivator for latrine ownership(28). Study in Ethiopia, 2006 also found privacy was one of the motivational factors for latrine ownership (25).

Cleanliness and avoiding smell: Several studies reported that the perceived benefits of latrine use that include maintaining the cleanliness of the environment, avoiding smells, and preventing flies motivated people to adopt a latrine. A study in Philippines also showed that when the attributes for latrine adoption and use put in rank order, the top ones were avoidance of smell, prevention of flies, and making cleaner (112). Consistently, a study in Ethiopia, 2006 show cleanliness is the number one mentioned advantage of latrine ownership/use mentioned by half of the study participants (25). On the other hand, when latrines are poorly maintained and have smell creates, it gives a negative perception about latrine and it leads them to open defecation (113, 114).

Health benefits: Some studies showed disease prevention was one of the motivating factors to latrine ownership and latrine use (24, 26, 115) . There are also a considerable number of studies that reported health benefit as the least valued factor for latrine ownership and use (26) (26).

Culture: In some countries, culture and societal rules determine the individual's acess to latrine. For instance, a study conducted in Alaba diitrict of Ethiopia indicated that the culture did not allow women to use the same latrine as their in-laws (116) , a study conducted in Tigray region of Ethiopia reported that it is a taboo for men and women to share same toilet (73) , and a study conducted in Zambia reported that their culture doesn't allow in-laws like the daughter-in-law to share the same toilet (116) .

A literature review on psychosocial factors of the adoption and use of sanitation facilities showed that despite the availability of theoretical models, there are limited studies in the area of sanitation that applied theoretical models for understanding the relationship between latrine ownership and consistent latrine use with psychosocial factors such as knowledge, beliefs, and attitude. Understanding the relationship of these attributes is important for designing strategies to increase sanitation adoption and use for the development of behaviour change interventions ((49) (50). This indicates that the development and refinement of sanitation programs need a scientific understanding of the behavioural attributes.

Technological factors

Based on the capability to hyegenically separate excreta from human contact as well as safe reuse/treatement of excreta insitu, the UNICEF/WHO JMP classified latrine technology into safely managed, basic, and unimproved (17). Evidence has shown that technology-related factors that include latrine quality, influence the adoption, and the use of a latrine (18). Rogers' theory of adoption states the initial adoption of any technology requires its availability, its affordability, and its capability (quality) to satisfy the needs or solve the problems (117). According to this theory, latrine adoption can be influenced by the availability of materials for construction and maintenance, market distance from the community, the cost, its capability, and acceptability (18, 118) . Rogers also stated that people continue with an adopted technology if they feel satisfied with it. When they are dissatisfied or if they find a better alternative technology, they will discontinue the older technology (119) .

Availability: Evidence showed that latrine use is influenced by the availability of latrine. For instance, a study in Ghana also indicated that latrine use was significantly associated with its availability (120) . A review of global sanitation program working research reports also showed that people who did not have access to a latrine at work or home usually went to open defecation (121) . However, the availability of latrine facility does not necessarily imply consistent use or the elimination of open defecation. Studies showed that geographic distance to latrine influences its usability (24, 26, 73, 75). Accessibility of the latrine to all family members can be limited due to socio-cultural influences. For example, a study conducted in a Kenyan slum

reported that women had limited access to shared latrines due to distance and privacy concerns (122).

Affordability: The affordability component comprises financial capacity to afford latrine construction. Many studies reported financial constraints as one of the main barriers to latrine adoption (27-29). A study conducted in Zimbabwe reported that cost is the main barrier for people to improve their latrine in moving up the sanitation ladder (123).

Quality: Studies has shown that poor latrine quality was associated with inconsistent use of a latrine. For instance, a study in Zimbabwe reported that latrines constructed from locallyavailable resources were less preferred options because of their low durability (123) . Despite the WHO JMP definition of improved latrine should hyegenicaly separet human waste from environment, sanitation programs in Ethiopia are focused on promotion of households to construct their own latrine using locally available materials. However, studies show there has been a high rate of returning open defecation free villages into open defecation, and households that owned latrine couldn't sustain due to its poor quality, unable to pay the latrine cost, and lack of access to latrine construction materials for building quality latrine (41). In Ethiopia, latrine constructions are not subsidized or not tax exempted and the construction materials are expensive. However, there is limited evidence available about how quality and durability affected latrine adoption and its use in Ethiopia. In this study, quality of a latrine was assessed based on the person's perception, satisfaction and judgment on existing latrine technology.

Contextual factors

Contextual factors are those related to the individual setting, and/or environment that can influence the adoption and use of a latrine. These include access to enabling resources, socioeconomic and demographic characteristics of the household. A natural environment such as rainy season and soil type affected the adoption and sustainable use of latrine (18).

Socio-demographic and economic factors are the most reported individual level contextual factors that were associated with the adoption of sanitation facilities. For instance, the prominent socio-demographic facilitators of latrine use/ adoption were having a better educational status, being male, a larger family size and better income (21-26).

Evidence have shown that environment influences the latrine adoption and use of latrine. For instance, a study in Kenya showed that shared sanitation facilities became dirtier and less used during the wet season (122). A review of global sanitation programs indicated that many latrines collapse and their utilization decreased during rainy seasons in East African countries based on the soil and land profile, and access to water (40). Another review of literature on

sanitation conducted in 2014 suggest evaluation of the local environment and soil profile prior to planning and construction of sanitation facilities (18) (40). However, limited studies examined the environmental determinants of latrine adoption and use in Ethiopia.

In this study barriers to sanitation were analyzed using a socio-ecological model, considering the three dimensions (psychosocial, technological and contextual) at each level. The current study was based on the following assumptions and concepts.

- Sanitation includes the adoption, maintenance and consistent use of latrine including safe disposal of child faeces.
- Sanitation in developing countries is influenced by a complex set of interrelated factors that exist at individual/household, community, and societal levels.
- Factors that can influence sanitation interact to or influence each other.

Individual and household level factors

The individual level is at the center of the social-ecological model. This level includes personal factors that increase or decrease the likelihood of individual adopting sanitation facilities, the consistent use a latrine, and the safely disposal of children's faeces. Individual factors which influence sanitation behaviour can be the individual socio-demographic factors that include age, sex, level of education, socioeconomic status, knowledge, attitudes, cultural and behavioural beliefs, perceptions, etc. (35).

Community level factors

The community and social environment comprise the relationships, the culture and thesociety with whom the individual interacts. The community-level factors have a significant influence on sanitation behaviour of individuals (34, 124). The social environment includes access to social support networks versus social isolation, the influence of professionals such as health extension workers, community norms, cultural norms and practices, and the socioeconomic status of the community. Strategies which bring change at the community level include community education, support groups, and social marketing campaigns. These are used to promote positive community attitudes and awareness to participation in sanitation behaviour (125).

Social support has been one of the important functions of social relationships (35). Researchers showed that in cultures where there is a close social relationship among individuals, the collective is emphasized over the individual, or interdependent views and norm perceptions exert a more powerful influence on individual's behaviour (126-132). A study in India showed that communities with high levels of network cohesion were less likely to own a latrine and

indicated how negative norm influenced individuals in the social network cohesion (133). In most of the rural Ethiopia setting, people are socially interconnected. However, little is documented about the role of social networks and social support in enhancing individual's ability to own latrine or to use latrine consistently.

Societal/system level factors

Societal or system-level factors are the laws, policies, strategies, and leadership regarding sanitation that includes the allocation of resources for sanitation (35). Effective policy can stimulate the delivery of programs that address sanitation needs. Ethiopia has a strong health policy that favours disease preventive strategies, in which provision and promotion of hygiene and sanitation are articulate the d as the key focus (134). Sanitation and hygiene efforts have been dealt under the ministry of health in Ethiopia through the Health Extension Program (HEP) that was launched in 2003 (135). Ethiopia has developed the National Hygiene and Sanitation Strategy in 2005 that anticipated for 100% adoption of improved hygiene and sanitation facilities by each community (135). Ethiopia has also developed a national hygiene and "On-Site" Sanitation Protocol" that could be used as a guide for all stakeholders promoting improved hygiene and sanitation (136).

The public-sector investment on sanitation is minimal in Ethiopia. Studies estimating the effect of subsidy and provision on the sustained adoption and use of sanitation facilities had inconsistent conclusions. A review of literature of studies on public subsidy and supply-driven approaches had concluded that these approaches were effective when they also addressed demand creation, behaviour change and financial access to the poor (137).The Ethiopian national sanitation strategy stated no subsidy or provision at the household level (42). In Ethiopia, construction materials are not subsidized or not tax exempted and therefore the construction materials for improved sanitation facility are expensive. Given this policy, ensuring of safe, affordable, and sustainable sanitation facility that considers access to the poor seems a challenge in the country. However, there is limited evidence available that can show how these policies influence the adoption and sustainability of sanitation facilities in Ethiopia.

2.5 Summary of the Review

The inconsistency of level of latrine coverage and latrine use has been a challenge in Ethiopia. This study measured four sanitation behaviours 1) latrine ownership, 2) consistent use of latrines, 2) safe disposal of children's stools, 4) handwashing. Measurment of sanitation coverage and consistent use of latrine were adopted from WHO JMP to determine the percentage of population that used improved, shared, unimproved and open defecation were reported (3, 45). For comparison with previous studies conducted in Ethiopia, indicators such

as latrine utilization (51), a latrine in use (52), and the consistent use of latrine (51) (47) were measured. A combination of quantitative and qualitative study design was employed to acquire a depth of understanding of sanitation level and practices in rural Ethiopia.

The literature review showed that factors influencing sustained adoption and consistent use sanitation facilities are very complex that has multi-dimensional. However, prior studies on sanitation focused on the hardware and the individual level analysis(18). It has shown that understanding multi-level contextual and technology related barriers is important for designing different strategies to increase the adoption and sustainable use sanitation facilities (18). Researchers have called for a better model to understand multi-level and multi-dimensional influencing factors (20). Socio-ecological was employed in the current study to explore the potential individual, social and environmental influences on the sustained adoption and consistent use of sanitation facilities. In most of the studies on sanitation, the individual level factors continuing to dominate the research agenda. In this study, the socio-ecological model was applied to explore multi-level barriers to sustained adoption of sanitation, and the interaction of these factors in the rural context of Ethiopia (50). The contextual and technological factors that influence the ownership and use at multiple levels were explored using a qualitative method.

The psychological perspective that seeks to understand how beliefs, culture, attitudes, and other behavioural attributes influenced the person's decision to construct and use a latrine was not addressed (138). In this study beliefs and cultural values related to latrine use were explored. The study applied theoretical models as a framework to determine the role of individual psychological factors such as attitudes, disease risk perception, self-efficacy, and perceived norm related to latrine ownership and use.

3. OBJECTIVE OF THE RESEARCH

The study investigated the socio-ecological and beghavioral deterinants of the adoption sustainability, and consistent use of sanitation facilities in Becho district district, Oromia region of Ethiopia. According to the 2014 woreda health report, the percentage of the population owning any kind of latrine in the Becho district was 57% (139).

3.1. General and specific objectives of the study

3.1.1 General Objective

The general objective of the current study is to determine the psychosocial, technological and contextual factors associated with latrine adoption and consistent latrine use in rural Becho district of Ethiopia individual, household and community and societal levels.

3.1.2 Specific Objectives

1. To determine the level of latrine ownership, and consistent latrine use in rural Becho district, oromiy region of Ethiopia.
2. To determine the psychosocial predictors of latrine ownership and consistent latrine use in rural Becho district, oromiy region of Ethiopia.
3. To investigate the contextual and technological factors that influence the adoption and use of improved latrine at the individual, household and community and societal levels in rural Becho district, oromiy region of Ethiopia.

3.2 Research questions

The study was designed to answer the following research quastions:

- What are socio-demograohic determinants of latrine ownership, consistent use of latrine, hygienic child faeces disposal and handwashing after latrine use in rural Becho district of Ethiopia?
- Which behavioural (psychological) factors influenced latrine adoption and consistent use of latrine in rural Becho district of Ethiopia?
- What salient beliefs determine the individual's attitudes towards latrine and is use in rural Becho district of Ethiopia?
- What contextual and technological factors determine the adoption and sustainability improved latrine, and consistent latrine use at the societal, community, interpersonal and household/individual levels in rural Becho district of Ethiopia?

4. CONCEPTUAL FRAMEWORK

As illustrated in Figure 6, a conceptual framework that was adapted from socio ecological model and the IBM-WASH framework was used to investigate the potential barriers to the adoption, sustainability and use of sanitation facilities. The study explored multilevel influences that range from the individual, household, and community to social determinants on the sustained adoption and use of sanitation in rural setting of Ethiopia. Under each level, we have explored the contextual, psychosocial and technology related dimension.

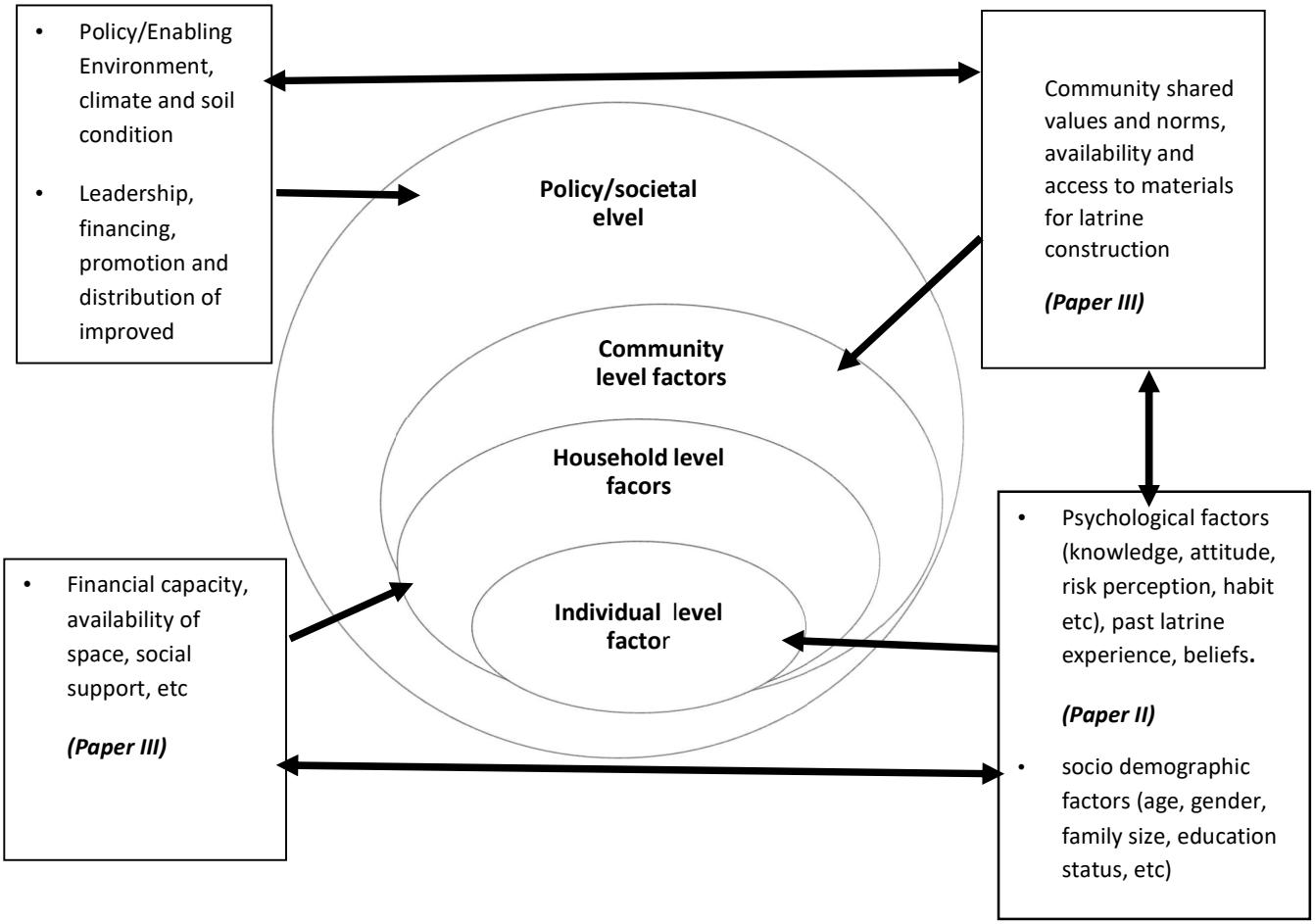

Figure 6. Conceptual framework for the adoption and consistent use of sanitation facilities.

Individual and household level factors include the socio-demographic factors such as age, sex, level of education, family size, etc.; the psychosocial factors such as knowledge, attitudes,

cultural and behavioural beliefs, perceived ability, perceived norm; and the contextual situations such as availability of space were explored.

The community level factors that include the social networks and social support systems that can influence individual decision to adopt latrine or consistently use it, friends, peers, religious networks, customs or traditions. The community norms and shared values, exposure to informational communications on sanitation, access, etc. were investigated.

The societal factors such as policies and strategies on sanitation, leadership, financing, manufacturing, and distribution for sanitation and access to the product, restrictive policies were explored.

5. METHODS AND MATERIALS

5.1 Study setting

In descending order of administrative levels, Ethiopia has the national, regional, zonal, district, kebele, and village levels. Kebele is the lowest administrative unit, comprising 20–30 villages each village populated with approximately 5000 people(47). Oromia Region, where the study was conducted, is one of Ethiopia's nine regional states of Ethiopia. Becho woreda (a district) is located 80 km to the South West of Ethiopia's capital Addis Ababa. Based on the 2007 national census, Becho had a projected total population of 88,550 in 2016, with 80.4% being rural residents (66). The majority of the inhabitants are followers of Orthodox Christianity (95 %), and 2 % are Muslim. The local administrative report showed in 2014 rural latrine coverage in Becho district is 57%. The livelihood of Becho district is categorized as mixed farming and the main economic activities are crop production and livestock production. The major livelihood of people in rural Becho was farming of teff, wheat, chickpeas. Becho has a soil that holds water becomes very sticky in a wet season. In the dry state the soil cracks down the surface; its permeability is extremely low (140).

CLTSH was the main behavioural change approach on sanitation that has been implemented in Becho district. As part of the national CLTSH scale up by the government, its implementation started four years back. The health extension workers and a trained expert from the district facilitate the "CLTSH triggering" at a village level in all Kebeles (139). The study was conducted post CLTS triggering in all of the selected Kebeles (Figure 7).

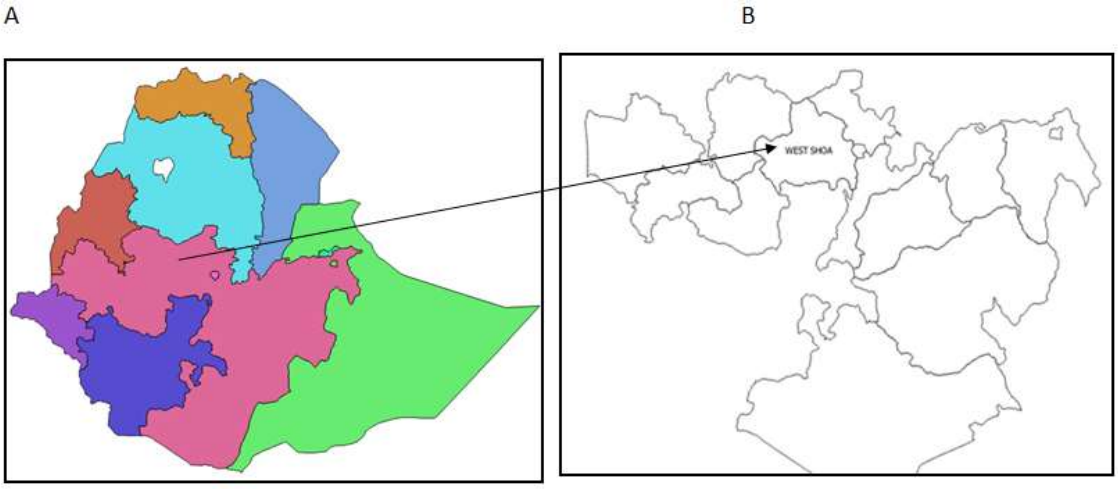

Figure 7. Location of Oromia region (A) in the map of Ethiopia, and the study area in the region (B)

5.2 Research design

The research design and its flowchart is illustrated in Figure 8. Mixed methods research is the type of research that combines elements of qualitative and quantitative approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purpose of breadth and depth of understanding (141).

A combined of qualitative and quantitative methods in a single study can result in a more powerful design than a single study (142). The use of mixed method in the study will help to provide complete understanding of a problem, and to compare, validate, or triangulate the results of the study. A mixed method designed was employed in the study with both qualitative and quantitative methods given equal weight. The use of mixed method in this research enabled to explore the complex multiple level factors influencing the adoption and use of rural sanitation facilities, and their interconnectedness.

The qualitative method helped to explore and describe the individual's values, beliefs, attitudes and other socio-cultural perceptions that influenced the adoption and use of sanitation facilities; and, to investigate the multiple socio-ecological level contextual and technology related factors influencing the adoption and use of sanitation technologies. The quantitative method explained the role of demographic, and psychological factors in predicting latrine adoption and latrine use.

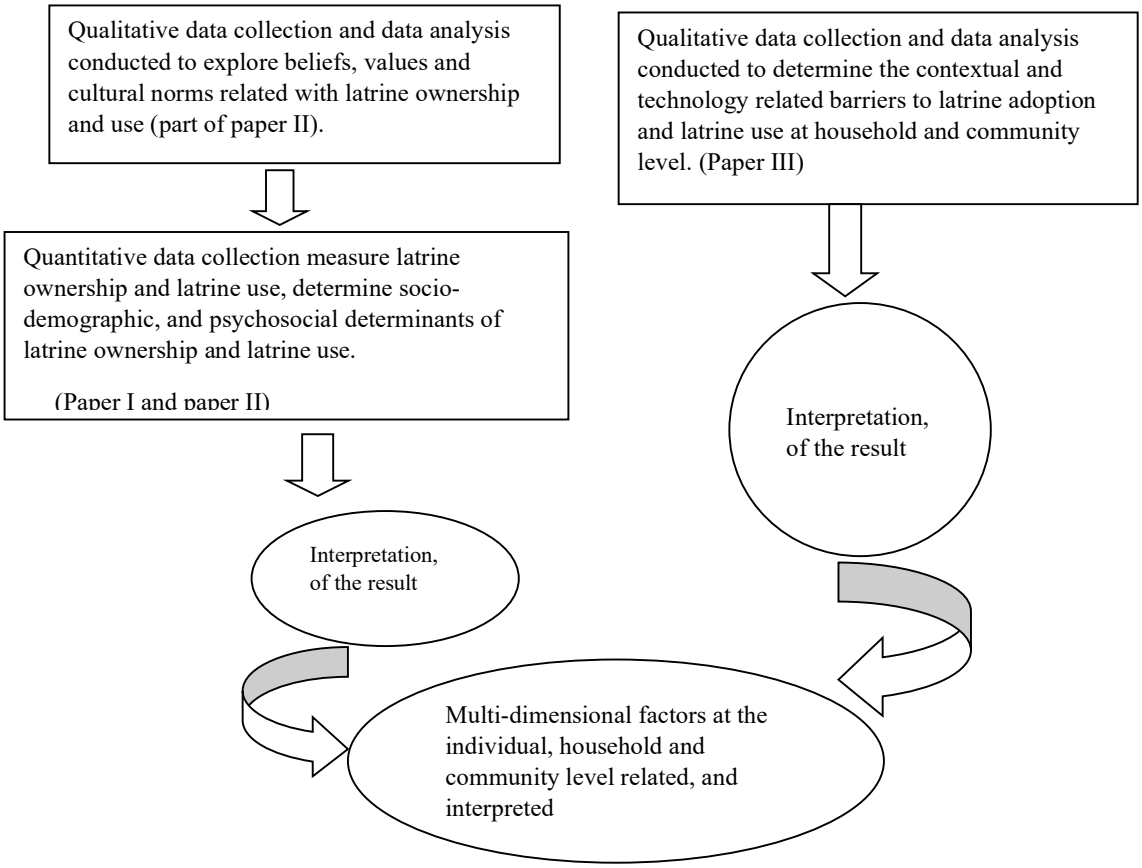

Figure 8. The study flowchart

5.3 Quantitative study

Determining Latrine ownership, latrine use, socio-demographic and psychological factors (objective two and objective three)

The quantitative part of the study was conducted to describe the level of latrine ownership and latrine use, the associated with socio-demographic factors (objective one), and to predict the role of psychological factors (disease risk perception, attitudes, subjective norm, perceived behavioural control) on latrine adoption and latrine use by applying mixed theory (objective three) A cross-sectional quantitative study was conducted. Household heads were interviewed using a structured questionnaire, and data collectors verified latrine ownership through observation. The same questioner captured variables for objective one and two of the study.

