A cross-sectional investigation of sanitation and water services and related factors among residence of Negele town, Arsi zone, southeast Ethiopia

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Abstract

Background Access to at least a basic water supply service and improved sanitation contributes to human health and socio-economic development of a country. This study was conducted to assess the sanitation and water services coverage and related factors among dwellers of Negele town, Arsi zone, southeast Ethiopia

Method Two Kebeles (administrative units) were randomly selected from each of the three zones of the town to collect data via questionnaires from randomly selected households (380), via interview from purposely selected key informants (40) and via personal observation employing a cross-sectional survey design from April-May 2018. Data were analyzed using microsoft Excel program and results were expressed using table as frequency and percentages .

Result Latrine coverage of the town was low (45%) mainly due to shortage of land or fund and expansion of building illegal houses. Among the available latrines, 75% were closer than the recommended distance (6m) to kitchens, 52.3% lacked roofs, 53% lacked doors, and 100% lacked hole cover (sheet of metal or wood which are commonly advised to be put on the small hole of the latrines) and water to clean. Latrine lacking households defecate at various sites of the environment with problems on environmental sanitation, personal safety and health. Similarly, water service coverage was very low (7.6%) as a result of deficient water sources and non-functioning pipe lines forcing the people to use unprotected water sources or expend much time in fetching water from others' private taps. The administration of the town had planned to build four public toilets and raise its water supply coverage to about 70% by 2018/2019.

Conclusion Latrine and water service coverage of Negele town was so low implying it is not on a track to achieve the United Nations (UN) sustainable development goal target 6.1 and 6.2. This may initiate the administration of the town to provide land, arrange loan or search for aids for the construction of standardized private and public toilets. Searching additional water sources like underground water and maintaining non-functional and/or constructing new pipe lines may also be promoted to improve the water service coverage of the town. The plan of the administration of the town should include long term plan, be public participatory and target the UN sustainable development goals.

1. Background

Access to potable water and sanitation facilities like latrine is a basic human right and is related to social and psychological well-being, public health, socio-economic development and environmental sustainability [1]. However, millions of people living in developing countries lacked access to such facilities due to fast population growth, poor service provision, poor economic and educational status. They are conditioned to practice open defecation, expend lots of time and energy in fetching water and to suffer from and die of a wide range of preventable diseases. Recognizing these, United Nations; UN [2] set sustainable development goal target 6.1 – universal access to safe water and 6.2 – universal access to sanitation by 2030.

Open defecation has been commonly practiced throughout Ethiopia, for instance by 28 million people in 2015, due to lack of hygiene awareness, adequate policy and income [3]. Sanitation coverage of the country was about 71% in 2015 and approximately, 42% of the Ethiopians lacked access to safe water in 2017 [4] **though the country** targeted 100% improved hygiene and sanitation coverage by 2015; extension of safe water supply to 98% and 100% of rural and city dwellers by 2020 via Water, sanitation and hygiene (WASH) program [5]. Open defecation and lack of access to safe water might have contributed to the wide prevalence of common water borne diseases, and some recently emerged life threatening Acute Watery Diarrhea (48 814 cases and 880 deaths in 2017; [6] and cholera (614 cases, [7]) in Ethiopia. In 2017, the Ethiopia's national at least basic drinking water estimate and basic sanitation estimate were only 41% and 7%, respectively [8]

Urban expansion with continuous inflow of population from rural areas can lead to constraints on water and sanitary services. Scientific inquiry is necessary to determine the water and latrine service coverage of an area so as to predict the environmental and population health risks and implement appropriate measures. Such studies have been conducted in some parts of Ethiopia. [9] reported a 58.4% latrine coverage for Bahir Dar Zuria District, north western Ethiopia. [10] also reported that about 68 % and 95 % of the inhabitants of Wolaita Sodo Town (Southern Ethiopia) had access to improved water supply and latrine, respectively. According to [11], 31.2% of respondents of Gonji Kolela Woreda in West Gojjam Zone, northwestern Ethiopia were using either river or unprotected spring for their domestic consumption [12] indicated the possession of latrine by 89% of households in Diretiyara, Eastern Ethiopia. Similarly, [13] reported latrine coverage of 27.5% for Chiro Zuria Woreda, eastern Ethiopia

This research was conducted at Negele town, south east Ethiopia, which was established on the landscape of 300 hectares in 1984. A portion of its residents have access to latrine and water service whereas others practice open defecation and use unsafe water sources. However, no study has been done to assess the latrine and water service coverage of the town. Thus, this study was initiated to determine the latrine and water service coverage, and associated factors of the town so as to contribute to future efforts to achieve the national goals of the country in providing access to improved sanitation and water supply.