5.3.1 Inclusion and exclusion criteria

Inclusion criteria

Household heads that are resident in rural Becho district for at least 6 months before the study period were included.

Exclusion criteria:

Households with the following criteria were excluded from the study.

- Those temporally replacing the household head for taking care of the household.
- People with severe mental disorders who lack the capacity to consent.

5.3.2 Sample size estimation

Sample size estimation for Objective one: determining latrine ownership, latrine use, and socio-demographic factors.

The sample size for determining latrine ownership was estimated using Epi-info software version 7. We considered 68% latrine coverage (any kind latrine) from DHS 2014; design effect of 2; margin of error of 0.04 and 95% confidence level. Based on these assumptions, a total sample size was estimated using the formula indicated below.

$$n = \frac{(Z\,\partial/2)2\ p\ (1\text{-}P)2}{d\ 2}$$

$$n = \frac{(1.96)2 \times 0.68(0.32)}{(0.04)\ 2} = 522$$

522+ 52= 574 (10% non-response rate)

574 x 2 = 1148 (Design effect 2)

The estimated sample size was 1148.

Sample size estimation for Objective two: determining psychosocial predictors of latrine ownership and latrine use.

Since there was limited evidence available in Ethiopia and sub-Saharan Africa on the behavioural predictors of latrine ownership, the maximum sample size (50 %), marginal error (d) 0.05, non-response rate of 0.1, with 95 % confidence certainty and design effect 2 is considered. Based on these assumptions, a total sample size calculated was 844.

Finally, the maximum sample number that was 1148 was taken.

5.3.3 Sampling procedure

Becho district in Oromiya region was selected because of the researcher's prolonoged experience of working in health programs with the government and communities in the area. A two-stages sampling procedure was followed for the selection of quantitative study participants.

Cluster (Kebele) selection: Considering 42% of the total clusters (kebeles), eight were selected by the simple random sampling method. Village level structure wasn't considered for the sampling proceducre.

Household and study individuals' selection:

The sample frame for each selected kebele were the list of all households obtained from the local administration office. The sampling interval (SI) 6 was calculated by dividing the total number of households the selected kebele (6369) by the estimated sample size (1148). The first household in each kebele were randomly selected, then the head of every sixth households were interviwed. To capture the gender related factors that affect access to sanitation, it was decided to interview women spouce in every other selected householeld.

5.3.4 Data collection procedures and tools

Data was collected using a structured, pre-tested standardized questionnaire in the form of face-to-face interviews, and latrine observation using checklists and printed picture that demonstrates the distinct types of latrines. All questions were designed to be consistent with the objectives of the study. It was adopted from standard tested instruments in the specific thematic areas.

Quantitative data collection questioners were designed in a simple pre-coded multiple-choice question. The questionnaire was designed to cover mainly: demographics, latrine ownership and use, place of defecation, availability, and status of handwashing facility, child's stool disposal, and socio-demographic variables, psychosocial variables that include the participant's attitude, norm perception, ability perception, and disease risk perception. The questionnaire was prepared in English and then translated into local language which is Oromiffa.

Data collectors and supervisors were provided training by the principal investigator for two days. The training provided knowledge about the study objective, accurate data collection and completion of the data collection form, social skills and interviewing techniques, research ethics and expectations from each study team. As part of the training, the study team conducted a half day field exercise using the questioner. Pilot testing of the instruments was done for all the instruments before conducting the main study. The questionnaire was assessed for its clarity, consistency and completeness before finalizing the tool. The pilot testing was done in a rural Becho district in a village that was not selected for the study. The pilot interview was conducted among 40 households using the translated Oromiffa version questionnaire. Ten data collectors that had a high school education; and three supervisors with master's degree, who were fluent speakers of local language were recruited locally. The field supervisors ensured that each data

collector collected quality data, monitored the performance of the data collators, assisted and resolved any problems the data collector faced.

Prior to departure to the field work, the supervisors had ensured that the team members carried enough questionnaires and other materials necessary to complete their assignment. Each morning before leaving for field visits, the supervisor checked that they have all necessary materials. Households were visited a day before the interview for pre-announcement before the interview date. If the selected participant were not available during the first visit, up to three visits were attempted before substituting the sampled respondent. Every participant was informed in detail about the study and asked for signing consent before starting the interview.

5.3.5 Data management and analysis

Quantitative data were entered into Epi info software version 3.5.4. All participants were assigned unique identification numbers to facilitate data tracking, data entry, and confidentiality. The PI ensured that the entry template variables are correctly named, all values for categorical variables are correctly labelled, and all variables with data are entered. Double entry of data was done to help identify entry errors and to ensure the quality of the data. The two data sets were compared to find any typing errors, were corrected. The responses were transformed into numeric codes represented by a fixed number of digits. Questions with more than one response were split into several variables, each corresponding to one response option. A codebook was prepared that provides a comprehensive description of the contents and layout of the data that were entered using a computer for analysis. Data verification and cleaning was done starting from data collection at different stages. The cleaned data were exported to SPSS version 20 for analysis. The normal distribution assumption for the selected socio-demographic and main independent variables was assessed using SPSS. We conducted an analysis of the cleaned data using SPSS version 20. Logistic regression analysis was used to assess association between binary outcome variables and potential associated factors. Descriptive summaries generated from the collected data are presented in tables and graphs. In the first step, bivariate logistic regression model was fitted to assess unadjusted association of each socio-demographic variable with latrine ownership. Variables which were statistically significant were considered for multivariable logistic regression model. Odds ratio was used to assess the strength of association and results were reported as being statistically significant whenever p-value is less than 0.05.

5.3.6 Variables and measurements

5.3.6.1 Variables and measurements for determining latrine ownership, latrine use and socio-demographic determinants

Latrine ownership: The ownership of any kind of latrine, and consistent latrine use were the outcome variables of the study. We measured latrine ownership by asking respondents the type of latrine facility where the family members normally use, that was in parallel verified by observation for the presence. We reported latrine ownership in two ways. The proportion of participants that used improved, shared, non-improved or no latrine/open defecators; and ownership of any kind of latrine. Latrine use was measured by using two indicators.

Latrine use: Consistent use of latrine was measured by asking participants the frequency of latrine use in the past one week while she/he stayed at home, responses provided for choice such as almost never, rarely, sometimes, most of the time, or always. Consistent use was estimated with the proportion of latrine owner participants who consistently (always) used their latrine when they stay at home during the past one week (143). The indicator "latrine in use" was measured by the percentage of latrines with an observed indication sign of use during data collection time. Latrine in use was yes if there was at least one indication sign such as: a path to latrine has been walked on; visibly used anal cleansing material that can be paper, tissue paper, water, etc., a detected in the pit using flashlight; the slab is wet, and the latrine is smelly(144). The composite score of 0 to 5 of latrine use was recorded to yes for values 1 to 5 and no for a value 0.

Handwashing: Handwashing was measured using two proxy-indicators: the availability of handwashing facility closer to a latrine, and an indication for the use of handwashing facility. The availability of handwashing facility was be measured by yes or no for its presence or absence confirmed by rapid observations. The availability of water for handwashing was yes if any local water container like pot, jerikan etc. that is prepared for handwashing is available inside or within 10 paces of the toilet facility, No for its absence (144). Use of handwashing facilities was be measured by checking a sign of use, yes if there are signs that people have recently washed their hands, such as wetness on the ground below handwashing facility, worn track and other signs of recent use.

Safe child stool disposal: was measured by asking caregivers about the the percentage of children less than five-year-old who were assited to use a latrine, or whose stool was disposed of using a latrine, or rinsed into the latrine or buried.

Cleanliness of the latrine: Cleanliness was measured with subjective evaluation of the overall cleanliness of the latrine: Good if no sign of stool anywhere, Clean and tidy; Fair when some stool around pan/squatting plate only; Poor when stool on the floor or wall (144).

Latrine with protected entry: The availability of protected entry was Yes, when the door is made of metal sheet, a sheet made of bamboo matting, wood, curved entrance with plastered walls, flat wood, sheets made of bamboo; and No, when there is no door, or if is cloth curtain, curved entrance un-plastered wall, or plastic sack (42).

Latrine with superstructure: The response for "Latrine has superstructure "was yes, when the wall is made of brick and cement, metal sheets, stone, stone/mud, sheets of bamboo matting, wood, etc.; The response was "No" when the wall is made of sesame stalk, leaf, cloth, plastic sheets or no wall.

5.3.6.2. Variables and measurements to the study that aimed to determine the psychological predictors of latrine ownership (objective two)

The psychological factors such as perceived risk (perceived vulnerability and perceived severity), attitude, and perceived norm (injective norm and descriptive norm) were investigated for predicting latrine ownership in this study (38) . Cues to action, beliefs about latrine use and other possible modifying factors such as the individual's socio-demographic characteristics that can possibly influence latrine adoption were included in the analysis (145) . Since the study was limited to a one-time data, the effect of intention and perceived ability on future behaviour among non-owners couldn't be determined. Rather, descriptive data of the two variables were presented. The questions that were used to assess psychological variables were adopted from RANAS, and from a behavioural studies that applied same model (38) . Overall, the questions used to measure the psychological variables were developed guided by the Theory of Planned Behaviour (TPB)/ Theory of Reasoned Action (TRA) (146, 147) , Health Belief Model (HBM))(145) , and theory of Normative Social Behaviour (148). These theories were the most commonly and widely used in the context of sanitation and hygiene behaviour. The TNSB in particular has been widely applied to studies conducted to determine the effect of social influence on behaviours (148, 149). The psychological factors that predict latrine ownership were measured using a uni-polar Likert scale that range from zero to five Likert scale (38). The details are summarized below, and each measurement is described in Table 4.

Risk perception: In this study, perceived vulnerability was defined as the extent to which the person believes that she/he is susceptible to diarrheal disease due to contamination from open defecation; and perceived severity is the perception of the severity of the diarrheal illness consequences (145). Perceived vulnerability and perceived severity were measured using a

Likert scale that ranges from zero to five. Perceived vulnerability and perceived severity were coded into high severity for the responses 4 to 5, low severity for responses 1 to 3.

Norm perception: The effects of social norms perception on a particular behaviour is described by the theory of normative social behaviour (TNSB) (148), which is analogous to the subjective norm in the theory of reasoned action (TRA) (146). Social norm is differentiated as the descriptive norm, individual's beliefs about what others behave, and injunctive norm, the beliefs about what others expect them to behave (101).

In this study, the psychological variables are defined as below:

- ***Descriptive norm***: In this study, the descriptive norm for latrine use is defined as the participant's perception of the extent to which latrine use are prevalent. It was measured using 3 items that were adopted from social norm studies. The composite score 4 to 15 then recorded into a high descriptive norm for the score greater than 10.5, and a low descriptive for the score less than and equal to 10.5.
- ***Injunctive norm***: Injunctive norm is the participant's perception that their important referents expect them to own a latrine or use a latrine. The injunctive norm for latrine ownership was measured using two items. The composite score, ranging from 2 to 10, was recorded as high injunctive norm latrine ownership for a score of 8 to 10, and low injunctive norm form latrine ownership for a score of 2 to 7. The injunctive norm for consistent latrine use was measured using 3 items. The total score of three items ranged from 3 to 15, which was recorded. The score of three items ranged from 3 to 15 recoded into high and low for scores 3 to 10, and greater than 10 respectively.
- ***Attitude:*** The TRA/TPB explains that attitude, which is the feeling arising when performing or thinking of the behaviour will help predict behaviour. Attitude is influenced by the beliefs about consequences of the behaviour and outcome evaluations(147, 150). In the current study attitude was assessed using three items that ask the participants' feeling of using latrine, the composite score of the three items scored 4 to 15, then recoded in to high attitude for the score greater than 10, and low attitude for the score 4 to 10.
- ***Perceived ability (Self Efficacy***): The theory of planned behaviour explains the individual's perception about their capacity (151). Only latrine non-owners were asked about Self-efficacy, their perceived ability for building their own latrines in the coming one year. The responses scores 1 to 5 recoded in to high self-efficacy for the score above 3, and low self-efficacy for the score 1 to 3.

- ***Beliefs on latrine use outcome (outcome expectancy):*** As it was recommended by the TPB (146), first the beliefs about latrine were identified using qualitative method. Each of the identified belief items such as latrine prevents disease, provides convenience, increases social status, prevents smell, provides privacy, and provides security were measured using a Likert scale. The response items that had scores of 1 to 5, were coded into high for the score 4 to 5, and low for the score 1 to 3.
- ***Cues to action***: Participants were asked about their exposure to personal and media communication on sanitation, recorded as it was reported by the participants.
- ***Behavioural intent (intention):*** The TRA/TPB explains that a person's intention when combined with perceived behavioural control will help predict behaviour (146). Intention was defined as the behavioural intents to build own latrine in the coming one year, and only non-owners were asked. The response score 1 to 5, was recorded into high for the scores 4 and 5 and low for the scores 1 to 3.

Table 4. Measurements that were used to assess the psychological predictors of latrine adoption and latrine use

Factor	Items	Responses	values
Outcome variables			
- **Latrine ownership**	Ownership of latrine	No/Yes for ownership of latrine	0/1
- **Consistent latrine use**			
Predictor variables			
Risk Perception			
- **Vulnerability**	How high or low are the chances that you contract diarrheal disease when defecating in the open field?	Five point scale, that ranges from almost Very low, to Very high	1 to 5
- **Severity**	If you have diarrheal disease because of open defecation, how severely would that impact your life?	Five point scale, that ranges from almost Very low, to Very high	1 to 5
Attitude (affective)			
	How much beneficial/important it is building your own latrine in the one year.	Five point scale, that ranges from almost Very low, to Very high	
	How much beneficial/important it is to defecate using latrine regularly.	Five point scale, that ranges from almost Very low, to Very high	1 to 5
	How much do you like to use latrine?	Five point scale, that ranges from almost Very low, to Very high	1 to 5
	How much do you do you enjoy defecating in latrine?	Five point scale, that ranges from almost Very low, to Very high	1 to 5
Self-efficacy (latrine ownership)	How much ability you think you have building your own latrine in the next one year	Five point scale, that ranges from almost Very low, to Very high	1 to 5
Injective norm (latrine ownership)	Most of the people in my village think I should have my own latrine	Five point scale, that ranges from completely disagree to completely agree	1 to 5
	People in my village will judge me if I don't have my own	Five point scale, that ranges from completely disagree to completely agree	1 to 5
Descriptive norm (latrine use)	Most of the people I know in the community defecate using latrine regularly	Five point scale, that ranges from completely disagree to completely agree	1 to 5

Factor	Items	Responses	values
	How many of your neighbors use latrine for defecation?	Five point scale, that ranges from almost nobody to almost all	1 to 5
	Using latrine regularly is the right thing to do because everybody does so	Five point scale, that ranges from completely disagree to completely agree	1 to 5
Injunctive norm (latrine use)	people who are important to me approve /disapprove that you use latrine	Five point scale, that ranges from completely disagree to completely agree	1 to 5
	Defecating using latrine is regularly is something that most of the people in my village think	Five point scale, that ranges from completely disagree to completely agree	1 to 5
	People in my village will judge me if I defecate in the open field	Five point scale, that ranges from completely disagree to completely agree	1 to 5
Cues to action			
Exposure to Health education (HEW)		Yes/No	
Exposure to CLTSH triggering		Yes/No	

5.4 Qualitative study design

Qualitative data were collected to exploring beliefs, values and cultural values on latrine (part of objective two), and to investigate the contextual and technology related barriers and facilitators of latrine ownership and latrine use at the individual, household, community and societal levels (objective three).

5.4.1 Data collection techniques and participants.

5.4.1.1 Individual In-depth interview (IDI)

In-depth interviews were conducted with household heads, health extension workers, and with district WASH coordinator, and community members, the purpose of in-depth interviews was to explore community and societal level barriers and facilitating factors that influence ownership and consistent use of a latrine. The interview was conducted in Oromiffa language. The PI was responsible for conducting the interview, audio recording and taking notes.

In-depth interview with household heads: Six indepth interviews with households (three adopters and three non-adopters) were conducted to explore the values, beliefs and cultural norms related with latrine ownership and latrine use (part of objective two); and to investigate the household level contextual and technological factors that influence the adoption latrine, and its sustainable use. The influence of materials availability in the market, distance of the market from the community in terms of time taken to travel to the nearest market, and the cost of materials for latrine construction explored. Access to latrine for use interns to the location and distance of latrine from home, its accessibility to all family members that considers their age and gender was investigated. The perception of households about the quality of the latrine, its design and others aesthetic reasons were explored.

***In-depth interview with experts*:** four key informant interviews were held with purposively selected three health extensions workers from the kebeles selected for the survey (two from lower latrine coverage and one from higher latrine coverage kebeles) and, one district WASH coordinator. Decision was made about final sample size based on the the adequacy of information.

Inclusion and exclusion criteria for in-depth interview

Inclusion criteria for the in-depth interview

- Household heads that were resident of rural Becho district for at least 6 months before data collection period.

- Working as a health extension worker/WASH expert in the selected Kebele/district/health centre for at least 1 year was the inclusion criteria.

Exclusion criteria for in-depth interview

- Those temporally replacing the household head for taking care of the household was excluded from the study.
- People with severe mental disorders who lack capacity to consent.
- For professionals who cannot be available during the data collection period, temporary replaced for the position were excluded.

5.4.1.2 Focus group discussion

The purpose of the focus group discussion was to explore the community perception about latrine ownership and use, the community level barriers and facilitators for latrine ownership and latrine use, the local commitment to abandon open defecation, the local leadership, collective efficacy for supporting and maintaining consistent latrine use. Each FGDs comprise of 8 to 12 participants'. The total sample size for the FGD was determined by the level saturation of data. Consultation was done with the local administration and health extension workers to get ideas about how to gain access to the target people and how best to approach people. FGDs were undertaken with 75 participants who were randomly selected from the study kebeles based on their availability and willingness to participate. For maintaining group homogeneity and encouraging open discussion, FGDs were held separately with adult men, adult women, boys and girls (age 15 to 18). FGDs participants were also stratified into based on latrine ownership to let them discuss topics openly together. Hence, two FGDs were held with latrine owners, and two FGDs with latrine non-owner household heads. The participants of FGDs were randomly recruited by the local village leaders and health extension worker.

Inclusion criteria for FGD:

Being a resident of the study site for more than one year.

Exclusion criteria for FGD

- Those temporally replacing the household head for taking care of the households.
- People with severe mental disorders who lack the capacity to consent.

5.4.2 Data collection procedure and instruments

All in-depth interviews and FGDs were conducted in Oromiffa, the local language of the study area. The FGD with each group took place in their village close to their home. The principal

investigator was responsible moderate the FGD. Two co-facilitators who had a diploma and above education level and Oromiffa speakers were employed to facilitate the FGDs and provided a two days training. Their role was note-taking, recording the demographic details of each participant on the enrolment form, and handling the tape recording during the discussion. The interviews and FGDs were conducted in Oromiffa language. On average, interviews lasted 45 minutes while FGDs took 60 minutes.

Open-ended topic guides were used for the focus group discussion and for the individual in-depth interviews. The topic guides for IDI and FGD were designed guided by SEM and IBM WASH framework. Specific questions were adopted from previous studies in the areas (25, 152). The topics covered the psychological factors such as beliefs and perceptions towards latrine adoption and use; contextual factors such as availability and cost of of materials for latrine construction, access to the market, access to resources, the availability of space, soil type, the community exposure to sanitation campaigns; the technological factors such as the, perception about quality latrine, problems with existing latrine and acceptability of the improved sanitation. The guides were prepared in English and translated into local language which is Oromiffa. The translated versions of the topic guide were used for in-depth interview and focus group discussion.

5.4.3 Data management and analysis

All FGDs and interviews were recorded. The Principal investigator took an expanded field note during the interview, then typed on the computer on a word file. Each interview and FGD records were transcribed into a word in Oromiffa language as the interview recorded. The transcribed documents were translated in a meaning-based approach from the Oromiffa into English. The analysis of the transcriptions and the notes taken during the interviews and FGDs was supported by the QSR NVivo project version 10. An excel layout of a summary of quantitative data that describe the participant's demographic characteristics, the location and other key information to situate the interview was prepared. All data files such as transcriptions, contact summaries, and audio files were imported filed into NVivo. A framework that was developed from combined SEM and IBM WASH models was followed during the design and data analysis. Joint discussions were conducted with researcher and supervisors to compare the identified themes and sub-themes under the framework. Any differences were discussed until consensus was reached.

5.5 Data quality assurance for quantitative and qualitative study

To ensure data quality, double entry was done. Following this, data screening and cleaning were performed by running frequencies and cross-tabulations. To avoid biases, people that have been

in sanitation program implementation in the study area such as health extension workers were excluded from data collection process. Data collectors were provided with adequate training on the data collection instruments, and interview techniques. Specific focus was given on how to ask questions with likert scales that were used to assess the psychological variables without influencing the participants' responses. Adequate information provided on the purpose of the study for participants before the start of the interview, and close supervision provided to each data collectors and timely correction provided.

To ensure credibility, the study was designed after reviewing adequate literature. To understand the study area contextual situations, the principal investigator stayed more than a month in the study site before data collection started. During data collection and analysis time, continues debriefing had been conducted among the research team. Conformability was ensured through triangulation of data that were collected from various sources. Adequate description of the study setting contexts was provided so that the transferability will be based on the detailed understanding of the context or setting. All the collected data that include tape recordings, transcripts, and field observation notes were documented stored in a secured, locked cabinet so that the dependability of the study result can be ensured.

Table 5. Summary of the study objective, data collection, data management and data analysis methods

socio-ecological model and dimensions	Objectives	Design and data collection method	Sampling	Data management and analysis
Individual level, contextual dimension.	1 Objective 1 Determining the level latrine ownership, and consistent latrine,	Quantitative method, Community survey using structured questioner.	- Two stage sampling. Cluster sampling to select Kebeles and systematic random sampling to select households.	- Data was entered using Epinfo version 3.5.4 and was analyzed using SPSS version 20.
Individual level, psychosocial dimension.	Objective 2 Determining the individual psychosocial and demographic predictors of latrine ownership and consistent latrine use.	A mixed of qualitative and quantitative methods design conducted. - Qualitative data were collected using in depth interview and FGD. - Quantitative data were collected using a structured questionnaire.	- Two stage sampling. Cluster sampling to select Kebeles and systematic random sampling to select households	- Using SPSS version 20, the data were analysed to assess the psychological predictors of latrine ownership and latrine use. - Thematic approach of qualitative data analysis followed. Tape recording, transcription, and NVivo software for analysis.
The contextual and technology dimensions.	Objective 3 To explore the Contextual and technological factors the influence the adoption and consistent use of latrine.	- FGD with In-depth interview with owners and non-owner households. - FGD with latrine owner, and latrine on-owner households - KII with health extension workers at Kebele(village) - KII with environmental health experts the at health centre	- Random sampling to select households, Purposive sampling to select FGD participants and health workers.	- Content analysis and thematic approach of data analysis followed. Tape recording, transcription, and NVivo software for analysis.

5.6 Ethical considerations

Throughout the process of the study, the basic ethical principles were applied with the following considerations maintained at the level of study participants, the institution and the scientific integrity of the researcher.

Ethical clearance: Ethical approval was obtained from Addis Ababa University Research Committee. Permission was obtained from the Ethical review board of Oromia regional Health office.

Informed consent: Participants were informed about the purpose, their role in the study the potential benefits, and possible risks associated with participating in this research study. The right of the respondent to refuse to answer for few or all questions was fully respected. Participants were given adequate information about the purpose of the study and contact information if they have questions. The consent form was presented orally when the participant was unable or reluctant to read based on the responses obtained from participants about their literacy status. If a participant cannot read and/or write, she/he was able to document the consent by giving a thumbprint on the informed consent. A literate witness was present for the informed consent process for any illiterate participants, and the witness was also signed the consent form.

Risks and Benefit: While there may be no direct benefit to study participants, they were informed that the benefit of this study is for future similar programs improve sanitation in Ethiopia and similar countries. Study participants were informed that others may learn of their participation or responses, but that they study team was take measures to help ensure confidentiality with regards to their participation and responses. They were also being informed about their rights to participate or reject answering any questions about which they do not feel comfortable. A written Informed consent was obtained from all participants before they participate in a study to safeguard respondents and protect their right to self-determination.

Right to privacy: To maintain the privacy of participants, interviews were conducted at their own home in private settings. Data collectors were well trained to maintain the privacy of the study participants and, they were monitored during the data collection process.

Participant's confidentiality: Identification of study participants including names were not recorded in the questionnaires. Participants name was also never used when reporting findings and data were analyzed as group data so that individuals could not be identified by their responses and was not be included in any formal or informal presentation or documents. Hand-written transcrips, signed consent forms and, audio recordings were stored under lock and key

at the study sites. The digital files from audio-recordings were stored on password-protected computers. Hand-written transcripts and audiotapes were destroyed after data analysis. All data forms and electronic files were stored in a secured place. Each team members of the study were trained on the study protocol, research ethics, and interviewing skills.

Justice: Sampling and the recruitment of respondents were held based on the research protocol, but not for their easy availability. Equal opportunities were secured by random sampling of respondents.

6. RESULTS

6.1 Socio-demographic characteristics participants

6.1.1 Qualitative study participants

A total of 85 people participated in the study, of which 49 (57.6%) were male. Age group of the participants showed that 19 (22.4%) were <20 years of age, 14 (16.5%) were 20-29 years old, 21 (11.7 %) were 30-39-year-old, 26 (24.7%) were 40-49-year-old and 5 (5.9%) were >49-years old, while the mean age was 33.7. Overall, 36 (44.5 %) participants were latrine non - owners, 45 (55.6 %) were owners, 60 (70.5 %) were married, 8 (9.0%) were widowed /divorced, 17 (20.0%) were single, and all participants were from Christian religion and Oromo ethnic group. The type and number of participants are summarized in Table 6.

Table 6. Socio-demographic distribution of qualitative study participants in Becho district of Ethiopia, May 2015

No	Data collection type	No. of FGD/IDI	No of participants		
			Male	Female	Total
1	IDI with larine owners	3	2	1	3
2	IDI with latrine non-owners	3	2	1	3
3	KII with HEW	3	0	3	3
4	KII with WASH coordinator at district	1	1	0	1
5	FGD with adult women	1	0	10	10
6	FGD with adult men	1	10	0	10
7	FGD with youth(female)	1	0	9	9
8	FGD with youth(male)	1	10	0	10
9	FGD with latrine non-owners	2	11	7	18
10	FGD with latrine owners	2	13	5	18
	Total	15	49	36	85

IDI = In-depth interview; KII = Key informant interview; WASH = Water, Hygiene and Sanitation; FGD = Focus group discussion; HEW = Health Extension Workers

6.1.2 Quantitative study participants

The socio-demographic characteristic of study the survey participants was summarized in Table 7. Data were collected from 1047 study participants with non-response of 9%. Among the respondents 650 (62%) were male, the mean age (SD) of respondents is 42(13.3), the majority were married (88.2%), farmers (96.4 %), didn't have formal education (58%), from the Oromo ethnic group (99%) and are followers of Orthodox Christianity (98%).

Table 7. Socio-demographic characteristics of quantitative study participants in Becho district of Ethiopia, May 2015 (n=1047)

Characteristics	Latrine ownership	
	Yes No (%)	No Number (%)
Sex		
Male	484 (63.4)	166 (58.7)
Female	280 (36.6)	117 (41.3)
Marital status		
Married	683 (89.4)	240 (84.8)
Single/Divorced/widowed/separated	81 (10.6)	43 (15.2)
Educational Status		
No education/informal education	416 (54.4)	193 (68.2)
Primary education	284 (37.2)	77 (27.2)
Secondary education and above	64 (8.4)	13 (4.6)
Occupation		
Farmer	733 (95.9)	276 (97.5)
Others	31 (4.1)	7 (2.5)
Age		
<= 30	112 (14.7)	59 (20.8)
31 -50	420 (55)	147 (51.9)
50+	232 (30.4)	77 (27.2)
Family size		
1-6	455 (59.6)	205 (72.4)
7-10	271 (35.5)	74 (26.1)
10+	38 (5.0)	4 (1.4)

6.2 Paper I. Latrine Ownership, Consistent Latrine Use and The Socio-Demographic Determinants

A. Qualitative findings

6.2.1 Larine availability and use

Participants of FGD and in-depth interview expressed perceived decrease of open defecation practice in the area, and sharing of a larine was not a common practice. As reported by participants, open defecators are family of people who doesn't own a latrine, travelers and farmers who say away from home.

The FGD and interview result revealed that latrine use behaviour of participants was influenced by the routines of different community groups. Participants reported that almost all adult men practiced open defecation during daytime as they mostly stay far from home working on their farm.

"Usually we stay working on the farm. That is natural. We always go to open defecation because there is no available latrine closer to the farm". (FGD, 48 years age man)

Women tend to use latrine as they have access to a latrine in their home. Women had a habit of waking up early in the morning to prepare the family breakfast. It is a tradition that a woman should go to the toilet and then wash her face and hand before preparing the family meal. Women from non-latrine households usually go to the bush for open defecation early in the morning, and late in the night for fear of shame to be seen doing open defecation. Young boys and girls had a better access to latrine through the day as mostly they spend half of their daily time in school and half of their day at home. However, out of school students tend to practice open defection as they usually stay away from home farming or keeping the cattle where they couldn't access a latrine.

6.2.2 Child stool disposal practice

Most community members practice unsafe child stool disposal. Participants reported that child stool disposal ways were determined depending on the age of the child. Smaller children under the age of one toyears defecate on a cloth. Majority of caregivers reported throwing the dirty water out of their compound after they washed stools from smaller children's body and cloth. Children between two and five-year age made to defecate on the ground in the compound. Their caregivers pick the faeces using a spade to transport the stool, and they dispose it in the latrine while some participants reported throwing it out of the compound. Almost all participants

reported that never washed the tool after they dispose the child faeces with it. Usually they keep the tool spade out of home during the day and took it back home during night.

"Smaller children can sit in the compound, we pick their faces with Akafa and dispose it in the latrine. We put the spade outside the house to dry and we take it back home during the night. We also use the tool for another purpose like digging of a soil".

(In-depth interview, 29 years old latrine owner woman)

6.2.3 Perception about child stool

There is a difference of understanding about child stool in causing disease, which ranges from child stool to be non-infectious, mildly infectious, to infectious like adults. As it was revealed during FGD and IDI, there was a clear difference between their understanding and conceptualizing about the link between child stool and disease. Mostly, bad smell was perceived linked with disease, the higher the magnitude of bad smell from child stool related with the severity of the illness. Some participants discussed the magnitude of illness and the type of disease the can be caused by child stool are mild, and it affects only small children. Flue is the most frequently mentioned disease that was perceived to be caused form child stool. The infectiousness of child stool was related with the age of the child, which is linked with the type of food they eat, indicating older children were more likely to cause disease compared with the younger ones. Two of the participants have explained that small children take only breast milk, and their stool cannot be infectious.

6.2.4 Perception about child stool disposal options

Potties is a new technology that participants were not aware about. None of the participants reported their children using potties for their small child defecation. There is a perception that potties are used by few people their community who are either highly educated or came from the city. Cost wasn't raised as a barrier to buy potties. Most participants have expressed that they are not sure about the availability and the cost of potties. Few participants indicated that potties are not expensive, but the lack of initiation limited them to buy it.

Avoiding the time to be elapsed cleaning the child after defecation in the potties and disposing the stool in to the latrine was one of the reason that the preference of open defecation than defecating on the potties that was most frequently mentioned by the participants.

"... I go to the farm most of the day time, and children stay at home. I tell my child to defecate on the open field anywhere in the comound, I collect the stool and dispose it in the latrine when I come back home. If the child used potties once and no one is there to dispose it into the latrine, the child willhave a problem to defecate again. I prefer the children to defecate in the open field

than using potties. Most households have two to three under five children, and there should be adult person who can dispose the stool after the child uses potties"

(42 years woman, FGD with women group, Awashbume kebele)

Two participants indicated that they are afraid that their children can develop a habit of using potties, which will be for them to avail it always or they are afraid that they may not be around their children to dispose the stool after potties are used.

"Once the children became familiar with popoo, they might refuse to use the open field. Do you think it possible? It is not. The children shouldn't learn potties and they should not develop a habit of using it".

(36 old woman, FGD with latrine adopter households in seyouma kebele)

6.2.5 Handwashing practice

Handwashing after latrine use was rarely practiced in the area. Awareness about handwashing in preventing disease latrine is high acquired from the house to house promotion of handwashing by heath extension workers. The participants had a good undestanding of the importance of handwashing they learned while an incidence of diarrheal illness occurred 3 years ago in their area. Participants indicated that immediately after the diarrheal incident, handwashing after latrine use was practiced by the majority of community members. However, few people sustained practicing it.

"Two years ago, there was an epidemic of acute diarrhea in this village. At that time, we were told that we can acquire acute diarrhea unless we wash our hands after latrine. They told us that the disease can kill us in twenty-four hours. Then all of us put a jerikan with water next to the latrine, and we washed our hands after latrine use. Then we stopped it after the epidemic is over". (FGD, 53 years old man- abati kebele)

6.2.5.1 Facilitating and inhibiting factors that determine handwashing practice

Religious ritual and social norm

As described by participants, the Muslim religion follower community members practice handwashing after latrine use as part of their religious ritual. For them, handwashing was perceived as being pure and holiness.

The gender-related norms have more influence on women to wash hand after latrine use. Both men and women believe that handwashing after latrine use is an obligation for women. FGD participants revealed the societal belief that the injera (local bread) backed by a woman might

mould unless she washes her hand after latrine use. Handwashing every morning after latrine use is part of the women routine. Women are expected to walk up early before other family members woke-up, and she is expected to wash her hand after using a larine, which became every woman's habit.

Aspiration for educated or city people

Aspiration for educated or city people is the motive for handwashing practice, or the reason for intending to practice it. The in-school youth have a desire to wash hand is associated with identifying themselves as educated people, they have explained that handwashing practice is something that the educated people should do. Handwashing after latrine use was perceived as the practice of city people,

"*In the cities, people wash their hand after latrine use. I usually go to restaurants for lunch whenever I go to the city market. I have seen that all the people washing hand after latrine use".* (FGD, Latrine owner, 42 years old man)

Lack of water

The lack of water was revealed as an inhibiting factor that limit handwashing practice after latrine use. As it was indicated by the participants, most of the available handwashing facilities at household latrines have not been used. Participants indicated that the unavailability of water close to the latrine limited them to wash their hand after using a latrine.

"…we put jerrican (water container) next to the toilet, but we forget to put water in the Jerrican. The unavailability of water limited us from washing hands after latrine use".

(FGD, Latrine owner, 42 years old man)

Habit

Some participants indicated that that the lack of habit to wash their hand after toilet use is the main reason that the men community members are not practicing it. The student particiants indicated that they practice handwashing in their home. However, they failed to develop a habit of handwashng because of the unavailability of water in school latrines.

Lack of priority

Lack of priority by school management given for handwashing practice was reported. As it was indicated by the woreda WASH coordinator, even the schools that were provided with tap water by NGOs didn't avail water closer to the latrine to be used by the students after latrine use.

"Even the schools that have water are not willing to provide water for the students to wash their hand after latrine use. It is because the tap water is available at a distance place from the latrine. So, the students don't go that much distance to the tap water after they use latrine".

B. Quantitative results

6.2.6 Latrine ownership

Overall 764 (73%) owns some type of latrine. Among all participants 725 (69.3%) used non-improved latrine, 283 (27%) practice open defecation, 23 (2.2%) use shared latrine and 16 (1.5%) use improved latrine. Among the observed latrines (n=764), 445 (58.2%) had a superstructure wall, 166 (21.7%) had protected entry door, 70% of latrine roofs are made of grass, 9.4% made of iron sheet or 20.6% made of other local material. (Table 8).

Table 8. Latrine availability and its condition, Becho district of Ethiopia, May 2015

Latrine characteristics	Number	Percent
Latrine ownership (n=1047)		
Didn't own a latrine	283	27
Owned a latrine	764	73
Type of latrine facility used (n=1047)		
Pit Latrine without slab	716	68.4
Pit Latrine with slab (not connected with a sewer)	16	1.5
Open pit	9	0.9
Shared latrine/Yes	23	2.2
Open defecation	283	27.0
Latrine has superstructure(n=764)		
No	318	41.8
Yes	445	58.2
Latrine has entrance (n=764)		
No	598	78.3
Yes	166	21.7
Latrine has a roof(n=764)		
No	138	18.1
Yes	626	81.9
Material the latrine roof made of(n=626)		
Roof made of grass	438	70.0
Roof made of iron sheet	59	9.4
Roof made of plastic	73	11.7
Roof made of other local material	56	8.9
Location of the house (n=760)		
Latrine outside the compound	204	26.8
Latrine in the compound	556	73.2
Latrine Distance from the house(n=762)		
0-50 meters	618	81.1
51-100 meters	108	14.2
100+ meters	36	4.7
There is a cover / lid for the hole (n=764)		
No	646	84.6
Yes	118	15.4
Latrine in use (n=764)		
No	16	2.1
Yes	748	97.9
Overall cleanliness of the latrine(n=764)		
Poor	99	12.9
Fair	499	65.2
Good	167	21.8

Sixty- two percent of those who had a latrine in the past reported that it has been less than one year since they stopped using it. The mean age for the previous latrine was 3 years (SD 1.67).

Seventy-two percent of household's latrines are in their compound. Among 283 latrine non-owners participants, 98.6% reported that they owned a latrine in past, and there was convincing evidence for 213 (75.3%) respondents

6.2.7 Latrine use

Latrine use behaviour and disposal of child stool were summarized in Table 9. The one week prior to data collection period latrine use practice (consistent use of latrine) showed that 602 (79 %) latrine owner reported that they practiced consistent use of latrine, while only 8 (2.8%) of non-latrine owner participants practiced consistent use of a latrine. When the latrines were checked for an indication of use (latrine in use), 749 (98.0%) of latrines were in use (has at least one indication sign that the latrine was in use). Among latrine owner who had children less than five years old, 567 (74 %) had satisfactory latrine utilization. Places for open defecation (n=1047) were latrine 778 (74.3%), bush 212 (20.3%), open field 25 (2.4%), close to their compound 21 (2.0%) and in running river 10 (1.0%).

Table 9. Participants' latrine use behaviour in Becho district of Ethiopia, May 2015

Latrine use behaviour	Number (percent) Latrine Owners	Number (percent) Latrine non-Owners
Most frequently used defecation place during the past one week(n=1047)		
Open defecation	9 (1.2)	279 (98.6)
Latrine	755 (98.8)	4 (1.4)
Consistent use of latrine during past one week(n=1047)		
No	162 (21)	275 (97.2)
Yes	602 (79)	8 (2.8)
Satisfactory latrine utilization (764)		
No	197 (24.8)	
Yes	567 (74.2)	
Latrines in use (764)		
No	749 (98)	
Yes	15 (2)	

6.2.8 Handwashing

Among latrine owners, only 84 (11%) had handwashing facilities (8% of the total participants), 75 (9.8%) of the latrines had water nearby, 47 (6.2%) of the toilets had a soap or ash as observed during the data collection time, 74 (9.8%) latrines had the evidence of recent handwashing practice (Figure 9).

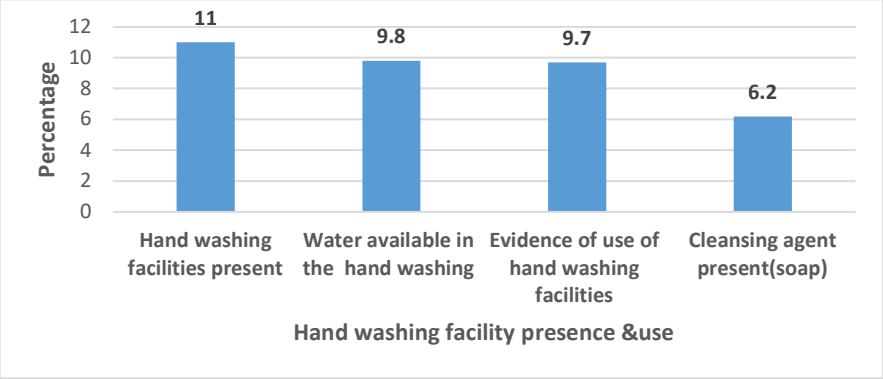

Figure 9. The avilablity and use of handwashing facilities

6.2.9 Latrine use by under-five children

Figure 10 shows the percentage of the distribution of latrine user children by age category. A total of 390 children with age of 6 to 59 months are reported on in this study, of these 93 (24%) had age 6-11 months, 72 (18.5%) age 12-23, and 127 (32.5%) age 24-35, and 98 (25%) age 36-59 months. Overall, only 39 (10%) of children reported using a latrine of which 55% were in the age category of 36 to 59 months.

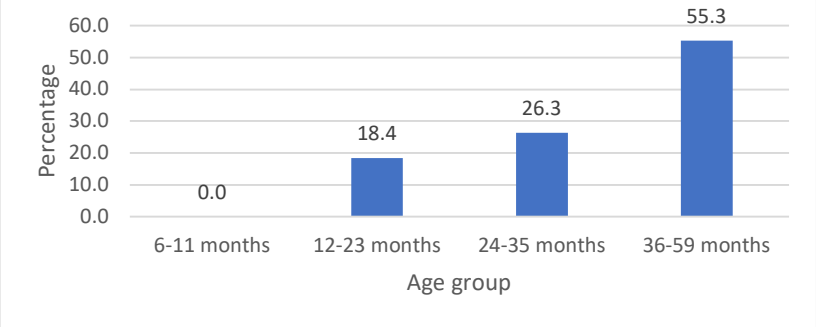

Figure 10. Latrine use by children with 6 to 59 months of age (n=39)

Figure 11 shows the child stool disposal practice among latrine owner and non-owners. The survey data indicate that out of the total 432 children with age 0-59 months, only 42.8 % child stool were reported to have been safely disposed in to the latrine. When only latrine owner households were considered, the stool of 185 (63.4%) children were reported to be safely disposed.

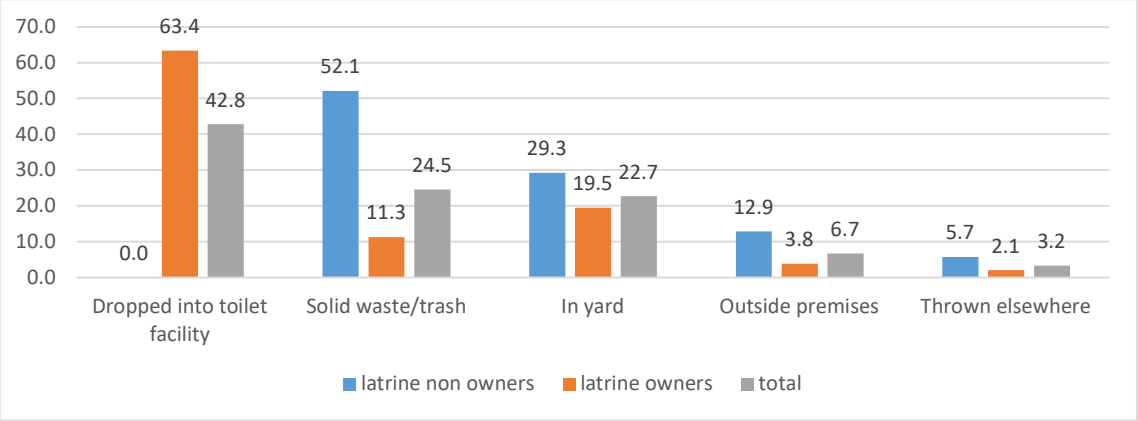

Figure 11. Places of disposal for underfive children fecces

6.2.10 Socio-demogrhicdeterminants of latrine ownership, latrine use, handwashing and child stool dispisal

6.2.10.1 Socio-demographic determinants of latrine ownership

Table 10 summerizes results form logistic regression analyssis that investigate the demopraphic determinants of latrine ownership. The univariate logistic analysis of demographic factors with latrine ownership as an outcome variable show that all the variables were significantly associated with latrine ownership. Participants with age above 30 years (30 to 49, and 50^{+} consecutively) were 1.5 times more likely to be latrine owners compared age less than 30. The multiple logistic regression analysis with a model which takes account of selected demographic factors. Among the demographic factors, households with family size of more than 6 had 1.4 times more likely to be larine owners compared to those with smaller family size (95%CI 1.01-1.97); The odds of households above 50 years of age was 1.65 times than that of younger than 50 years (95%CI 1.02-2.69); households that had a kid in school were 1.97 more likelihood of being larine owners compared with those with no school kid (95%CI 1.27-3.06). Households with at least high school [(AOR = 2.33; 95% (CI: 1.20-4.60)] or primary education [(AOR 2.12; (95%CI 1.49-3.00)] were more likely to be latrine owners as compared to those who were not formally educated

Table 10 Results from logistic regression analysis that investigate the demographic determinants of latrine ownership in Becho District of Ethiopia, May 2015 (n=1047)

Characteristics	Number (%) who didn't own latrine	Number (%) who own latrine	COR(95%CI)	AOR(95%CI)
Socio-demographic variables				
Age group				
<30	59 (20.8)	112 (14.7)	1.0	1.0
30-49	147 (51.9)	420 (55)	1.51 (1.04-2.17)	1.33 (0.87-2.03)
50+	77 (27.2)	232 (30.4)	1.58 (1.05-2.38)	1.65 (1.02-2.69) **
Marital status				
Single/divorced/widowed Separated	43 (15.2)	81 (10.6)	1.0	1.0
Married	240 (84.8)	683 (89.4)	1.51 (1.02-2.24)	1.43 (0.89-2.28)
Education Status				
No education/informal Education	193 (68.2)	416 (54.4)	1.0	1.0
Primary education (grade 1-8)	77 (27.2)	284 (37.2)	1.71 (1.26-2.32)	2.12 (1.49-3.00) **
High school and college	13 (4.6)	64 (8.4)	2.28 (1.23-4.25)	2.33 (1.20-4.60) **
Family size				
<=6	205 (72.4)	455 (59.6)	1.0	1.0
>6	78 (27.6)	309 (40.4)	1.81(1.35-2.44)	1.41(1.01-1.97) **
Presence of a school child				
No	53 (18.7)	82 (10.7)	1.0	1.0
Yes	230 (81.3)	682 (89.3)	1.91(1.31-2.79)	1.97(1.27-3.06) **

6.2.10.2 Socio-demographic determinants of consistent latrine use

During the univariate logistic analysis, the result shows that demographic factors and three latrine quality related factors that were: having a clean latrine (OR= 1.69; 95% CI 1.00-3.00), latrine with protected door (OR=1.94; 95% CI 1.10-3.48), and latrine with superstructure (OR=2.26; CI 1.47-3.48) had a significant positive association with consistent latrine use. Factors not associated with consistent latrine use during univariate logistic regression were demographic variables such as age, gender, family size, education status, and presence of a child who attended school.

When factors that showed significant association in the univariate logistic regression analysis were entered for multivariate logistic regression analysis, the three latrine quality factors, remained significant. Participants that owned a clean latrine were 1.69 times more likely to be consistent latrine users compared to those who own non-clean latrines (95% CI 1.00-3.00). Latrines that had superstructure were 2.3 times more likely consistently used compared with latrine without superstructure (95% CI1.47-3.48). Latrines that had a protected door were 1.94 times more likely to be consistently used than latrines with no door (95% CI 1.10-3.48). (Table 11).

Table 11. Results from logistic regression assessing the potential demographic determinants of consistent latrine use in Becho district of Ethioipia, May 2015. (n=764)

Characteristics	Number (%) who did not consistently used latrine	Number (%) who consistently used latrine	COR (95%CI)	AOR (95%CI)
Demographic variables				
Age group				
<30	22 (13.6)	90 (15.0)	1.00	1.00
30-49	92 (58.6)	328 (54.5)	0.87 (0.52-1.47)	0.79 (0.43-1.45)
50+	48 (29.6)	184 (30.5)	0.94 (0.53-1.65)	0.71 (0.35-1.40)
Education Status				
No/informal education	84 (52.0)	332 (55.0)	1.00	1.00
Primary Education	69 (42.6)	215 (5.7)	0.79 (0.55-1.13)	0.66 (0.42-1.05)
Secondary education	9 (5.6)	15 (9.0)	1.54 (0.74-3.30)	0.86 (0.36-2.04)
School child present				
No	17 (10.5)	65 (10.8)	1.00	1.00
Yes	145 (89.5)	537 (89.2)	0.97 (0.55-1.70)	0.90 (0.46-1.73)
Family size				
0-6	97 (60.6)	351 (58.8)	1.00	1.00
>6	63 (39.4)	246 (41.2)	1.08 (0.76-1.54)	1.06 (0.71-1.59)
Gender				
Male	103 (63.6)	381 (63.0)	1.00	1.00
Female	59 (36.4)	221 (37.0)	1.01 (0.71-1.45)	1.05 (0.67-1.66)
Yes	43 (26.5)	152 (25.2)	0.94 (0.63-1.39)	1.02 (0.64-1.62)
4.**Latrine quality factors**				
Clean latrine				
No	38 (23.5)	60 (10.0)	1.00	1.00
Yes	124 (75.5)	542 (90.0)	2.77 (1.76-4.35) *	1.69 (1.00-3.00) *
Latrine has protected entry				
No	144 (89)	454 (75.4)	1.00	1.00
Yes	18 (11)	148 (24.6)	2.61 (1.54-4.40) *	1.94 (1.10-3.48) *
Latrine has superstructure				
No	96 (59.3)	222 (37)	1.00	1.00
Yes	66 (40.7)	380 (63.0)	2.48 (1.74-3.54) *	2.26 (1.47-3.48) *

6.2.10.3 Socio-demographic factors associated with availability of handwashing facility

The multivariable logistic regression analysis of the availability of handwashing facility showed that positive association with having a family member participated in the CLTSH mobilization event (AOR 2.53; 95%CI 1.53-4.16) and having at least high school (AOR 4.22; 95%CI 1.88-9.48) or having a primary education (AOR 2.38 95%CI 1.34-4.20) as compared to those who were not formally educated households (Table 12).

Table 12. Results from regression assessing the association of availability of handwashing facility with demographic factors and exposure to information communication in Becho district of Ethiopia, May 2015 (n=764).

Characteristics	Number (%) that own handwashing facility	Number (%) who does not own handwashing facility	COR(95%CI)	AOR(95%CI)
Age group				
<30	14(12.5%)	98(87.5%)	1.0	1.0
30-49	46(11.0%)	374(89%)	0.86(0.455-1.63)	0.57(0.28-1.17)
50+	24(10.3%)	208(89.7%)	0.81(0.40-1.63)	0.80(0.35-1.80)
Marital status				
Single/divorced/widowed or separated	6(7.4%)	75(92.6%)	1.0	1.0
Married	78(11.4%		1.51(1.02-2.24)	1.66(0.84-3.30)
Education Status				
No /informal Education	31(7.5%)	389(92.5%)	1.0	1.0
Primary Education (grade 1-8)	40(14.4%)	244(85.9%)	2.04(1.24-3.34)	2.38(1.34-4.20)
High school/college	13(20.3%)	51(79.7%)	3.17(1.56-6.44)	4.22(1.88-9.48)
Family size				
<=6	42(9.4%)	406(90.6%)	1.0	1.0
>6	39(12.6%)	270(87.4%)	1.400(0.88-2.22)	1.29(0.77-2.15)
Presence of a school child				
No	7(8.5%)	75(91.5%)	1.0	1.0
Yes	77(11.3%)	605(88.7%)	1.36(0.61-3.10)	2.49(0.88-7.10)
Advised by Health extension worker				
No	13(19.4%)	54(80.6)	1.0	1.0
Yes	71(10.2%)	626(89.8%)	0.47(0.25-0.91)	0.47(0.23-0.96)
A family member participated in CLTSH				
No	49(8.6%)	520(91.4%)	1.0	1.0
Yes	35(17.9%)	160(82.1%)	2.32(1.45-3.71)	2.53(1.53-4.16)

6.2.10.4 Socio-demographic determinants of safe child stool disposal

After adjusting with the possible confounding factors in the multi-variate analysis, the results show that safe disposal of child stool remained strongly associated with latrine ownership 242 (23.5-1813). The stool of children in the households that had primary level or secondary level education were 2.3 times and 2.2 times more likely be safely disposed compared with non-educated households consecutively. (See table 13).

6.2.10.5 Occurrence of childhood diarrhea

The two-week diarrheal prevalence among children less than five years old was 7.5%. The logistic regression analysis result showed that there was no significant difference in children's diarrheal prevalence between households of latrine owners and latrine non-owners [COR 1.2

(95%CI 0.53-2.68)], and the socio-demographic variables were not significantly associated with childhood diarrheal prevalence.

Table 13. Results of logistic regression analysis to assess the demographic determinants of under-five children's' stool disposal practice

Predictor variables	Frequency	Percentage	COR (95%CI)	AOR (95% CI)
Latrine ownership				
No	283	27	1.00	1.00
Yes	764	73	241 (33.3-1755)	242 (23.5-1813)
Age category of the child				
0-5 months	78	16.7	0.23 (0.10-o.49)	0.20(0.09-0.41)
6-11 months	93	19.9	1.9 (1.10-3.53)	1.85(0.97-3.52)
12-23 months	72	15.4	2.23 (1.13-4.42)	2.1(1.028-4.23)
24-35 months	127	27.1	1.19 (0.66-2.15)	1.15(0.617-2l14)
36-59 months	98	20.9	1.00	1.00
Family size				
0-6	660	63		1
7- 10	345	33	1.50 (1.00-2.24)	0.778-1.99
>10	42	4	1.52 (0.65-3.53)	0.501-3.16
School child present				
No	135	12.9	1.00	1.00
Yes	912	87.1	1.60 (0.95-2.70)	0.878-3.03
Education status				
No/Informal education	609	58.2	1.00	1.00
Primary education	361	34.5	2.12 (1.40-3.21)	2.3(1.467-3.62) *
Secondary education and above	77	7.4	2.50 (1.24-5.10)	2.2(1.031-4.52)
Advised by health extension workers				
No	84	8	1.00	1.00
Yes	963	92	0.84 (0.40-1.75)	0.95(0.419-2,12)
Family member participated on CLTSH				
No	825	78.8	1.00	1.00
Yes	222	21.2	0.91 (0.56-1.46)	0.82(0.49-1.38)

6.3 Paper II: The Psychological Predictors of Latrine Ownership and Consistent Latrine use

A. Qualitative findings

6.3.1 Participants beliefs and perception about latrine

Avoiding bad smell

The desire to own latrine to avoid the bad smell coming from open defecation. Participants dislike the bad smell after having recent exposure to a latrine recently.

"*We used to practice open defecation for many years. we didn't even recognize the bad smell. But After we started using a latrine, we feel the bad smell when someone does open defecation in the village. Now we are changed, and we hate the bad odour".*

(FGD, 45 years-Adopter, male-Awashbune kebele)

Bad smell from open defecation was perceived strongly related with disease, the magnitude the bad smell reflecting the severity of the disease they might acquire.

Cleanliness

Latrine was valued for providing cleanliness mainly for aesthetic reasons. The decrease of OD was appreciated for having a clean surrounding. Participants have expressed that the trees which were dirty are now being used for community meetings and other gatherings.

"Our surrounding used to be dirty from open defecation. Now because we use latrines, our surrounding looks clean and nice". (IDI with latrine owners, 35 years old male).

Most participants relate cleanliness and avoiding smell with disease prevention. The avoidance of OD was related with a feeling of being responsible for other community members by keeping their surrounding clean, which is more significant when thee households have a big family size.

"We are six in a family. If we come to this field for defecation, the surrounding could have been very dirty".

Health benefits

Latrine use was related with disease prevention mentioned by most of the participants regardless of their age, gender or latrine ownership. The youth mentioned more frequently about the benefit of latrine use in preventing disease compared with adults. Some of the participants conveyed that they have decided to build a latrine for a fear of getting Acute Watery Diarrhea

(AWD), after they heard of AWD incidence occurred in other villages. Preventing expenditure on health care for a family member who was sick of sanitation- related diseases was one of the motivating drives of building a latrine. Flu and malaria, followed by diarrhoea and trachoma, were mentioned as the diseases that latrine use helps to prevent. Unlike the perception about open defecation, minimum health threat perceived about children's stool.

Preventing shame and providing privacy

Privacy was mainly characterized by the need to avoid being seen uncovered by practicing open defecation. To maintain their privacy, women from non-latrine owner households indicated that they usually go to open defecation very early in the morning or late in the evening.

Privacy of being seen practicing open defecation is rarely a concern of men for themselves. To them, latrines is a means to maintain the dignity of their family. A man whose family goes to open defecation while others use latrine feels shame.

"It is a shame to see my families going to an open defecation, while my neighbors use a latrine. People can talk about me or laugh at me. I prefer constructing a latrine and be respected by the community".

(FGD, with adult men. 45 years old man)

Both men and women mentioned that latrine is very important for women compared to men because the magnitude of shame related with OD is higher for them. Women participants related latrine use is a means of maintaining self -respect and dignity. Women from latrine non-owner households expressed that their life is very difficult because of the extreme shame whenever they practice open defecation.

"I don't have a latrine. Practicing open defecation is the most difficult thing to do, it is very embarrassing an I have suffered from it. Most of the time I return back home without defecating whenever I see someone around".

(FGD, Non-adopter, 55 years old, woman)

Women mentioned that their life will be very difficult if they don't own a latrine, or whenever they are away from home since they don't have access to public latrine. Two adult women mentioned that they knock at the door of any household and they ask any woman to allow them to use a latrine whenever they went to market places which are far from home. As it was indicated by the participants, most women allow other women to use their latrine since they

face similar challenge. Young girls mentioned that they have been suffering with bladder pain due to holding their urine for a long period whenever they travel to market and other places.

Protection and safety concerns

A concern of security for women and children while going to open defecation was expressed by most of the participants. Adult men mentioned about protection very often compared with adult women, but during the discussion with young girls, it was revealed that limited availability of bush close to their home has made them to travel long distance. Related with this, they have expressed their fear of being rape, attack by strangers or animals.

Convenience

Latrine was valued for its convenient in terms of having a place of defecation within a short distance, avoiding exposure to the dangers while going out to bush at night, or providing access to latrine sick or old age and sick family members.

"I can use a latrine at any time. Especially, when I get sick of diarrhea and I feel going to the toilet again and again. Imagine if it is a dark night you had diarrhea. It is difficult to go to bush or to the field".

(FGD, Latrine Owners, 48 old-man).

Preventing flies

The presence of too many flies was associated open defecation. Flies are very much disliked due to their physical disturbance. Most of the time, the presence of flies is linked with disease.

External pressure

Persuaded by government or NGO workers to build a latrine was expressed as a reason to construct a latrine by few participants. For examples, in some villages participants mentioned that it was a requirement to construct latrine for getting free mosquito bed net, or for accessing tap water.

Lack of alternative

Two participants expressed that they still prefer open field defecation because they enjoy it better than a latrine. However, the unavailability of trees or bush limited them.

Modernism

Owning a latrine was perceived as having a way of modern life. Two participants of FGD expressed that relating themselves with city people for having a latrine.

"The people in our Kebele are modern like city people. We are using latrines. Most of us own latrine except few. We are happy about it. We use latrine like city people".

(FGD4, 35 years old man, latrine owner)

Table 14. Beliefs about latrine use in Becho district of Ethiopia, May 2015

Beliefs/Drives	Beliefs about the use of latrine	Frequency
Convenince	The physical distance from home and its easiness for sick, old age family memebr or at night A feeling of being comfortable while using a latrine compared with OD	10
Shame, privacey, dignity	Being ashamed to be seen by people practicing OD Embarassing for women to be seen by men beeing seen practicing OD A fear of loosing social tigh or being socially rejected	21
Protection/security	latrine provides safety from the possible risk of attack and other accidents that can occur in the bush while practicing OD	51
Cleanliness	A clean physical surround for aesthetic reason avoiding the breeding place for flies linked to disease prevention	43
Health benefit	Latrine use in preventing diseasetransmission. Avoiding helath expenditure to the sick family members.	48
Avoiding smell	Dislike, the bad smell fro OD Bad smell percieved to cause disease such as flue, malaria, diarrhe	25
Extennal pressure	participants were asked to Construct a latrine to get mosquito bed net, or to fech water from communal water tap	5
Lack of alternative	No alternative since there is no bush ccloser to their home	2
Prevents flies	The stool from OD were perceived as the breeding place for flies. Flies were related with disease The pretense of flies was disliked for disturbing their surrounding	43

B.

Quantitative results

6.3.2 Descriptive statistics of beliefs on latrine use outcome

Table 3 displays mean, standard deviation, minimum, maximum, and calculated item scales. Overall, the degree of agreement with all the belief items about latrine use was high.

Table 15. Descriptive statistics of the belief item and attitude index (n=1047)

Beliefs and attitude	Range (min, max)	Mean	SD	Number of Items
Protection/Security	4 (1, 5)	4.56	0.64	1
Avoiding shame/dignity	4 (1, 5)	4.46	0.75	1
Reduces flies	4 (1, 5)	4.21	1.04	1
Prevent bad smell	4 (4, 5)	4.54	0.81	1
Provided privacy	4 (1, 5)	4.10	1.08	1
Provides convenience	4 (1, 5)	4.50	0.67	1
Prevents disease	4 (4, 5)	4.54	0.64	1
Attitude	11 (4, 15)	13.63	1.75	4

Table 16 presents the frequency and percentage of participants who have high score for the dichotomized composite score of the listed beliefs about latrine use outcomes, disaggregated the sex of participants. From the total participants, the majority have agreed with the beliefs on latrine use outcome, that include: "*latrine prevents disease*" (96.6%), "*latrine convenience*" (94.3%), "*Latrine provides with privacy*" (80.3%), "*Latrine gives protection*" (95.6%), "*Latrine prevents smell*" (93.0%), "*Latrine prevents/ reduces flies*" (83.6%). The chi-square test show that more men tend to have the perception that "latrine prevent disease", and "latrine is convenient" compared with women, while there is no difference on the other belief items based on sex.

Table 16. Beliefs about latrine use disaggregated by sex, Becho district of Ethiopia, May 2015

	Sex		Total	chi-square
Belief items	Male	Female		
Prevent disease (1047)	97.50%	95.00%	96.60%	0.026
Convenience (1043)	96.40%	93.50%	94.5	0.027
Privacey (n=1041)	80%	81%	80.30%	0.717
Protection (1043)	96%	95%	95.60%	0.727
Prevents smell (n=1033)	92%	95%	93%	0.0688
Reduces flies (n=1047)	82%	84.60%	83.60%	0.468

6.3.3 Satisfaction with the place of defecation, and attitude towards sanitation facilities

Figure 12 shows the participants level of satisfaction with the place of defecation disaggregated by latrine ownership. Overall, 47% of latrine owner respondents reported very much satisfied

with their place of defecation compared to none of the latrine non-owners reported feeling very much satisfied with their place of defecation. When the level of satisfaction for the place of defecation that ranges 1 to 5 coded into high level of satisfaction for score above three, 80% of latrine owners feel highly satisfied with the place of defecation their family use compared with only 1.8% non-owners that reported highly satisfied.

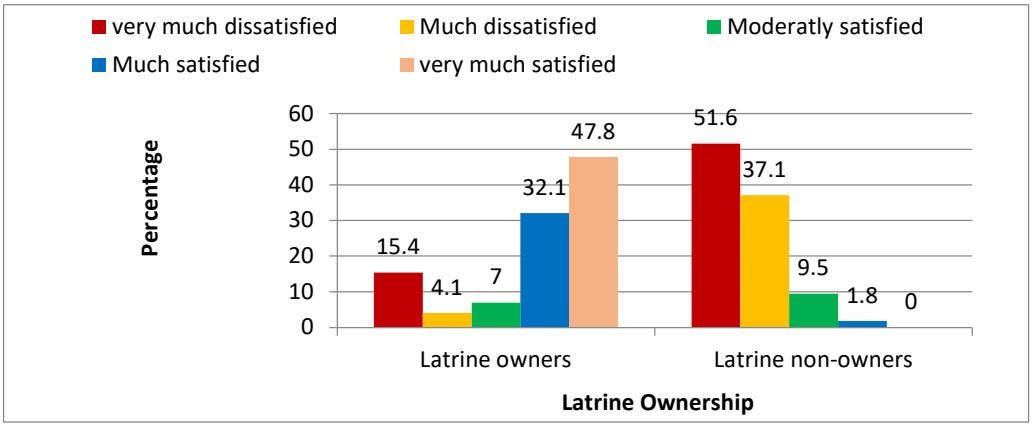

Figure 12. Satisfaction with the place of defecation by latrine ownership (n=1047)

The percentage of population with dichotomized high score attitude measurement items is shown in Figure 13. Attitude was assessed using four items that has a score 1 to 5. Participants were asked about the degree of how they like the latrine, they think latrine is beneficial, they think latrine is important, or they enjoy a latrine. When the sum of four attitude items was dichotomized into high and low, 61.7% of the total participants had a high score of attitude towards latrine. The Cronbach's Alpha of attitude 0.80 suggested an acceptable level of internal consistency of the items measuring attitude.

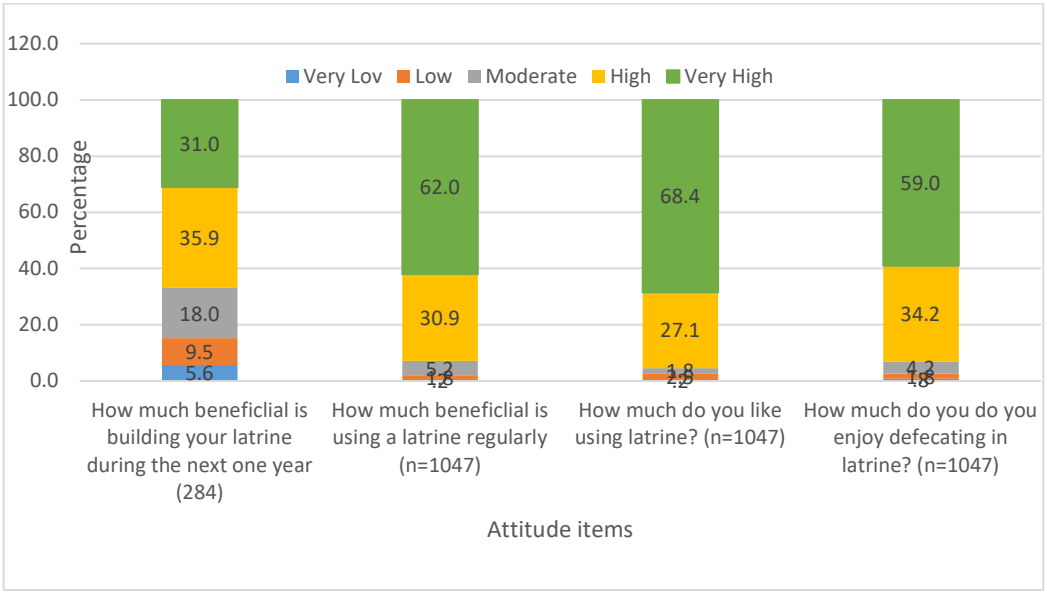

Figure 13. Percentage of participant that were categorized into high for items that assess attitude towards latrine use

6.3.4 The individual Psychological factors

The mean, range, and standard for each individual psychological item are summarized in Table 17. The mean (standard deviation) of composite scores were 8.0 (1.8) for injunctive norm of latrine ownership, 10.4 (2.3) for injective norm of latrine use, 10.4 (2.3) for descriptive norm (latrine use), 3.5 (1.3) for perceived ability, 13.6 (1.8) for attitude, 4.6 (0.8) for perceived vulnerability, and 4.5 (0.8) for perceived severity respectively.

Table 17. Psychological predictors of latrine ownership, Becho district of Ethiopia, May 2015.

Psychological factors	N	Range (min, max)	Mean	SD	Number of Items
Risk Perception					
Vulnerability	1047	4 (1, 5)	4.33	0.79	1
Severity	1047	4 (1, 5)	4.48	0.75	1
Attitude (n=1047)	1047	11 (4, 15)	13.63	1.75	4
Injunctive norm (latrine ownership)	1047	8 (2, 10)	.8.0	1.79	2
Self-efficacy (latrine ownership)	281	4 (1, 5)	3.45	1.29	1
Descriptive norm (consistent latrine use)	1047	11 (4, 15)	10.37	2.32	3
Injective norm (consistent latrine use)	1047	11 (3, 15)	10.37	2.31	3

The percentage of respondents with high score psychological factors is presented Figure 10. A high percentage of respondents attainted high score on most psychological factors except

descriptive norm and injunctive norm, in which almost half of the participants reported low score.

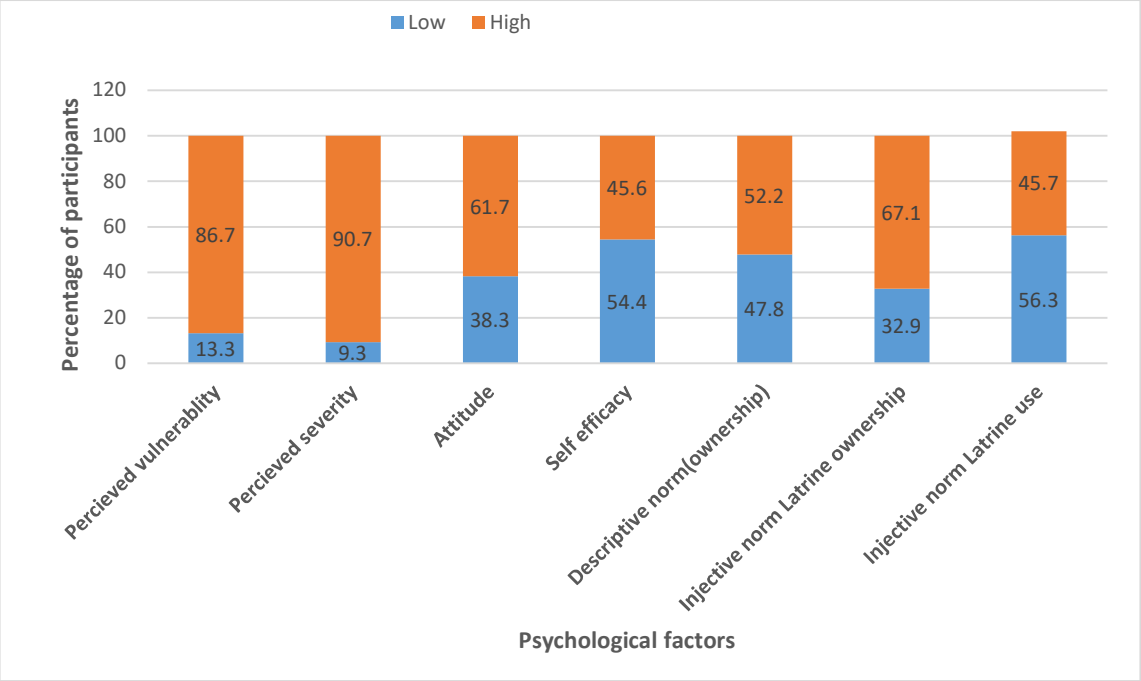

Figure 14. Psychological factors among study participants, Becho district of Ethiopia (n=1047)

6.3.5 Cues to action

The majority of participants (93.7%) reported that they were advised or motivated by someone to build their own latrine; almost all (98.2%) were advised by government health workers. 21% of respondents reported that their family member took part in the triggering of community-led total sanitation (CLTSH) during the past one year. Participants didn't mention other Medias like radio TV or brochures as a source of information about sanitation.

6.3.6 Beliefs predicting attitude towards latrine

Table 18 presents results of logistic regression analysis that show the association between the dichotomized latrine believe items with the dichotomized composite score of attitude towards latrine. The multivariate analysis that took into account all the belief items, that include "latrine provides security" [(OR 23.4 95%CI 4.9-120.8)], "latrine reduces flies"[(OR 3.80; 95%CI 2.33-6.20)], "latrine prevents bad smell" [(OR 2.80; (95%CI 1.16-6.72)], and "latrine provides privacy"[OR 2.41; (95%CI 1.66-3.51)], were significantly and positively associated with attitude towards latrine, while the beliefs that "latrine prevents disease" [OR 0.28; (95%CI 0.07-

1.07)], and "latrine provides convenience" [OR 2.20; (95%CI 0.78-6.10)]" were not significantly associated with attitude towards latrine.

Table 18. Results from regression analysis assessing the association between beliefs with attitudes as an outcome variable, Becho district of Ethiopia, May 2015. (N=1047)

Beliefs of respondents about latrine	Number (%) with no for high score attitude	Number (%) with yes for high score attitude	Logistic regression with attitude	
			COR (95% CI)	AOR(95%CI)
Protection				
No	44 (11.0)	02 (0.3)	1.0	1.0
Yes	355 (89)	642 (99.7)	39.8 (9.6-165.0)	23.4 (4.9-120.8) *
Reduces flies				
No	121 (30.2)	51 (7.9)	1.0	1.0
Yes	280 (69.8)	595 (92.1)	5.0 (3.5-7.2)	3.80 (2.3-6.2) *
prevent bad smell				
No	51 (12.9)	21 (3.3)	1.0	1.0
Yes	345 (87.1)	616 (97.7)	4.3 (2.6-7.3)	2.8 (1.2-6.7) *
Privacy				
No	133 (33.2)	72 (11.2)	1.0	1.0
Yes	268 (66.8)	568 (88.8)	3.9 (2.8-5.4)	2.41 (1.7-3.1) *
Convenience				
No	42 (10.5)	07 (1.1)	1.0	1.0
Yes	358 (89.5)	636 (99.9)	10.7 (4.7-24.0)	2.2 (0.8-6.1)
Prevents disease				
No	30 (7.5)	6 (0.9)	1.0	1.0
Yes	371 (92.5)	640 (99.1)	8.63 (3.56-21.0)	0.3 (0.1-1.1)

6.3.7 Psychological Predictors of latrine ownership

Result from logistic regression showing the crude and adjusted effects of five psychological and other modifying factors on the odds of latrine ownership is summarized in Table 18. In a univariate analysis, latrine ownership was positively significantly associated with high perceived vulnerability [OR 2.17; (95%CI 1.50-3.14)]; high perceived severity [AOR 2.71; (95%CI 1.78-4.15)], high positive attitude [OR 2.35; (95% CI 1.78-3.11)], high descriptive norm [OR 2.05; (95% CI 1.55-2.71)] and high injunctive norm [OR 3.43 ;(95% CI 2.55-4.60)].

Table 19. Results from logistic regression analysis assessing psychological predictors of latrine ownership, Becho district of Ethiopia, May 2015 (n=1047)

Characteristics	Number (%) who didn't own latrine	Number (%) who own latrine	COR(95%CI)	AOR(95%CI)
High perceived vulnerability				
No	58 (20.5)	81 (10.6)	1.0	1.0
Yes	225 (79.5)	683 (89.4)	2.17 (1.50-3.14)	1.24 (0.70-2.20)
High perceived severity				
No	46 (16.3)	51 (6.7)	1.0	1.0
Yes	237 (83.7)	713 (93.3)	2.71 (1.77-4.15)	0.70 (0.36-1.33)
High attitude				
No	151 (53.4)	250 (32.7)	1.0	1.0
Yes	132 (46.4)	514 (67.3)	2.35 (1.78-3.11)	2.08 (1.53-2.83) **
Perceived norm				
High descriptive norm				
No	172 (60.9)	328 (43.0)	1.0	1.0
Yes	111 (39.2)	434 (57.0)	2.05 (1.55-2.71)	1.66 (1.22-2.25) **
High injunctive norm				
No	200 (70.9)	316 (41.6)	1.0	1.0
Yes	82 (29.1)	444 (58.4)	3.43(2.55-4.60)	2.71 (1.97-3.72) **
Cues to action				
Advised by Health extension worker				
No	17 (6.0)	67 (8.8)	1.0	1.0
Yes	266 (94)	697 (91.2)	0.67 (0.38-1.15)	0.61 (0.35-1.16)
Family members participated in CLTSH triggering				
No	256 (90.5)	569 (74.5)	1.0	1.0
Yes	27 (9.5)	195 (25.5)	3.25 (2.12-5.00)	3.03 (1.92-4.78) **

In the multiple logistic regression analysis with a model which takes account of selected demographic factors, exposure to information communications on sanitation, and psychological factor (i.e. perceived vulnerability, perceived severity, attitude, descriptive norm and injunctive norm) with latrine ownership showed that three psychological factors such as attitude [(AOR 2.08; (95%CI 1.53-2.83)], descriptive norm [AOR 1.66 (95%CI 1.22-2.25) and injunctive norm [AOR 2.71;(95% CI 1.97-3.72)] were positively and significantly associated with latrine ownership. Households that had a family member that took part in CLTSH triggering were 3.0 times more likely to be latrine owners than those who did non-participated (95% CI 1.92-4.78).

6.3.8 The psychological predictors of consistent latrine use

Results from logistic regression analysis of consistent latrine use as an outcome variable and psychological predictors are displayed in Table 19. The univariate regression analysis of each psychological factor with consistent latrine use (i.e. perceived vulnerability, perceived severity, attitude, descriptive norm and injunctive norm) showed that attitude (OR= 6.48; 95% CI 4.44-

9.45), perceived severity (OR=2.17, 95%CI 1.50-3.14), perceived severity (OR= 2.71; 95% CI 1.77-4.15), and injective norm (OR=1.34, 95%CI 1.00-1.90), were significantly associated with consistent use of latrine (OR=7.45; 95% CI 4.91-11.30). In the multivariate logistic regression, 78.8% of the study participants were correctly classified, and the model explained between 18.2% (Cox and Snell R-square) and 28.3% (Nagelkerke R-square) of the total variability in the outcome was explained by the model (p-value <0.05), Factors not associated with consistent latrine use during univariate logistic regression were cues to action (being advised by a health extension worker or participating in CLTSH triggering). When factors that showed significant association in the univariate logistic regression analysis were entered for multivariate logistic regression analysis, one of the psychological factors (attitude) remained significant. Participants who perceived positive attitude towards latrine were 7 times more likely to be consistent latrine users (95% CI 4.91-11.30).

Table 20. Results from logistic regression assessing the potential predictors of consistent latrine use in Becho district of Ethioipia, May 2015. (n=764)

Characteristics	Number (%) who did not consistently used latrine	Number (%) who consistently used latrine	COR(95%CI)	AOR(95%CI)
Psychological factors				
Perceived vulnerability				
Low	24 (14.78)	57 (9.5)	1.00	1.00
High	138 (85.2)	545 (90.5)	2.17 (1.50-3.14	2.069 (0.97-4.41)
Perceived severity				
Low	11 (6.8)	40 (6.6)	1.00	1.00
High	151 (93.2)	562 (93.4)	2.71 (1.77-4.15)	0.30 (0.11-0.80)
Attitude				
Low	108 (66.7)	142 (23.6)	1.00	1.00
High	54 (33.3)	460 (76.4)	6.48 (4.44-9.45)	7.45 (4.91-11.30) *
Descriptive norm (latrine use)				
High	71 (43.8)	257 (42.8)	1.00	1.00
Low	91 (56.2)	343 (57.2)	1.04 (0.73-1.48)	0.95 (0.63-1.44)
Injunctive norm (latrine use)				
Low	184 (65.0)	405 (53.0)	1.00	1.00
High	99 (35)	359 (47.0)	1.34(1.00-1.90)	1.23 (0.80-1.90)
Cues to action				
Advised by HEW				
No	20 (12.3)	47 (7.8)	1.00	1.00
Yes	142 (87.7)	555 (92.2)	1.66 (0.95-2.90)	0.60 (0.35-1.05)
Participated in CLTSH				
No	119(73.5)	450 (74.8)	1.00	1.00
Yes	43 (26.5)	152 (25.2)	0.94 (0.63-1.39)	1.02 (0.64-1.62)

6.4 Paper III- The Contextual and Technological Factors That Determine the Sustained Latrine Adoption and Consistent Latrine Use, The Socio-Ecological Qualitative Analysis

6.4.1 Individual-level factors

As participants expressed during FGD, people who built a latrine in the past decided not to maintain or rebuild it because they had negative experiences like the collapse of their original latrine. Current latrine owner households also expressed dissatisfaction with the existing pit latrines due to their poor strength, and inability to resist flood runoff and collapsing soil. People who have been replacing latrines were perceived as relatively better off economically. Participants identified durability, strength, and depth as criteria for an excellent quality latrine. In one of the villages, latrines with taller height were preferred to make them more convenient for taller people. However, participants reported that quality latrines with good strength hardly existed in their community due to the lack of ability to pay latrine construction cost, and almost all community members in Becho used unimproved pit latrines.

6.4.2 Household level factors

Sustainability of latrine ownership was influenced by the ability of households to construct a new latrine. The lack of physically strong family member or being unable to pay for labour was cited as barriers to the sustained adoption by FGD and IDI participants. Latrine owner households reported that most of non-owner of a latrine are of lower socio-economic status, older age, and female-headed households. Latrine owners suggested that support for the poor households is crucial for them to build their own latrines.

"Can't you see Mamo's mother? She doesn't have a latrine. She is poor, and she doesn't have the capacity. Her older son left her, and she lives alone. Do you think she can dig the soil for latrine? Don't you think that she should be assisted? For example, you can see Mimi's mother, or Mr. Abe Gofa. Aren't these people poor? Do you think that they have the capacity? We force them to construct a latrine. Can they? These people need assistance".

(FGD with 42 years old, latrine adopter man).

Similarly, latrine non-owner households also perceived that they have less capacity compared with latrine owner households as they disclosed during FGDs.

"There is a difference between us and people who own latrine. They have a better wealth. They own trees to construct a strong latrine. But we use straws, grass or something like that. Our latrine has been collapsing every year. Those who have a better wealth don't face the same challenge as we do face".

(FGD with 32 years old, non-owners man).

Limited availability of space after frequent replacement of collapsed latrine in the compound was identified as a barrier for sustainable latrine adoption as it was reported by respondents during FGD and IDI.

"We all are challenged. I have been building new latrines every year. Now I have finished the available space in my compound. This makes me very hopeless. I might stop building in the future ". (IDI, latrine owners, 35 years old man).

6.4.3 Community level factors

Lack of public latrines at the community level influenced people to practice open defecation whilst away from home. In some village, communal latrines were building by the community members; but it remained unused due to its distance from the center and its inaccessible location.

"We go for open defecation when we stay in the farm during the day. There is no available latrine closer to the farm. Maybe we can use latrine early in the morning before we leave home, and late when we come back, usually after 12 hours. But we can't always do that".

(FGD, latrine owners, 38 years old man).

Gender-related cultural norms strongly influenced women to use latrine consistently. Some women participants expressed being over-pressured to the extreme and ashamed specifically when practicing open defecation.

"It is very challenging whenever we stay away from home because no public latrine is available anywhere. It is very challenging for a woman. Sometimes I suffer from bladder pain for holding urine for a long time".

(FGD, youth, 17 years old girl).

Exposure to CLTSH triggering has positively influenced the community perception about latrine use. Participants reported that the exercise during CLTSH triggering helped them to perceive open defecation as "eating their own sheet". The health extension workers also conveyed that CLTSH was effective to help community members to realize that they eat their own faeces from open defecation.

"During CLTSH triggering we conducted transient walk with the community member to show them how it feels to see open defecation in their surroundings. When we return from the walk, we gave them a bottle of clean water and asked them to drink, usually they drink it. Then

we added piece of hair in the bottle of water, telling them to assume it as it the leg of the fly that just came from the sheet that we saw during the walk. The community members usually react and refuse to drink it. We told them that this is happening every day at their home. We told them that they had been eating it every day through the contaminated food, and drinking water, cooking materials. Usually they agreed to stop open defecation with emotions after the triggering process".

(IDI, health extension worker, 29-year-old woman).

Even though CLTSH triggering was conducted in all the study villages, all of them failed to achieve ODF. A network of community members called "Health Development Army (HDA)", organized by the government, aims to discuss and solve their own social, security and health problems, including sanitation. Each group comprises of up to 30 households residing in the same neighbourhood, and each HDA group is further divided into smaller groups of six members, commonly referred to as one-to-five networks. Theoretically, the government has designed the post-triggering follow up to be carried out by the one to five networks. However, the community didn't set a collective norm against open defecation after the CLTSH triggering considering they already had that role among the one to five networks; and neither the committee elected during CLTS nor the "one to five network" took the post- triggering follow-up role.

"Most of the time the rules set against OD was not implemented. The sanitation committees that were elected by the community during CLTSH triggering don't have the power to implement the rules. This is because rules against OD were not set during CLTSH triggering, because the community already has social and health issues that was set among "one to five group". But these rules have never been implemented".

(IDI with Health extension worker).

The latrine cost and the lack of ability to pay latrine cost by the majority of people in the village were reported as major barriers for the adoption of improved latrines. It was inferred from the FGD participants that the average cost of low quality traditional pit latrines was US$13-17 which was still perceived as too expensive by some poor community members. An improved latrine costs an estimated US$260-304.

6.4.4 Societal level factors

Climate and soil formation emerged as the major challenge for sustained latrine adoption. As expressed by the community members, the soil formation is spongy, holds too much water during wet season and it cracks whenever it dries during the dry season making latrines collapse.

"The soil in our surrounding is a dark black soil. It holds much water when it rains, and it cracks whenever it gets dry that makes latrines collapse. At that time, we go for open defecation.

(IDI, owners HH, 38 years old man).

The community members build latrines with local materials such as grass and straws that are unable to cope with the ever-changing soil and climatic conditions. Participants expressed their discontent saying that poor quality pit latrines easily collapsed during the rainy season. Various adaptation strategies to overcome latrine collapse were reported by the community members to overcome Latrine collapse. Respondents reported that the roots of broad trees help to keep the soil from slide and prevented latrine from collapse as it was expressed by most of community members both during IDI and FGD.

"Some people dig a latrine under big trees. The root of big trees can hold the soil so deep and prevents latrine collapse. ……. But it is hard during the digging. It is not easy to dig as other places without trees. But it is very helpful. The latrine will not be collapsed".

(IDI 2, latrine owners, 35 years old man)

Digging the soil in v shape is also mentioned as a technique the community used that helped them prevent the soil from slide and their larine stayed longer without collapse.

"The soil shouldn't be dug in a straight line. It should follow a V- shape, that that has a wide opening and narrow at the bottom. The soil will not slide if they follow this technique. Otherwise the latrines will not last longer. In addition, during the rainy season the soil absorbs and holds water and it cracks whenever it dries. Then the latrines fall. But v shape helps to prevent the soil slide and latrines stay longer"

(IDI 6, latrine owners, 45 years old man).

Participants also described that the casing of the soil using tires is the best technique that prevent latrine collapse, but non-affordable by most community members.

"We cut the tire and insert it into the hole. Some people around here have done that. They buy used and thrown tires. They dig a hole and insert like a ladder step by step. It prevents the collapse. It increases the strength of the soil. Then they tie it with a wood at the top so that it will not slide. Then the upper wall will be covered with a wood".

Participants explained that selecting the higher location in their compound for latrine construction prevent flood getting into the latrine.

"The other option is to prevent the water entering the latrine; you have to select the location. You must see the land slope in your compound and build a latrine on a higher level. If you build it at lower level, the rain water comes from higher slope and enters to your latrine" (FGD 6, latrine owners, 38 years old man).

The community members mentioned that when latrines filled up with water, most people wait for the latrine to dry and use it. Some community members mentioned that they added salt in to the latrine helped the latrines dry. Non-owner households expressed that they felt less motivated to build a new latrine after frequent latrine collapse.

"I have decided that I will never try to build a latrine which is like the previous latrine. I will never build a latrine unless I get those materials and I get the capacity to buy stones and tires. It is just a waste of energy. I will wait until I get the capacity to afford buying materials to construct an excellent quality latrine".

(FGD 7, latrine non-owners, 49 years old woman).

The lack of a strong local leadership was revealed from the interview with sanitation workers. Participants of key informant interview from government staffs working on sanitation indicated that less priority has been given to sanitation during program planning, monitoring and reviews at all levels of the health system including at the district, zone and regional levels. Within the health system the communications on sanitation program were very limited, mostly it was only for reporting purpose.

"Sanitation has been given the least priority in the health system. You can see the reporting system as an example; sanitation was not included in HMIS report. The issue of sanitation has been raised at the end during the health program planning at the zonal level, may be for five minutes, and it has never been properly addressed. Sanitation has never been raised during program reviews. Less attention was given to sanitation both at the zonal and regional level compared with other programs like MCH, HIV/AIDs/, Malaria, etc."

(IDI, sanitation staff at the district level).

7. DISCUSSION

The current study determined the level of latrine adoption and latrine use; identified the complex barriers to sustained adoption of sanitation facilities at multiple levels using a socio-ecological model analysis; and determined the behavioural predictors of latrine ownership. The findings of the study showed that access to improved latrine sanitation facilities in the study area was far below the recommended level by any standards. Open defecation was less proffered by almost all participants. Several contextual, psychological and technology related barriers influenced the sustained adoption of a latrine at multiple levels.

7.1 Ownership of sanitation facilities and classification in the sanitation ladder

The study finding showed that 73% of participants own some kind latrine while only 2.2% owned improved latrine. The percentage of participants that used shared latrine, non-improved or who practiced open defecation were 1.5%, 69.3% and 27%, respectively. This finding was close to the 4% access to improved latrines in rural Ethiopia reported by the 2016 Ethiopia DHS report (67) and the WHO and UNICEF JMP report (17). Although the achievement of decreased open defecation can be celebrated, the result showed that 97.8% of people were lacking access to improve sanitation is unaccepted and far below the national target that aimed to meet 82% improved sanitation by 2015 (152). The reduction of OD can be linked to the sanitation program that uses CLTSH as the main strategy change model focuses on communities to come up with their own latrine designs that incorporate low cost, locally available materials (96). However, the implementation of CLTSH has failed to enforce the progress into the sanitation ladder after the achievement of decreased open defecation. Still sanitation programs in Ethiopia are focused on expanding latrine coverage with less emphasis given to promoting sanitation improvement.

Results have shown that there was a good level of latrine usage. Overall, 79% of latrine owners reported using the latrine consistently, and 98% of the observed latrines had an indication sign of usage. Consistent to this, the quantitative finding indicates that there is a preference of latrine by both latrine owners and non-owner households than open defecation. The indicator "satisfactory latrine utilization" was measured in this study to compare the level of latrine usage with prior studies in Ethiopia. The result shows that there was 74% latrine utilization. Various levels of latrine utilization with some level of geographical variations were reported in previous Ethiopia studies: 61% in rural Hulet Ejju Enessie Woreda (51); 62% in Bahir Dar Zuria (74), and 45-50% in Hawzen district (73). The Observed differences could be partly explained by improved latrine use behaviour as a result of the health extension program (70),and the implementation of CLTSH efforts in Ethiopia (52).

Despite evidence that indicate children's stool had higher pathogenic organisms than that of the adults (153-155), results of this study show that children's faeces were understood as less infectious, and there was limited awareness about safe child faeces management options. In this study 48% of child stool were reported to have been safely disposed in to the latrine, which is a bit higher than the data reported by DHS Ethiopia 2017, which shows 40 % safe disposal of child faces (67)

The availability and use of handwashing stations was very low. Only 11% had handwashing facilities were available within 10 paces of distance from the latrine, and only 9.8% latrines had soap or ash close to the handwashing facility. Almost all the handwashing facilities that had water had the sign that indicate recently usage. Consistent to this finding, the qualitative results revealed that handwashing practice was limited by lack of water. The low prevalence of handwashing practice was also reported by previous studies in Ethiopia. For instance, 7% presence of handwashing facilities in BahirDar (74) and 5.1% handwashing after defecation reported in Kersa district (85) were reported. Given this situation, efforts by sanitation program may not bring the intended health benefits to the community.

7.2 Socio-demographic determinants of the adoption and use of sanitation facilities

Education was found as a facilitating factor for improved sanitation and hygiene practice. Participants with a primary or secondary level of education, or households that have a child attending school were more likely to be latrine owners compared to non-educated participants, or households who don't have a child attending school. Households that had some level of education were morel likely to practice safe disposal of child stool compared with those of non-educated. Households with a family size greater than five were more likely to own a latrine compared with households with family size of five and less. Consistent to this, the qualitative result revealed that having large family size motivates households to build a latrine for a reason of protecting their family dignity. The other possible explanation for this could be larger family households can have relatively more potential labour for latrine construction than small size households. Consistent with this finding, other studies conducted in Ethiopia and other Africa countries have reported that people with a better educational status, a larger family size and a better income were more likely to be owners of latrine (21-26). However, consistent use of latrine was not associated with any of the socio-demographic variables.

7.3 Behavioral determinants of the ownership and use of sanitation facilities

Results from this study show that almost all participants reported positive beliefs about latrine. Only about 26% of latrine owners were dissatisfied with latrine, and all the data sources indicate

that latrines are preferred than open defecation. In contrast to this finding, negative beliefs and taboos about latrine were also reported by previous studies conducted in Ethiopia and other African countries. For example, the study conducted in southern region of Ethiopia indicated that the culture does not allow a woman to use the same latrine as their in-laws (116); a study conducted in Tigray region of Ethiopia reported that it is a taboo for men and women to share same toilet (73); a study conducted in Zambia reported that their culture doesn't allow in-laws like the daughter-in-law to share the same toilet (156). The possible explanation for high positive beliefs and attitude towards latrine in the current study could be the effect of health extension program that has been intensively implemented in Ethiopia for the last 10 years might increase awareness on sanitation (88) . The study showed that participants were more likely to have a positive attitude towards latrine if they value latrine for providing protection, reducing flies, avoiding shame or dignity, prevents bad smell, or providing privacy.

The beliefs that "latrine provide protection/security" was the strongest predictor of attitude towards latrine. The perceived benefit of latrine in protecting women and children from animal attack, accident or rape while they go for open defecation had the highest predictive value of attitude towards latrine. Consistent to this finding, studies in developing countries reported that among the primary motives of latrine adoption, security/safety from attack by strangers, animals and supernatural power were most frequently listed (21, 24, 28, 110). This result indicates that protection can be used as an essential tool for sanitation promotion campaigns.

Participants with the high score for perceived beliefs of latrine use to preventing flies, and avoiding smell were 3.8 times and 2.8 times more likely to have high attitude compared with participants with a low score of those beliefs consecutively. A review of sanitation research has indicted that smell was a key factor influencing sanitation behaviours in developing countries (113). On the other hand, poorly maintained latrines that smell bad might have negative influence on people's attitude towards latrine and it might leads them to open defecation (113, 114). This conclusion is supported by part of this study elsewhere that indicated clean latrines were more likely to be consistently used compared with unclean ones (157). Convenience and comfort in terms of ease of access and short distance, privacy, cleanliness, keeping dignity/fear of shame, preventing smell were the perceived benefits of a latrine. Similar positive beliefs about latrine use were reported by other studies conducted out of Ethiopia (21, 24, 26, 158).

Attitude was positively associated with latrine ownership, and a higher dissatisfaction with a place of defecation reported by open defecators compared latrine users. The positive beliefs about latrines (i.e. latrine use prevents disease, convenience, latrine provides security from danger during going out at night or distance place for open defecation, latrine increases social

status, and latrine prevents smell) were positively and significantly associated with attitude (feeling) towards latrine. Consistently, studies conducted in Ghana (26), and Tanzania (159) reported that high satisfaction with latrine use, which is the reflection of having a positive feeling for a latrine, influenced the adoption of a larine.

Results show social norm, both descriptive norm and injective norm predicted latrine ownership. Almost half of the study participants had the perception that the majority of people in their community are practicing open defecation (descriptive norm) and their referent approve/disapprove them for using latrine or open defecation (injunctive norm). Consistent with these findings, a study conducted in Zambia reported that open defecation was being commonly practiced because of its acceptance in the societal norm (160). We suggest that normative and persuasive behaviour change interventions in the current setting. Even if community-led total sanitation and hygiene (CLTSH) approach the appropriate behaviour change model in the study area, adding a social norm component to any behaviour change approaches, for instance, adding social norm messages to sanitations behaviour change communications is suggested by this study.

The current study found that attending CLTSH triggering was positively associated with latrine ownership. However, among the villages where CLTSH was implemented, few of them declared ODF and all of them returned to OD. Several studies in developing countries reported that CLTSH successful changed attaining ODF (161, 162). The lack of follow up and support during post-triggering phase was a big gap that limited the achievement of ODF in the area. In addition to CLTSH, other behaviour change communication campaign directed toward sanitation can use a normative and pervasive campaign messages. Challenges related to post-triggering follow-up emerged due to the overlap of roles between the sanitation committee elected during CLTSH triggering and the “Health Development Army (HAD)” or “one-to-five network”. Post-triggering follow-up needs to be integrated within these existing structures (HAD), other community structure with clearly defined roles. The implementation of sanction for non-compliance of the rules against open defecation is important as the Theory of Social Norm Behaviour (TSNB) indicates that people are more likely to comply to rules when they perceive that social sanctions exist for non-compliance of socially set norm (148).

High level of knowledge attained. Results of this study showed that the majority of non-adopters had a high knowledge about disease transmission through faeco-oral route, and a high intention to build latrine in the coming year. According to the health action processes of behaviour change model, the CLTSH triggering that uses a shocking or persuasive technique can help people to move people from the pre-intention to-intentional stage or to post intention

but pre- action stage in behaviour change process (163). The high intention of building a latrine might be the effect of people's exposure to CLTSH triggering. However, given almost half of intenders reported having low perceived ability, there is a low chance that their intention can be executed.

A large majority of latrine non-owners reported owning a latrine in the past years, which highlights that latrine ownership might not be sustained. Non-behavioural factors that include the environmental factors, lack of affordable latrine option, and the financial capacity of people influenced the sustained adoption of latrine.

7.4 Technological and contextual determinants of the ownership and use of sanitation facilities

The WHO benchmarking sanitation ladder and the definition of improved sanitation is poorly understood by the local sanitation staffs and people in the community. Rather, the health extension workers promote a latrine that has qualities defined the ministry of Ethiopia criteria for improved latrine that include latrine location closer to the house, has washable floor, with a wall and door made of any material that can provide safety and privacy, has a roof that prevents from rain and sun, and has a lid to cover (164). Even though the WHO sanitation ladder classification is based on latrine qualities that can separate faecal matter from environment, non-health benefit of latrine use was significant factor for adopting sanitation facilities. Latrine use was associated with having a latrine with superstructure, and a latrine with protective door, and durability was values as the best quality latrine. Consistent to this finding, studies in least developing countries suggest that sanitation facilities were valued for keep people's privacy, dignity, prestige, and health is just one of the perceived benefits (23, 24, 27, 109-111).

The collapse of latrines during rainy seasons due to poor quality, and its incompatibility with soil profile were found to be the main barriers for sustained larine adoption. Frequent Latrine reconstruction cost and efforts discouraged people from constructing new latrines and predisposed them to go to open defecation. Consistently, a study conducted in Zimbabwe reported that latrines constructed from locally available resources were less preferred options because of their low durability (123). Results of the study revealed that the durability of a latrine was the most valued quality. The community innovated various adaptation strategies to overcome latrine collapse However, there was still a lack of affordable and durable latrine product and limited construction skill.

The economic conditions people in the village unable to pay for improved latrines was identified as barriers to latrine adoption. Consistently, studies conducted in other African and Asian countries reported that high latrine cost had been the major barrier for the sustained

adoption of improved sanitation (27-29). It was inferred from the FGD participants that the average cost of low quality traditional pit latrines was US$13-17 which was still perceived as expensive for some poor community members. An improved latrine costs was estimated 260-304. A pilot study by UNICEF Ethiopia that explored the market of affordable toilet design as a business model and the willingness to pay for dome slab reported a much lower latrine cost. According to the UNICEF study, the price of cement for making one concrete slab was estimated to be 5 USD (about 150 birr (165). The cost difference might be because the later study didn't include the cost of superstructure, pit hole lining, and the door, and a bulk production of slab is more economical than the latrine cost incurred by individual households. Sanitation policy makers and programmers should promote affordable toilet production and marketing. Besides demand creation on improved sanitation, lessons learned from other developing countries show the need to expand pro-poor sanitation market development along with rapid CLTSH scale-up (166).

The results of the study showed that people who have been replacing latrines after collapse were perceived as relatively better off economically and the issue of equity of access to the poor was illustrated. Consistent to this, the 2017 JMP report indicated that Ethiopia is on the first rank among the list of countries that had big discrepancy of access to latrine depending wealth index, with the poor access to sanitation disproportionately affects the poorest (17). Despite the national sanitation strategy which stated no subsidies for household latrines (42), there is a need that the poor households provided with subsidy to ensure equity of access to improved sanitation. This suggestion is supported by the conclusion from a review of literature on public funding on sanitation that showed public subsidy works, but it fails whenever it does not take into consideration household preferences, behaviour and poor targeting (137). The study results showed that latrines that had a good status of cleanliness were more likely to be consistently used compared with non-cleaned latrines. In accordance with this finding, a study conducted in Ethiopia reported that cleanliness was the number one mentioned advantage of latrine ownership and latrine use (25). However, only 22% of the latrines had good cleanliness (22%). Sanitation programmers need to promote easily washable latrines to increase latrine usability.

Lack of local leadership may affect the adoption and sustained use of latrines. Despite the availability of strong policy and a clear strategy (42, 96), a weak implementation linked to lack of local political commitment was demonstrated. Sanitation issues were left for the health sector to deal with. However, low priority was given to sanitation within the health sector during program planning, monitoring and reviews at the district, zone and regional levels. Within the health system communication about the sanitation program was very limited, mostly it was only

for reporting purposes. Despite the one WASH approach and multi-sectoral strategy at the national level, there was limited coordinated effort has been observed at the lower local level in sanitation implementation.

7.4 Summary of findings

The study found that there is very limited access to improved latrine, and almost all the constructed pits were without slab and without pit lining. Generally, latrine use was preferred over open defecation and positive beliefs on the benefits latrine. Sanitation facilities were valued not only for health benefit, but also for security, privacy, dignity and protection reasons. Perceived influence of social norm was positively associated with latrine adoption. Participants were more likely to adopt a latrine, and to consistently use it if they have positive attitude towards a latrine. Cleaned latrines and latrines that provide privacy were more consistently used compared with dirty latrines.

Several contextual and technological barriers influenced the adoption and consistent use of sanitation facilities. The lack of access to environmentally feasible, affordable and safe toilet options are the technological barrier. The majority of people own low-cost sanitation that collapses and there was a lack of solution for the vulnerable or households where the inhabitants are physically or economically unable to construct the latrine. Lack of strong leadership at the local level that was demonstrated by less priority for sanitation, poor M&E, and only focused on demand creation on sanitation were among the identified contextual barriers that influenced the adoption and sustained use of sanitation facilities.

7.5 Validity and generalizability

Validity refers to the extent to which a test measures what we actually wish to measure (167). According to LoBiondo-Wood and Haber, there are three types of validity. Content validity, construct validity and criterion-related validity.

Content validity is the extent to which a measuring instrument provides adequate coverage of the topic under study (167). In this study, an extensive literature review was conducted to make sure the adequate items included in the data collection instrument, and review by supervisors though out the research process. Construct validity is the degree to which scores on a test can be accounted for by the explanatory constructs of a sound theory. It helps to predict correlations with other theoretical propositions (167). The questions were adopted from relevant guideline in the area of sanitation (54, 168), and published study articles that applied similar model (38). The questions that were used to measure psychological variables were developed guided by health theories (145-148). The questionnaires were evaluated by supervisors who have a relevant expertise in the current area of research, and it was pre-tested before the main study.

Adequate training was provided for the field data collectors to create a clear understanding of the instruments. The researcher made a close supervision of the field data collection. The absence of multicollinearity among independent variables was ensured.

External validity is the extent to which study finding can be generalized beyond the sample used in the study (169, 170). A large sample size was employed. Thus, the generalizability of the study from samples was enhanced. To avoid selection biased, study participants were randomly selected.

In qualitative research, reliability and dependability are concerns to maintain the accuracy and truthfulness of the scientific findings (171). In order to fulfil the credibility of a qualitative research, four characteristics should be ensured that include credibility, transferability, dependability and comfortably (171, 172) .

To ensure the credibility of the study results, the study was designed after reviewing adequate literature, and the principal investigator stayed more than a month in the study site to understand the local context and continues debriefing among the research team has been done during data collection and analysis. Conformability was endured through triangulation of data that were collected from various sources. We provided an adequate description of the context in which the study took place so that the transferability will be based on the detailed understanding of the context or setting. The dependability of the study results was ensured because all the data including tape recordings, transcripts, and field observation notes were documented stored in a secured, locked cabinet.

The study was conducted in rural Becho, which is a typical Ethiopian rural setting. Rural peoples in Ethiopia are interconnected and they share common values and societal norm. We believe that the suggestions of normative and persuasive approach in this study might be generalized for most of rural Ethiopia, where 85% of the population is residing. However, the generalizability can be limited in some context because of the diversity of population with over 80 ethnic groups in the country. However, before generalizing the findings of this study, researchers need to understand that the study was conducted in a very homogenous population with same ethnic and religion.

7.6 Strength and limitation

Strengths

- The use of the socio-ecological model and identifying multi-level barriers to recommend a range of potential sanitation interventions is the strengths of the study.
- The study used a standardized Likert scale adapted from theoretical models and determined the psychological predictors of latrine ownership and latrine use, which were among the study strengths.
- The fact that we involved a large sample size, and that we collected a preliminary background information using Focus Group Discussion (FGD) as an input for designing questionnaire is the strength of this study.

Limitations

The study the following limitations.

- Even though it was planned to select equal number of male and female participants by interviewing woman spouses in every other houses, more men (62%) were interviewed because the data collectors failed to follow the instruction strictly.
- Casual relationships between potential predictors and the outcome under investigation couldn't be established because the findings were based on a cross-sectional study design.
- Handwashing practice was measured using a proxy-indicator that was the presence of an indication signs of handwashed rather than observing the actual practice, is among the study limitations. Structured observations by trained observers to watch and record all the household member's handwashing practice at critical times such as after faecal contact, before handling food, and before child feeding is recommended in future research.
- Latrine use was measured based on the respondents' self-reported response, and data about latrine use behaviour of all the family members were collected by asking the head of household, in which reliability is a concern in both cases.
- Subjectivity and limited generalization due to the nature of qualitative study were among the limitations of the study.
- Using the IBM WASH framework in the current study, the category of variables under psychological, technological and contextual has several overlaps, which was challenging during the study design and data analysis. We could categorize the individual level factors into psychosocial, technology related, and contextual

dimensions. However, we were unable to follow this category for the household to system level analysis.

8. CONCLUSIONS AND RECOMMENDATION

8.1 Conclusions

This mixed method study was conducted to assess the behavioural and socio-ecological determinants of the adoption and consistent use of sanitation facilities in rural Becho district, Oromia region of Ethiopia. The results of the study showed 73% ownership of any kind latrine, which can be a satisfactory level of achievement of rural sanitation in Ethiopia. However, the use improved sanitation by only 1.5% of participants needs a critical attention.

There was very limited or no hygienic child stool disposal practice, and limited handwashing practice after latrine use in the study area. The finding of the study indicated that there was limited knowledge about the health risk of unhygienic child stool disposal. Having some level of education was found to be a facilitating factor for latrine ownership, safe child stool disposal, and handwashing after latrine use.

High awareness about disease transmission due to poor sanitation and hyegine was achieved. Latrines use was preferred than open defecation. Latrine ownership was positively associated with the degree of positive attitude towards latrine use and social norm. Non-health benefit that include privacy, dignity, protection, and bad smell were found the key factors influencing the attitude of participants towards latrine uptake and use. Latrines that had superstructure, clean latrines and or a latrine with protective door were more likely to be consistently used compared with latrnes with the counter values, and durability was values as the best quality latrine. However, sanitation behaviour change approaches are still focused on educating people about the risk of acquiring disease due to poor sanitation. The international monitoring measures sanitation progress is also continued focusing on only on the latrine chriteria of faecal matter separation from the environment to prevent disease.

The study showed that the sustained adoption and use of latrine was mainly influenced by the environmental condition (unstable soil and rain), added to the lack of appropriate latrine technology that can adapt the environment, and the financial capacity of the community members to pay for improved latrine. The poor were unable to replace latrines after frequent collapse.

The complex set of factors influencing the adoption and consistent use of sanitation facilities not only exist at multiple level, but also, they interrelated each other. For instance, the lack of

appropriate latrine technology, which is a technology related factor, affected the sustainability of latrine; ability factors affected the adoption of appropriate latrine technology. These factors are interdependent on each other and all of them are also likely to affect the sustained adoption and consistent use of a latrine. A single level intervention like health education will not result in ending open defecation or will not bring progress into sanitation ladder.

Poor implementation of CLTSH post-triggering follow-up affected its result. At the individual level exposure to CLTSH triggering event was significantly positively associated with latrine ownership. However, only few of the CLTSH implementation villages able to declare ODF, and none of them sustained ODF status. Lack of a strong local leadership at the lower level negatively impacted its effectiveness, showing the need to strengthen local capacity.

8.2 Recommendations

Program planners, policy makers and practitioners

The study showed that only 1.5% improved latrines, and only 11% of latrine had handwashing stations. It is critical that intensive efforts excreted to improve the progress of sanitation in to the ladder. Increasing Sanitation market development in Ethiopia is a potential for rural youth employment now, which fits with the current economic agenda of the country. Creating an enabling policy and institutional environment, will need to be pursued to increase access to improved sanitation. Government should involve private sectors in the toilet business. Emphasis is needed to increase the availability of handwashing stations, soap or ash, and water at the sanitation facilities, and ensuring that these are used.

Having some level of education wass a protective factoss for latrine adoption, handwashing after latrine use, and safe disposalof child stool, which indicated that sanitation and hyegine are not only the health agenda but also, they ate the development agenda that needs to be addresssed by all sectors including education sector.

Persuasive and normative social and behaviour change communication models are suggested to address the identified behavioural attributes to the adoption and use of sanitation facilities of the targets, which are attitude and social norm. CLTSH was the only persuasive and normative intervention in the area. Other social behaviour change interventions should use persuasive messages and normative approach. Having some education level was positively associated with increased latrine ownership. Behaviour change interventions can use the social network in the village educated people to influence their village people, or the students to take responsibility to change their own family to increase the use of improved sanitation.

The achievement and sanitation improvement should not only depend on a standard to prevent disease, other parameters that include safety/protection, privacy and dignity should be considered. Sanitation programmers should promote the construction toilet with a wall, protective door, and roof that can provide people with privacy and protection to increase its usage. In the rural areas of Ethiopia where most pit latrines don't have super structure and doors, it is important to promote low cost local materials like wood, bamboo, grass and plastic to build such latrine structures. Figure 15 below shows the recommended sanitation ladder.

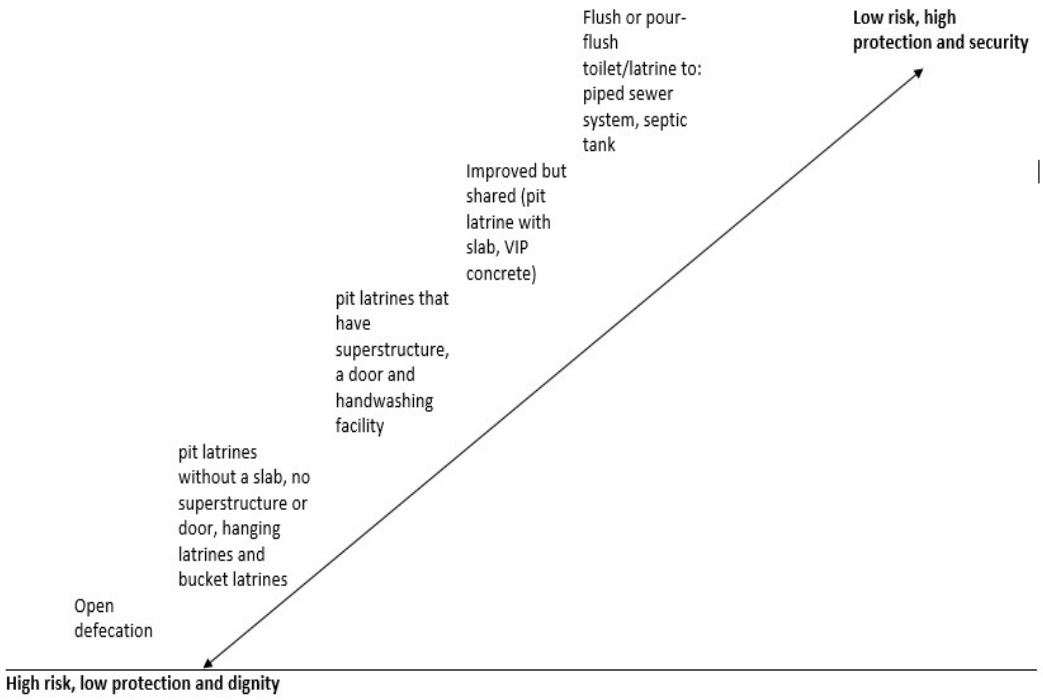

Figure 15. Proposed sanitation ladder for least developed countries

It is critical to increase access to environmentally feasible, affordable and safe toilet options Sanitation policy formulation and implementation need to include demand creation for improved sanitation, financing options for the poor or subsidy, sanitation market development, and latrine construction skill building to households. Thus, a strong political commitment is needed to enhance the efforts to achieve sanitation improvement in Ethiopia.

It is important to develop a strong local leadership and strengthen the existing community and government structure to achieve a sustained improvement of sanitation

Multi-level socio-ecological barriers influenced the adoption and consistent use of latrine. Synchronizing the efforts different sectors to align with the intended goal of increasing access to improved sanitation is mandatory.

Researchers

Based on the findings of the study, the following are suggested for further investigation.

In the country where there is a burden of diseases due to sanitation, the cost effectiveness of preventing diarrheal and other sanitation related diseases versus different investment modalities of providing access to improved sanitation is one of the research area that we recommend.

Attitude and perceived norm were significantly associated with latrine ownership. Hence, investigating the effectiveness of normative and persuasive approach is suggested for future research.

Further research is needed to explore environmentally feasible and affordable latrine designs, and the willingness to pay.

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ANNEXES

Annex I. Participant's information Sheet form for the household survey

Title: "A social-ecological-behavioural analysis of factors that influence the adoption and consistent use of sanitation facilities in rural Becho district of Ethiopia".

Researcher: Fikralem Mezgebu Alemu, BSC, MPH, PhD candidate, EIWR, Addis Ababa University

Address: Ethiopian Institute of Water Resource, Addis Ababa University, Akaki campus, tell-0924434017

Introduction: Good morning – afternoon – evening (as appropriate). My name is ----------. First, ‹ I would like to thank you for your time. We are asking you to take part in a research "Sanitation in Rural Oromia, Ethiopia: Latrine Ownership, Consistent use, and associated Psychosocial, Technological and Contextual Factors in Rural Becho District of Oromia Region, Ethiopia" The results of this study will provide program designers and implementers in government and civil society organization with sound to improve sanitation in Ethiopia in future. We want to be sure that you understand the purpose and your responsibilities in the research before you decide if you want to be in it. Please ask us to explain any words or information that you may not understand.

Information about the Research: As part of this research study, we are interviewing about 1047 people including you. You will be asked about your hygiene and sanitation related past and current practices, knowledge and attitude questions. The interview will take about 40 to 60 minutes.

Possible Risks: We do not anticipate any major risks to you because of your participation in this research. However, please note that should you choose to participate in this study, you will be taking time away from your regular activities. Thus, your personal activities may be affected. Responding questions about latrine ownership, hygiene and defecation practice may give you some discomfort. We also foresee no injury or harm, but if you do have any negative experiences, you have the choice to skip any question or terminate your participation at any given time without penalty. Please know we are interviewing you in private and keeping your responses safe, but there is always a chance someone may find out what you have told us.

Possible Benefits: The results of this study findings and recommendations for behavioural change sanitation and hygiene trachoma programs in future programs. Your participation in this

study will therefore be important to current and future similar programs. By participating in this study, you will however get no immediate and direct personal benefit.

If you decide not to be in the research: Your participation in this study is voluntary. You have the right not to participate at all or to leave the study at any time. Deciding not to participate or choosing to leave the study will not result in any penalty or loss of benefits to which you are entitled to any services in your community.

Confidentiality: We will keep information about you and your participation confidential the best we can. No names will be used on study information or materials, we will use a number code instead of your name. They will be kept confidential in a locked file drawer that is accessible only to our research team.

If You Have a Questions About the Study: If you have questions about the research in general or about your role in the study, please call Ms. Fikralem Mezgebu at +251 924434017, Or Dr. Abera Kumie, at Addis Ababa University, at +251-0911-882912, Dr.Teshome Gebre, International Trachoma Initiative at 0911203524

Do you have any questions?

Informed Consent form

With the due understanding of the aforementioned information, do you agree to participate in this research study?

YES

_____ _____

Signature Thumb print Date

No (terminate the interview)

_____ _____

Signature/Thumb print of participant Date

_____ _____

Name and signature of the interviewer Date

Supervisor's remark and signature

_____ _____

Name and signature Date

Annex II. Household survey questioners (English version)

House number or code	
Data collector's name	
Supervisor's Name	
Data and time of data collection	

Section I. Socio demographic characteristics of households

Code	Questions	Answer	Response options	Skip
Q101	Sex of respondent		Female=1 Male=2	
Q102	Age of respondent		Write in years…… Don't know=99	
Q103	Marital status		Single1=1 Married=2 Divorced=3 Separated =4 Widowed=5	
Q104	Did you ever attend school?		No =0 Informal or religious school=1 Primary school=2 Secondary school=3 Higher education=4	
Q105	What is your occupation? *Circle only one (select the one he or she spends most time doing)*		Farming =1 Petty trade(business)=2 Cattle rearing only=3 Formal employment (monthly salary) =4 Daily laborer=5 Farming only=6 Child=7 Other(written) _____ =98	
Q106	Have you ever travelled to (closes to major city)?		No =0 Yes=1	
Q107	How many people living in the house			

			____Number of adult women (19-60) ____Number of adult men (19-60) ____Number of girls (5-18) ____Number of boys (5-18) ____Number of <5 children ____Number of elderly (>60) ____Number of elderly men (>60)	
Q108	Do school agechildren (start atage7) in this? Household attend school (including religious or non-formal education)?		No school age children=0 Have school age child(ren) but don't attend =1 Some but not all school age children attend =2 All school age child(ren)attend=3	
Q109	What religion does the household follow?		Orthodox Christian=1 Muslim=2 Protestant Christian=3 Other(written) _____ =98	
Q110	What is your ethnicity?		Oromo=1 Amhara=2 Gurage=3 Tigre=4 Other(written) _____ =98	

Section II. Section II. Questions for latrine ownership and status

Code	Questions	Answer	Response options	Skip
Q201	Where is the toilet facility that members of your household normally use?		In the household latrine in the compound…. …….1 Neighbors' house/Public latrine /Open Defecation…….2	
Q202	Do you have latrine		No……0 Yes……1	
Q203	What kind of toilet facility do members of your household usually use?		Flush or pour flush toilet ……..…1 Ventilated improved pit latrine(VIP)……...….2 Pit Latrine with slab……..….3 Pit Latrine without slab…….4 Open pit……..5 Composting toilet…….6 Bucket toilet……7 Hanging toilet……8 No toilet/open field/bush……9 Other……99 If other, please specify……	
Q204	Do you share this toilet facility with other households?		No……...…0 Yes…….1	
Q205	How many households use this toilet facility?		…….	
Q206	When did you build the latrine?		Month| | | Don't know = 99	
Q207			Year | | | Don't know = 99	
Q208	Is this your first latrine		No=0 Yes=1	
	OBSERVE:			
Q209	Does it have a protected entry? *(It has a curtain or door or entrance is L-shaped)*		No =0 Yes=1	

Q210	Does the superstructure provide adequate privacy?		No =0 Yes=1	
Q211	Does the latrine have a roof?		No roof=0 Yes, that/local materials=1 Yes, iron sheet=2 Yes, plastic=3 Yes, other material: _____=98	
Q212	Where is, your latrine located from the house?		Within the compound……1 Outside of the compound……2	
Q213	How long does it take you to reach the toilet facility?		0 – 10 minutes……1 11 – 20 minutes……....2 20 – 30 minutes……...3 30 +……...….4 cannot estimated…….5	
Q214	Is there a cover/lid for the hole?		No =0 Yes=1	
Q215	Is it being used? *(Observe systematically each of the different items below and report your observations separately for each item.)*			
Q215.a	Path to latrine has been walked on		No =0 Yes=1	
Q215.b	Visibly used anal cleansing Material		No =0 Yes=1	
Q215.c	Detected faeces in pit using flashlight		No =0 Yes=1	
Q215.d	Slab is wet		No =0 Yes=1	
Q215.e	Smelly		No =0 Yes=1	

Q215.f	What is the overall cleanliness of the latrine?		Poor = 0 Fair =1 Good =2	
Q206	Does the household have handwashing facilities?			
Q207	Is there water available?			
Q208	Is there soap, ash or other type of cleansing agent present?			
Q209	Is there evidence that the handwashing facilities are used?			

Section III: Exposure to communication

Code	Description	Answer	Response option	Skip
Q301	Have you ever been advised/motivated by someone to build a latrine?		No =0 Yes=1	
Q302	If yes, who?		Health extension worker=1 Child =2 Government to official/kebele admin=3 Agricultural Development agent=4 On the radio =5 Observed others=6 A sanitation program in our community 7 Family member other than children = 8 Other(write-in) =98	
Q303	Does anyone from the family ever participated in community Led Total Sanitation triggering the past one year		No=0 Yes=1 I don't know=99	
Q304	If yes, How much regularly you rate the level participation in the CLTS triggering events		Almost never 1 Less often 2 sometimes 3 more often 4 almost all the time 5	
Q305	What did you pay for?		Labor = 1	

	After each response, prompt "anything else?" Circle all that apply.		Wood = 2 Grass/Thatch = 3 Sand = 4 Cement = 5 Slab = 6 Hinges, nails = 7 Iron sheet = 8 Vent pipe = 9 Plastic/tarp = 10 Other (write in) = 98	
Q306	In total, how much did you pay (in cash) to build the latrine?		Write total amount in Birr …… Don't know = 9999	
Q307	Did anyone help you to build the latrine?		No = 0 Yes=1	
	If yes, who helped you?		health extension worker = 1 health volunteer = 2 development agent = 3 members of the household = 4 relative not in the household = 5 neighbor = 6 kebele administration = 7 Other (write in) = 98	

Section IV: No latrine

Code	Description	Answer	Response option	Skip
Q401	Has there ever been a latrine in this household?		No =0 Yes=1	
Q402	Is there evidence of the previous latrine?		No evidence=0 Yes, a latrine is present but it is not usable=1 Yes, an indentation/hole in ground=2 Yes, part of superstructure=3 Yes, can see slab =4 Other=98 ----------	
Q403	Why did you stop using the previous latrine?		It collapsed=1 Slab broke=2 It became unsafe = 3 It was full = 4	

			Moved = 5 Smelled bad = 6 Other (write in) ---------- -- = 98	
Q404	When did you stop using the previous latrine?		Month| | | Don't know = 99	
Q405			Year | | | | | Don't know = 9999	
Q406	How old was the latrine when you stopped using it?		Write approximate # of yrs.---- ---------- Don't know = 99	
Q407	Did anyone advise you to replace it? If so, who? Circle all that apply.		No = 0 Health extension worker = 1 School child = 2 Health volunteer = 3 Government official = 4 Development agent = 5 Other = 98 Please write ----------	
Q407	Why have you not built a (new) latrine? Say "new" latrine if household previously had a latrine Select all that apply After each response, prompt "anything else?"		No space = 0 Too busy = 1 Lack of money = 2 Cannot provide labor = 3 It is not my culture = 4 Use neighbors/ families = 5 Don't need/want one = 6 Currently building one/Preparing to build = 7 Too difficult to build = 8 Did not like the previous latrine = 9 Land bad (water, rocks) = 10 Moved = 11 Other (write in) = 98 Don't know = 99	
Q408	Do you feel that you need a latrine?		No =0 Yes =1	
Q409	How high do you intend to install your own latrine in the coming one year?		Very high=5 High=4 Normal=3 Low=2 Very low=1	
Q410	Why do you feel you need a latrine? Circle all that apply.		Embarrassed by going in the bush = 1 Don't like to send visitors to the bush = 2 Safety = 3 Privacy = 4 Health benefits = 5 Told I need to build one = 6	

			Want to increase social status = 7 Other (write in) = 98	
Q411	Why do you feel that you do not need a latrine? Circle all that apply		Satisfied with bush = 1 Use neighbor's latrine = 2 Waste of money = 3 Other (write in) = 98 ----------	
Q412	Do you intend to install/ your latrine in the coming one year		No=0 Yes=1	
Q413	How much ability you think you have building your own latrine in the next one year		Very high=5 High=4 Normal=3 Low=2 Very low=1	

Section V: latrine use behaviour

Code	Description	Answer	Response option	Skip
Q501	Where is the defecation place, you use most frequently during the past one week?		Own latrine=1 Bush = 2 Neighbors' latrine = 3 Public latrine = 4 On the ground in the compound = 5 Other (write in) = 98	
Q502	How frequent do you defecate in latrine during the past one week?		Almost all the time = 5 Very often (More than 50% of defecation) = 4 Almost half of the time (about 50% of defecation) =3 Less often (less than 50% of defecation = 2 Almost never =1	
Q503	If the response is 1 or 2		No latrine or it is not	

	What is your reason for not using latrine most frequently		functional =1 staying away where there is no latrine =2 no superstructure, no privacy =3	
Q504	How satisfied are you with the place where your family defecates?		Very unsatisfied .....1 Somewhat unsatisfied…2 No opinion .....3 Somewhat satisfied ....4 Very satisfied…….5 *(If answer is 3-5, skip the next Q)*	
Q505	Where do those people who are not allowed to? Use the latrine go?		Bush = 1 Neighbors' latrine = 2 Public latrine = 3 On the ground in the compound = 4 Other (write in) = 98	
Q506	Do you have under 5 children in the house?		No……1 Yes……...……2	
Q507	If yes. How many?		Age group Name of the child 0-5 months __ 6-11 months __ 12-23 months __ 24-35 months __ 59 month __	
Q508	Do <5 children use latrine?		NO(0) Yes(1) Name of the child 1. …… _-- --- ------- 2. …… _-- --- ------- 3. …… _-- --- ------- 4. …… _-- --- -------	

Q509	The last time (name of child) passed stool, where were his/her faeces disposed?		In the toilet .....1 Waste/trash .....2 Yard .....3 Outside premises.....4 Public latrine .....5 Into sink or tub .....6 Thrown away .....7 At the well .....8 Thrown elsewhere (specify) 9	
Q510	Do any of your <5 children had diarrhea in the 2 weeks?		No=0 Yes=1	

Section VI: Beliefs on latrine benefits (Outcome expectancy)

Please indicate the extent to which you agree or disagree with the following on the benefits of using latrine.

Code	Latrine benefits	Answer	Response option	Skip
Q601	Prevents disease		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
Q602	Convenience		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
Q603	Privacy		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
Q604	Prevents not smell		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
Q605	Improves my status		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
Q606	Reduces flies		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
Q607	Cleanliness		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	

Section VII: Attitude towards latrine ownership and use

Code	Questions	Answer	Response options	Skip
Q701	How much beneficial/important to you building your own latrine in the next one year?		1 = not at all 2 = little 3 = medium 4 = much 5 = very much	
Q702	How much beneficial/important it is to defecate using latrine regularly?		1 = not at all 2 = little 3 = medium 4 = much 5 = very much	
Q703	How much do you like to use latrine?		1 = not at all 2 = little 3 = medium 4 = much 5 = very much	
Q704	How much do you do you enjoy defecating in latrine?		1 = not at all 2 = little 3 = medium 4 = much 5 = very much	

Section VIII: Disease Risk perception

Please indicate the extent to which you rate your risk perception.

Code	Questions	Answer	Response options	Skip
Q801	Do you think there is any risk you will get diarrhea because of open defecation?		1 = no → Q1001 2 = yes	
Q802	How high or low are the chances that you contract diarrhea because of open defecation practice in your community?		1 = not at all 2 = little 3 = medium 4 = much 5 = very much	

Q803	If you contract a diarrhea, how severely would that impact your life?		1 = very low 2 = low 3 = medium 4 = high 5 = very high	

Section IX: Normative factor

Code	Questions	Answer	Response options	Skip
	Descriptive norm			
Q901	Most of the people I know in the community defecate using latrine regularly.		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
Q902	How many of your neighbors' use a latrine regularly?		1 = almost nobody 2 = few people 3 = almost half of the people 4 = most of the people 5 = almost all people	
Q903	Using latrine regularly is the right thing to do because everybody does so		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
	Injective norm			
Q904	Do you think that, overall, people who are important to you rather approve or disapprove that you use latrine?		1 = almost nobody 2 = few people 3 = almost half of the people 4 = most of the people 5 = almost all people	
Q905	Most of the people in my village think I should have my own latrine		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
Q906	Defecating using latrine is regularly is something that most of the people in my village think		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
Q907	People in my village will judge me if I don't have my own		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	
Q908	People in my village can judge me if I defecate in the open field		1 = I completely disagree 2 = I disagree 3 = I neither agree nor disagree 4 = I agree 5 = I completely agree	

Section X: Future Intention and perceived ability to install a latrine

Q1101-1103 applies to latrine non-owners households only.

Code	Questions	Answer	Response options	Skip
Q1001	Do you intend to install a latrine in the coming one year?		1 = no 2 = yes	1101
Q1002	How do you rate your intention to install your latrine in the coming one year?		1 = very low 2 = low 3 = medium 4 = high 5 = very high	
Q1003	How do feel about your ability to build your own latrine in the next one year		1 = very low 2 = low 3 = medium 4 = high 5 = very high	

Annex III. Questionnaire Consent form (Oromiffa version)

Addis Ababa university fi institution Bishanii Itoopiaa(EIWR). Qoranoo haala mana fincaanii qabachuuf itti fayyadamaau Gaaffii maatii sarveeyii

Hirmaatootaa Fedhiin waa'ee qooranoo taasfame Oddeefanoo qoronichaa

Biyyaa keenyaa Ittiyoopjiyaa naannoo oromiyatti haala mana fincaanii qabachuuf itti fayyadamaa isaasaa irrati uummanii baadiyaa aadaa fi barsiifata jiru walin walqabsifnee qoranoo irratti gochuuf isin barbannee. Anni maqaan koo.....Jedhama. kanan dhufee Addis Ababa university iratti.

Annaa Becho kana keessaa uummata badiyaa jiratan keessaa naannoo namoota 1047 oola tahuu filatameera. Isinis isaan keessaa akka caraa filatamtanii

yeroo gaaffii kana isin dhiyyeesuun isin irrati midhaa fiduu tokko illee hinqabuu garuu yeroo keessan akka nu qodhaan kabajaan isin gaafana.yeroo gaafiin kan tasifnu haala mana fincaaanii qabaachuufi itti fayyadamuu isaa isiin gaafannuu kan keessaniif kan maatii keessaniin walqabsifnee isintti dhagahamu danda'a. Garuu qorannoon koon rakoo kana gara funduuraa tti hiikuuf ni gargaara waan taheef keessatti hirmaachuun kee bu'a guddaa qaba.

Dabalataan irratti hirmachuun kees hirmachuu dhisuun kee fayyada ati dhaabata naannoo kee jiru argachuu irrati fidu hinjiru. Hirmanna (marii) gootuu kan yeroo barbaadee addaan kutu dandessa.

Gaaffii yokin yaada yoo qabatan Yoo nu dubissuu bardadani Addis Ababa university supervisori Dr. Abera Kumie fi bilbilaa 0911882912 yokin Fiqraalam Mazgebuu bilbilaa bilbila 0924434017 bilbiluu ni danda'amaa

Akkuma beekamu gaaffiifi deebii dhimmaa mana fincaanii qabachuufi itti fayyadamuu isaa irratti qoorannoof tasifame irrati ummani baadiyaa aana bechoo yaada isaa feedhidhan na ibseer

Guyyaa Maqaa fi Mallattoo gaaffii taasiisee

Annex IV. Household Questionnaire (Oromifa version)

Gaaffii maatii sarveeyii

Lakkoofsa mana/Koodii?	
Maqaa daata quunanuu	
Maqaa to'ataa/Supervisarii	
Guyaa fi Yeroo itti Daatan fudhamee	Guyaa..... Yeroo Jalqabame..... Yeroo Xuumuramee.....

Kutaa I. Baayina maati, ummuriin, saalaan adda baasanii qarmeessu

Coodii	Gaaffii	Deebii	f fillamoon jiruu	Darbii
Q101	Saala gaafatama		Dhira=1 Dhala=2	
Q102	Umurii		Wagga meeqaa…… Hin beekuu=99	
Q103	Haala fudhaa/Heruumsaa/		Hinfunne/Hinheruumne=1 Fudhe/heruume =2 Seeran kan hiikee=3 Kan walhiike =4 Kan abban mana jala du'ee=5	
Q104	Baruumsa qabdaa?		Hinqabuu=0 mana amantiisa=1 Sadarka tokkoffaa=2 Sadarka lammaffaa=3 Kolleejii/university =4	
Q105	Haalti hojii kee maalii?		Qonnaa =1 Daldalaa=2 hor hiisuu =3 Hojjeetoota mootumma=4 Hojjata guyaa=5 Kan biroo= 99 _____	
Q106	Magaala guddaa deemtee beektaa		Lakki=0 Eyyee =1	
Q107	Mana kee nama meeqatu jiran		____lakk. dubatroon gaa'essa (19-60) ____ lakk. dhiraa gaa'essa (19-60) ____ Lakk. durbaa (5-18) ____ Lakk. dardageesa dhiraa (5-18)	

			____Lakk.ijoolee <5 ____Lakk mangudoo (>60) ____	
Q108	Ijoolleen waggaasaa barumsaf gahee barusmaa glalanii jiruu meeqaa dha?		Ijjolle umuriin barumsaf kan gahee hinjiru=0 Ijjolle Umriin barumsaf gahee jiran garuu baumsaa hingallee=1 Baay'een baruumsa galaniiruu xiqoon immoo hin gallee =2 Hunduu barachaa jiruu=3	
Q109	Maatiin amantaa maalii hordoftu		Ortodoksii=1 Muslim=2 Protestantii=3 Kanbiroo= 98 _____	
Q110	Sabummaa		Oromoo=1 Amhara=2 Guragee=3 Tigree=4 Kanbiroo= 98 _____	

Kutaa II. Gaafii waa'ee fincaanii qabachuu fi sadarka innijiru beekuu

Coodi	**Gaaffii**	**deebii**	**Fillannoo**	**Derbii**
Q201	Manni fincaanii maatiin kee itti fayyadamuu eesa?		Mana fincaanii Kan ofii …. …….1 Mana fincaanii ollaa, mana fincanii ummattaa, alattii/bosanatti……..2	2 yoo ta'ee gara gaafii Q301
Q202	Mana fincaanii qabdaa?		Lakkii……0 Eeyee……1	
Q203	Maatiin keessan mana fincaanii akkatti fayafdama (fotoo laalii)		mana fincaanii Ventilated improved pit (VIP)……..... .....….1 Pit Latrine with slab……...…. 2 Pit Ltrine with out slab……... ….. 3 Open pit……...….4 mana fincaanii hnjiuu ……...…5 Kan biroo……...……99 ……..	

Q204	Mana fincaanii Keesan maatii biraan nifaayyadama?		Lakki……...…0 Eyyee…….1	
Q205	Mana fincaanii keesanii maatii meeqatu fayyadama?		……	
Q206	Mana fincaanii yoom ijaramee?		Ji'aa | | | Hinbeekuu = 99	
Q207			wagaa | | | Hinbeekuu = 99	
Q208	Mana fincaaniii kun caaalqabaaf ijjarttee imoo kanan duraa hinqabda		Caalqaaba dha=0 kana duura hinqabaa=1	
	Kutaa III. Ilaaluu:			
Q209	Manni fincaanii balbaala qabaa?		lakki=0 Eeyyee=1	
Q210	Girgiddan Manni fincaanii keeaassan akka hin mul'anee ittisu nidanda'a?		lakki=0 Eeyyee=1	
Q211	Manni fincaanii sora qabaa? mal hira hojjatamee?		sora hinqabuu=0 Eeyyee, citaa irrati hoojjatame =1 Eeyee, qorqoroo irrati hojjatame=2 Eyee,plastikii irra hojjatame=3 Eeyee, meeshalee kanbiraa irra hojjatame=98 _____	
Q212	Manni fincaanii kee eessatti argama?		Dallaa Keessatti ……1 Dallaa alatti……2	
Q213	Mana fincaanii kee meetrii meeqaa fagaata?		Meetri 0<50.....…….…....1 Meetrii 51-100 ……....2 Meetrii 101 – 150…….3 Meetrii 150+…….;…...4 Hinbeekamuu....…….....5	
Q214	Bolli mana fincaanii keessanii qadaaddi qabaa?		Lakki =0 Eeyyee=1	

Q215	Mana fincaanii itti fayyaadamJiruu?			
Q215.a	Dandii gara mana fincaanii irraa deemuu ni jira?		Lakki =0 Eeyyee=1	
Q215.b	mana fincaanitti baahaanii qulquuleesitakan ittinfayyadaman jiraa.		Lakki =0 Eeyyee=1	
Q215.c	Bollati fincaaniifi sagaraa akk jiruu ibsan hinlaalama		Lakki =0 Eeyyee=1	
Q215.d	Waan jidhaaitti agarsiisa		Lakki =0 Eeyyee=1	
Q215.e	Manni fincaan ni ajahaa		Lakki =0 Eeyyee=1	
Q215.f	Walumagalumaan qulquulina mana fincaanii keessaasadarkaa maali irraa jira		Gadi aana= 1 Gidduu galeessaa=2 Gaarii=3	
Q216	Mana fincaanii bakka harkaa itti dhiqqataan qabduu?		Lakki =0 Eeyyee=1	
Q217	Bakka harka dhiqichaan Bishaan hinqabaa?		Lakki =0 Eeyyee=1	
Q218	Bakka harka dhiqichaan Saamunaa yokin daaraa waan itti qulquuleesita hinjiraa		Lakki =0 Eeyyee=1	
Q219	Bakka harkaa diqqachuu waan itti fayyadamuun isaa kan agarsiisu mallatto jiraa?		Lakki =0 Eeyyee=1	

Kutaa IV. Odeffannoo gahaa qabaachuu

Coodii	**Gaaffii**	**Deebii**	**f fillamoon jiruu**	**Darbii**
Q301	Mana fincaanii akka jjartuu namnii sittii himee beekuu jira		Lakki =0 Eeyyee=1	0 yoo ta'ee gara gaafii 303 darbi

Q302	Eeyyee Jettee, eegnuu dha		Extenshinii fayyaa .. 1 Ijolleen.....2 Qaamamootumma/durata'a gandaa……...3 Hojjata Misooma .....4 Raadio irraa .....5 Nama biraa kan mana fincaanii ijaaratee irra lale.....6 Ganda keegnati karoora qulquliinaa irra kan hojjatuuu irra barumsa argeeti..... 7 Nama Maatii yokin firaa kan tahee natti himee ..... Kan biraa.....98	
Q303	Maatiin keessa waggaa darbee karooraa qulqulina naanoo fi mana fincaa (CLTSH) irra hirmaatanii jiru?		Lakki =0 Eeyyee=1 Hinbeekuu=99	
Q304	Yeroo meqaa karooraamobilizationii mana fincaa (CLTSH) irra hirmaate jiru?		Hinhirmaanee 1 Yeroo Xinoo 2 Yeroo Tokko tokko 3 Yeroo Bay'ee 4 Yeroo Hundumaa 5	
Q305	Mana fincaa kee ijaaruuf maal kafaltee		Baasii humnaa = 1 Mukaa = 2 Margaa/citaa = 3 Ashawaa = 4 simintoo = 5 Slab = 6 Mismaara=7 qorqooroo = 8 Vent pipe = 9 Plastic/tarp = 10 Other (write in) = 98	
Q306	Waluma galatti mana fincaanii ijaaruuf hangaam baasii baastee?		Qarshi …… Hinbeekuu = 99	
Q307	mana fincaanii akka ijaartuu Namni si deegaree jiraa		lakki = 0 Eeyee=1	0 yoo tee gara Q 401 darbii
	Eeyyee yoo jettee, eegnu sigargaree		Exteenshinii fayya = 1 Feedhi fayyaaratii hojjatuu = 2 Hojjataa Misooma = 3 matii = 4 Firaa Kan maatii hintaanee = 5 oollaan= 6 Bulchaa gandaa= 7 Other (write in) = 98	

Kutaa V. kan mana fincaan hinqabnee

Coodii	Gaaffii	Deebii	f fillamoon jiruu	Darbii
Q401	Kana Duraa mana fincaanii ijaartee Beektaa ?		Lakkii =0 Eeyyee=1	
Q402	Kana Duraa mana fincaanii akka qabachuun isaaan maaliin beeksiisaa		Hinbeeksisuu=0 manni fincaanii Jira garuu fayyida hin kennu=1 Eyyee, baka qootame jira=2 Eyyee, girgidaan isaa ilaalema=3 Eyyee, bakka ta'aa jiraa =4 Kan biraar=98 ----------	
Q403	Mana fincaanii isaa duritti maaliif fayyadamu dhistanii?		Mana fincaanii Jiguuf jennan=1 Bakka ta'aan caccabnaan=2 Balaa nurraan = 3 Guutee = 4 Bakka Jijiramman = 5 Ajeefanoon = 6 Kanbiroo= 98 _____	
Q404	Mana fincaanii isaa duraaniffi fyyadamu yoom dhaabatani		Ji'aa | | | Hinbeekuu = 99 waggaa | | | | | Hinbeekuu = 99	
Q405	Mana fincaanii duraanii yeroo itti fayyadamu dhaabadanii haamam dulloomeeraa?		Tilmaman waggaa---------- Hinbeekuu = 99	
Q406	Mana fincaanii duraani sana akka jijjirtuu namni itti himeeru jiraa?		Lakki = 0 Hojjata esksteenshini fayyaa= 1 Ijjoollee barattuu = 2 Deegaraa/Volutirii fayyaa = 3 Qaama mootummaa=4 Hojjeetan Misooma = 5 Kan biroo = 98 ----------	
Q407	Mana fincaanii haara maalif inhojjatanii?		Bakka hinqabu = 0 Hojjitu natti baayata = 1 Hirinaa qarshii = 2 Humna hinqabuu = 3 Aadaa keegnaa miti = 4	

			Mana fincaanii Ollaan fayyadammaa = 5 Hin barbaachisuu = 6 Ammaa ijaaruuf qopha'ee ra== 7 Nati cima= 8 Mana fincanii isa duraa hinjaalannee= 9 Laftisa bishaan yokin dhagaa dha= 10 Jijiramaan= 11 Hinbeekuu = 98 Kabiroo = 99	
Q408	Mana fincaanii kan sinbarbaachisuu isinitti fakkaataa?		Lakki =0 Eeyyee =1	
Q409	Mana fincaanii qabaachuun hangaam natti barbaachisa jette yaaddaa?		Bay'ee baayee=5 Baay'ee cimaa =4 Giddu galleessaa=3 Xiqqaa dha=2 Baay'ee xiqqaa dha=1	
Q410	Maaliif mana fincaanii qabaachuu barbaaddee?		Bosona deemoon waan namnii nalaaluufi = 1 Keessumman akka bosona hindemneef= 2 Nagaa kootif = 3 Dhunfaa koof = 4 Fayyaa koof jedhee = 5 Ijjarii jedhamee nati himaniif= 6 Ganda keesssa kabajamuufi = 7 Kan biroo = 98	
Q411	Mana fincaanii qabaachuu maalif hin barbaannee?		Bosonatti fayadamuun waan natti toluuf = 1 Kan oolattiin fayyadama= 2 Qarshii waaniin dhaabeef = 3 Kan biroo = 98 ----------	
Q412	Bara dhufu mana fincaanii ijjarchuuf yaddattaa?		Lakki=0 Eeyyee=1	
Q413	Mana fincaan ijaarchuuf hamgam natti cima jette yaaddaa?		Bay'ee baye cima=5 Baay'ee cima=4 Gidu galleessaa=3 Gadi aanaa=2 Baay'ee xiqqaa=1	

Kutaa V: Mana fincaan ittifayadamuu

Coodii	Gaaffii	Deebii	f fillamoon jiruu	Darbii
Q501	Torbeen darbeen sagaraa bahuufi essati fayyaadamtee?		Mana fincanii kan dhunfaa kotti=1 Bosanatti = 2 Mana fincanii Kan ollatti= 3 Mana fincanii kan ummatta= 4 Dallaa koo keessatti = 5 Kan biroo = 98 ----------	
Q502	Torbee darbee keessati yeroo meeqaaf mana fincaanii fayyadamtee		Yeroo hundaa = 5 Harkaa caaluu (75% oli)= 4 Yeroo walaka (50%) =3 Walakka gadi (<25%) = 2 Yeroo Xiqqoo =1	
Q503	Yoo deebiin isaa lakk 1 yokin 2 ta'ee Sababiin isaan mana fincaanii yeroo hundaa hinfayyadamneef maalii?		Mana fincaanii hin jiiruu /faayida iinkeenuu =1 manii fincaanii fagoo dha =2 Mana fincaanii Nama agaarsiisaa =3	
Q504	Bakkii maatiin keessan bobbaa bahaan maal sitti dnagahama?		Baay'ee hin gammaduu .....1 hin gammaduu ..2 Filanoo biraa hin qabuu.....3 nigamadaa ....4 Baay'ee nigammadaa ……..5	
Q505	Nama Maaatii keessan mana fincaanii akka ittin hin fayyadamiin kan orgamu hin jira?		Lakki=0 Eeyyee=1	
Q506	Eeyyee Yoo Jeettanni, Eennnuu dna?		dubatroon gaa'essa (19-60) = 1 dhiraa gaa'essa (19-60) = 2 durbaa (5-18) = 3 dardageesa dhiraa (5-18) = 3 ijoolee <5 = 4 mangudoo (>60) =5	
Q507	Maaatii mana fincaanii akka ittin hin fayyadamiin kan orgamu eessatti fayyadamu?		Bosona= 1 mana fincaanii kan ollatti= 2 mana fincaanii kan ummata = 3	

			Dalla keessatti= 4 Kan biroo= 98 ----------	
Q508	Ijjoolnlee umuriin wagga jhanii gadii qabdu?		Lakki=0 Eeyyee=1	
Q509	Eeyyee Yoo Jeettanni, meeqaa dha		Maqaan ijoolee Ji'a 0-5 ---------- Ji'a 6-11 ---------- Ji'a 12-23 ---------- Ji'a 24-35 ---------- Ji'a 59 ----------	
Q510	Da'imman waggaa 5 gadi mana fincaanii fayyadamu ?		Lakki (0) Eeyyee (1) Maqaa Da'ma 1. …… _----- 2. …… _----- 3. …… _----- --- 4. …… _-----	
Q511	Da'imman mana fincaanii yoo hinfayyadamnaanii eessatti , bobbaa isaanii essatti gatamee? .		Mna fincaanii gatamee.....1 Baka boola kosii.....2 Naanoo qa'eetti .....3 Dalla alatti .....4 Mana fincaanii kan ummatatti...5 Yaa'ee bishaanitti…….....6 Kanbiroo……. .....99 ……..	
Q512	Ji'a darbee keessa ijjollee wagga 5 gadi garaa kaasaa qabee jira		lakki=0 Eeyee=1	

kutaa VII: Faayidaa mana ficaanii qabachuuf itti qabu ilaalchiisee

Coodii	Gaaffii	Deebii	f fillamoon jiruu	Darbii
Q601	mana fincaanii itti fayyadamuun dhukhuba ittisa		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	

Q602	mana fincaanii fayyadamuu natty tolaa		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	
Q603	mana fincaanii fayyadamuu iccitii nattii keenna		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	
Q604	mana fincaanii fayyadamuu Nageenyakoof natti toola		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	
Q605	mana fincaanii fayyadamuu nanoon akka hinhajaa orgaa		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	
Q606	mana fincaanii fayyadamuu Ummata keessati akka kabajaa argachuuf godha		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	
Q607	mana fincaanii fayyadamuun titsiisa orga		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	

Kutaa VIII: Ilaalchaa ummata mana fincaanii qabaachuuf itti fayyadamuu ilaalchiisee

Coodii	Gaaffii	Deebii	f fillamoon jiruu	Darbii
Q801	Mana fincanii dhunfaa kee ji'aa ja'a keessatti yoo ijjaratee faaydaa isaa hammami		1= Baay'ee xiqqoo 2= xiqqaa 3= Gidduu gallessa 4= Ol'anaa 5= Baay'ee ol'anaa	
Q802	Mana fincannii yeroo hundaa ittin fayyadamuu faayiaa isaa hammami		1= Baay'ee xiqqoo 2= xiqqaa 3= Gidduu gallessa 4= Ol'anaa 5= Baay'ee ol'anaa	
Q803	Mana fincannii ittin fayyadamuu hammami jaalattaa?		1= Baay'ee xiqqoo 2= xiqqaa 3= Gidduu gallessa	

			4= Ol'anaa 5= Baay'ee ol'anaa	
Q804	Mana fincannii ittin fayyadamuu hammami si gammachiisa?		1= Baay'ee xiqqoo 2= xiqqaa 3= Gidduu gallessa 4= Ol'anaa 5= Baay'ee ol'anaa	

Kutaa IX: dhibee mana fincaanii fayyadamu dhisurra dhufu Sodaachuu

Coodii	Gaaffii	Deebii	f fillamoon jiruu	Darbii
Q901	Alat'ti Bobaa'uun dhibee natti fidaa jettee yaadaa?		1= Baay'ee xiqqoo 2= xiqqaa 3= Gidduu gallessa 4= Ol'anaa 5= Baay'ee ol'anaa	Q1001
Q902	dhibee sababa alatti Bobaa'uun kan dhuufun naqabamu hamam dan'a jeetee yadaa		1= Baay'ee xiqqoo 2= xiqqaa 3= Gidduu gallessa 4= Ol'anaa 5= Baay'ee ol'anaa	
Q903	Sababa alatti Bobaa'uun dhinbee yoo qabatamtee hammam midhaa natti fidaa / saaxila nabaasa jettee yaada		1= Baay'ee xiqqoo 2= xiqqaa 3= Gidduu gallessa 4= Ol'anaa 5= Baay'ee ol'anaa	

Coodii	Gaaffii	Deebii	f fillamoon jiruu	Darbii
	Adaa Descriptive (yaada kee ibsii)			
Q1001	Ummanii hedduu yeroo hundaa mana fincaanii itti fayyadamuu		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	
Q1002	Olaan kenaessan nama hangam tahuu bobbaa mana fincaanitti baha		1= Eennyuulee hinfayyadamu, 2 = nama xiqootu fayyadamaa, 3 = Nama Baay'ee tu fayyadamaa, 4= Nama heduut fayyadama, 5= Namni hunduu fayyadama	

Q1003	Ummanii hunduu mana fincaaniiti waan fayyadamuuf, anilee mana fincaanii fayyadamun sirri dha jedhe yaada		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	
	Aadaa Injunctive			
Q1004	Namnii sitti dhiyaatuu ganda kee keessaa mana fincaaniibfayyadamu/hinfayyadamuu kee moruu ykn waligaluu dandaiaa		1= Eennyuulee hinfayyadamu, 2 = nama xiqootu fayyadamaa, 3 = Nama Baay'ee tu fayyadamaa, 4= Nama heduut fayyadama, 5= Namni hunduu fayyadama	
Q1005	Ummanii nanoo kana jiratun hundi akka ati manacaanii qabdutti si yaaduu		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	
Q1006	Ummanii hunduu mana fincaaniiti yeroo hundaa ittin fayyadamuun sirri dha jedhani yaadu		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	
Q1007	Ummanii nanoo kana jiratun ani man fincaanii dhuunfa yoo hinqaabnee nakomachuu danda'aan		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	
Q1008	Ummanii nanoo kana jiratun ani yoo alattii bobaaa'ee nakoomachuu danda'aan		1= Guutuma guututti wali hin galuu 2= wali hin galuu 3= hin mormuus hin degarsus 4= waliin galee 5= Guutuma guututti wali galee	

Annex V. In-depth interview guide with household heads

Participant IDNO |__|__|__|__| Gender Male / Female Kebele conde |__|__|

Date |__|__/__|__/__|__|

Introduction

I am _____ from _____

- ✓ General purpose of the study
- ✓ Aims of the interview and expected duration
- ✓ Who is involved in the process
- ✓ Why the participant's cooperation is important
- ✓ What will happen with the collected information and how the participant/target group will benefit
- ✓ Any questions?
- ✓ Consent

Warm up

Can I ask some details about you and your family?

How many people live in your family including yourself_____

Highest Educational Grade attained ___

Years in the current resident |__|__|yrs|__|__|mths

Are you originally from this area/district? □ Yes □ No

How old are you? ----------

Now I am going to ask you some questions about yours and your family practice on larine ownership, and latrine use

Domain	**Topic and Probes**
Latrine adoption status	Did you ever have a latrine? • Yes, I own larine now: group 1, • I don't have now, but I had it before - group 2; • I never had it - group 3

Individual perception about the values of larine *(All groups)*	What do you think of use of latrine? How do you see the sanitation situation in your surrounding? What are the advantages, importance, disadvantages and problems? - Latrine: own larine? And shared latrine? - Open defecation?
Motivations and challenges for building a latrine *This question will be asked for group 1 only*	What was your motivation factor for deciding to construct latrine? Is it your first? or subsequent latrines Who initiated you to build it? Why you decided to build it? What is your impression about having your own latrine? Was there any problems or difficulties you faced when you build a latrine? - Land? - Materials – what materials? How acquired? Where? - Distance - Cost - Labor – who built? Other?
Past latrine experience for latrine adoption (group 2)	What was your reason for stopping to use the previous latrine? What do you feel about the previous latrine? Was it good or bad? Why? What is your reason for not rebuilding it?

Latrine use, and habits and patterns of the defecation site for the family *(For all groups)*	Where is the defecation place that your families usually uses? Where is your place of defecation for you or your families when you/other are at home? Outside of home? For adult men Adult women? Younger children? How and why the defecation site(s) is (are) chosen, for self and household members? How easy or difficult is to find a latrine for use during the morning time? During day time? During the night time? For adult men Adult women? Younger children? Why?
Feeling about place of defecation *(all groups*)	What are the advantages of present defecation site? do you felt satisfied with it? why Disadvantages, concerns, problems with present site
Technological factors Perception about the quality, design, strength and weakness of latrine *(group 1 only)*	Can you tell me the kind of latrine you build it? How do you see the quality of your larine, is it good or bad? How? What does it need to be good quality? What is your reasons for design and construction this choice of latrine Is there any challenge you faced related with the design of a latrine? Explain it

	How old is your latrine? Have you ever repaired or maintained your latrine? If not, what are the challenges that influenced you for not doing that?
Barriers for constructing latrin	Describe the ground conditions which made building the latrine difficult? - Sandy soil - making the pit collapse? - Rocky – making it difficult to dig? - High water table – making the pit collapse? - area prone to flooding? How have these conditions discouraged people from rebuildingWhat difficulties have you faced in getting the follow ing to build/rebuild the latrine - easy - Land? - Materials – what materials? How acquired? - Labor – who built? Has lack of space prevented you from moving/ rebuilding your l atrine? Explain. Let us talk about the cost. How much did your latrine cost to build? How did you finance it?

	Did you have to borrow money to do it? How much does it cost to maintain (clean and repair) your latrin e? Is that affordable? Can you afford to maintain your latrine? Could you afford to re -build it if it collapsed or the pit filled up? Did the availability or lack of credit for toilets influence you? What credit facilities are available in your area? Did you get a l oan to build your latrine? Have you repaid it? Can people get access to materials for building a latrine? Is it a challenge? Where can they buy? Is it affordable by most people in the village? Did support from other people in your community help/encoura ge you to build and maintain your toilet? Who organized the support; was it formal or informal? What support were you given (describe)?
Access to latrine use *(only group 1)*	Are all members in the household allowed to use the toilet? Is the latrine accessible and safe for use by children? Is the latri ne accessible and easy to use by the elderly? How can school children access larine during morning? at night time? Is it different for male and female? What about the adult male? Adult women?
- Community commitment to abandon open defecation - Local leadership. - Collective efficacy for supporting and maintaining consistent latrine use	How do you see the Community commitment to abandon open defecation? What pressure was used by community leaders to foyou to build a latrine? - Are there rules/by-laws against open defecation? Are there fines/ penalties? Were there deadlines to build latrine? - Did you receive visits by leaders to exert pressure to end open defecation? Who forced you? How?

Future intention For discontinued owners and non-owners *(group 2 and group 3)*	Have you considered installing a latrine, why or why not? Do you have any preference of the latrine design or Style? Would you tell me more about it? What is your reason for the specific choice?
Closing Summarize, Thank participant, Provide extra information and contacts to participants	

Annex VI. In-depth interview guide with health extension workers

Participant IDNO |__|__|__|__| Gender Male / Female Kebele code |__|__| Date |__|__/__|__/__|__|

Introduction

I am _____ from _____

- ✓ General purpose of the study
- ✓ Aims of the interview and expected duration
- ✓ Who is involved in the process
- ✓ Why the participant's cooperation is important
- ✓ What will happen with the collected information and how the participant/target group will benefit
- ✓ Any questions?
- ✓ Consent

Warm up

Can I ask some details about you and your job?

Job _____

Highest Educational Grade attained ___

Years in the current job on the kebele |__|__|yrs|__|__|mths

Are you originally from this area/district? □ Yes □ No

How old are you? ----------

Now I am going to ask you some questions about your experience, challenges and opportunities related with owning, sustaining and consistently using latrine in your village.

Domain	Topic and Probes

Perception about rural sanitation in the community	What is your current role with promotion of sanitation (latrine) in this community? Would you tell us about situation of rural sanitation in your kebele? What percentage of households' own latrine, do they use it? Its functionality?
Challenges and opportunities for latrine adoption and use	Why people adopt latrine? Are there people who adopt latrine, discontinue and returned to open defecation? why
program implementation to improve sanitation	What kinds of activities were/are being implemented to improve sanitation in your community? By whom? Probes: what is the approach you usually implement? What factors affect whether people to accept this approach? What factors accept people to implement constructing latrine, or using latrine?
challenges and future recommendations	Can you tell me the major strengths of sanitation promotion over the last years? What makes it successful or strong? What makes it less successful or what were the weaknesses? Probes: Do you think sanitation promotion be implemented in any differently way? How?

- Community commitment to abandon open defecation - Local leadership. - Collective efficacy for supporting and maintaining consistent latrine use	How do you see the Community commitment to abandon open defecation? What pressure was used by community leaders to foyou to build a latrine? - Are there rules/by-laws against open defecation? Are there fines/ penalties?
Closing Is there anything else you think is important to tell me about sanitation? ✓ Summarize ✓ Thank participant ✓ Provide extra information and contacts to participants	

Annex VII. Participant's Information sheet for in-depth interview

Introduction: Good morning – afternoon – evening (as appropriate).

My name is --------. from Addis Ababa University, Ethiopian institute of water resource. First of all‹ I would like to thank you for your time. We are asking you to take part in research study to explore factors that influence latrine ownership and use.

The results of this evaluation will provide program designers and implementers in government and civil society organization with sound evidence about sanitation in future programs. We want to be sure that you understand the purpose and your responsibilities in the research before you decide if you want to be in it. Please ask us to explain any words or information that you may not understand.

Information about this Research: As part of this research, we will be talking to more than 15 key informants like you. We will ask you your opinion what factors affect the ownership and use of latrine. The interview will take about 40 to 50 minutes.

Your Part in this Research: You will be asked questions by an interviewer who will be following the prepared interview guide for this study. This will be done in a private place where you feel no one can hear what you are saying.

Digital Recording: We would like to audio record the interview to remember everything you tell us. Later, we will listen to the audio recording and write down the discussion. The information from the interviews may be presented at professional meetings or in written articles. We will not mention anyone's name in presentations or written papers. We will erase the recordings once the study has been completed.

Possible Risks: We do not anticipate any major risks to you because of your participation in this research. We will keep information that you provide in the strictest confidential way.

Possible Benefits: The results of this study findings and recommendations will inform future programs. Your participation in this study will therefore be important to current and future similar programs. By participating in this study, you will get no immediate and direct personal benefit.

If youdecidenot to be in the Research: Your participation in this study is voluntary. You have the right not to participate at all or to leave the study at any time. Deciding not to participate or choosing to leave the study will not affect you, and you will not be hindered from any services in your community.

Confidentiality: We will keep information about you and your participation confidential the best we can. We will not use names on study information or materials; we will use a number code instead of your name. We will keep all the data collected confidential in a locked file drawer that is accessible only to our research team.

If You Have a Questions about the Study; If you have questions about the research please contact Dr. AberaKumie, at Addis Ababa University, at +251-0911-882912; or FikralemMezgebu, the principal investigator of this research at 0924434017. Now, do you want to ask me anything about the purpose or content of this interview?

Informed Consent form

With the due understanding of the aforementioned information, do you agree to participate in this research study?

YES

_____ _____

Signature Thumb print Date

No (terminate the interview)

_____ _____

Signature/Thumb print of participant Date

_____ _____

Name and signature of the interviewer Date

Supervisor's remark and signature

_____ _____

Name and signature Date

Annex IX. Participant's information sheet for FGD

Introduction: Good morning – afternoon – evening (as appropriate).

My name is -------- from Addis Ababa University, Ethiopian institute of water resource. First of all‹ I would like to thank you for your time. We are asking you to take part in research study to explore factors that influence latrine ownership and use. The results of this evaluation will provide program designers and implementers in government and civil society organization with sound evidence about sanitation in future programs

Information about this Research: we will discuss you are about your perception and the community practices on latrine ownership and latrine use. The purpose of this study is to explore the values, contextual factors that influence latrine ownership/use and predispose to open defecation practices,

Your Part in this Research: We would appreciate your responses to some questions about this. There are no right or wrong answers. Please tell us what you really think

Confidentiality: The information you give us is completely confidential, and we will not associate your name with anything you say in the focus group. I will not write down your name so that the answers you give cannot be linked to you.

If you decide not to be in the esearch: You may refuse to answer any question or withdraw from the study at any time. Not accepting to participate rending your participation will not affect any services you will receive in your community.

Digital Recording: We would like to tape the focus groups so that we can make sure to capture the thoughts, opinions, and ideas we hear from the group. No names will be attached to the focus groups and the tapes will be destroyed as soon as they are transcribed. We understand how important it is that this information is kept private and confidential. We will ask participants to respect each other's confidentiality

The discussion may take one and half to two hours

If you agree to participate in this focus group, please sign on the signing sheet

If You Have a Questions about the Study: If you have any questions now or after you have completed the questionnaire, you can always please contact Dr. AberaKumie, at Addis Ababa University, at +251-0911-882912; or FikralemMezgebu, the principal investigator of this

research at 0924434017. Now, do you want to ask me anything about the purpose or content of this interview?

Informed Consent form

With the due understanding of the aformationed information, do you agree to participate in this research study?

YES

_____ _____

Signature Thumb print Date

No (terminate the interview)

_____ _____

Signature/Thumb print of participant Date

_____ _____

Name and signature of the interviewer Date

Supervisor's remark and signature

_____ _____

Name and signature Date

DECLARATION

I declare that the study on "*social-ecological and behavioural determinants of rural sanitation: a mixed method study in Becho district of Ethiopia"* is my own work and all the sources consulted, the data that are presented and, the words that are quoted are reliable source and, this work hasn't submitted previously to any of the institutions. All the resources and materials used for the dissertation, have been fully acknowledged.

Name: _Fikralem Mezgebu_

Signature: _____ Date___June 5, 2018

Place:___Addis Ababa University, Ethiopian Institute of Water Resources

Date of submission: _June 10,2018

Supervisors

This work has been done under my supervision.

Dr Abera Kumie
Supervisor (Primary) _____ Signature

Dr Teshome Gebre
Supervisor (Secondary) _____ Signature