2. Methods

2.1. Description of the Study Area

This research was conducted at Negele town, located in Guna Woreda, Arsi zone, Oromia region, southeast Ethiopia (7°21'N 38°42'E). The town was established on the landscape of 300 hectares in 1984. It is located 204 km away from Addis Ababa, the capital city of Ethiopia. Negele town experiences mild climate with mean annual temperature and rain fall ranging from 12-23°C and 700-1300 mm, respectively. The population size of the town was 22,578. Negele town has been administered at municipality level since 2000 and has its own administrative structure led by mayor. The town is demarcated by different rural “Kebeles” (the lowest administrative unit in Ethiopian): Amuma-Arago in the east, Nano Jawi in the west, Nano Hecho in the north and Cire Anole in the south. It has a primary school, a secondary school and a health centre. The economic activity of its surrounding population is predominantly agriculture, comprising farming and cattle breeding.

2.2 Study design and population sampling

A community-based cross-sectional qualitative and quantitative descriptive survey was conducted at Negele town from April 01 to May 31, 2018. Negele town has three sub-administrative zones: Central zone (Central hindy, Center of town and Central FTC villages), Eastern zone (Najate, Sheep site and East Hendy villages) and Western zone (Western Hindy, Mosque area, and Secondary school area villages). During the study, there were 4095 households (2631 represented by males as family head and 1464 represented by females as family head due to either being single, divorced or widow) living within in the three zones of the town.

The study targeted 2729 households living within six randomly selected villages (Table 1), two villages from each zone, as they were relatively homogenous according to the preliminary information obtained from town’s administrative office. Households were randomly sampled and the sample size (369) was determined according [14]. To minimize errors arising from attrition, 10% of the sample size was added making total sample to be 406 (244 males + 162 females) making the study household. Then, proportional sample size method was applied to allocate the number of participant households to each village. Both sexes were encouraged to participate in the study. As the overall coverage of latrine and water service (P) was not known for the study area, the maximum value (60%) was considered based on the data of

the coverage of environmental sanitation with main component of national latrine coverage for Ethiopia at a 95% confidence interval (Z) and a 5% degree of accuracy (d). Respondents whose age was below 18 and above 80 were excluded so as to gather data from matured active individuals.

2. 3. Data Gathering Tools and Procedures

A recognizance survey was conducted prior to the actual study from March 24-30, 2018 to sketch out the overall status of latrine and water service coverage. Observation, interview and questionnaire were used as data gathering tools. [25] was referred in the preparation of some points in observation check lists and some questions in questionnaire and interview (See the Supplementary file 1, 2 and 3 for complete data collection instruments), but they were mostly prepared by the authors based on the prevailing conditions, community practices and the public available resources and information.

Table.1. Study villages with their corresponding zones, target and study households of Negele town during the study

No	Zones	Total households	Selected villages	Target households	Sampled households (n=406)			
					Frequency		Total	%
					Female	Male		
1	Central	1718	Center of town	590	34	54	88	21.67
			Center of FTC	555	36	46	83	20.4
2	Eastern	1353	Sheep site	382	23	34	57	14
			Najate	520	30	47	77	18.96
3	Western	1024	Western Hindy	417	24	38	62	15.27
			Mosque area	265	15	25	39	9.6
Total	3	4095	6	2729	162	244	406	100%

Source: [16]

Latrines were observed for the presence of doors, roofs, hole covers and water supply during households' filling questionnaires according to the prepared observational check list. The households were sincerely requested and their consent was obtained to allow the data collector observe what were planned. Fetching of non-tapwater sources (river) and private tapwater were observed. Various fields were also observed for open defecation and sanitation.

Structured questionnaire was administered to gather data related to the households' socio-demographic characteristics, occupation, educational level, source of water, presence or absence of latrines, latrine door, hole cover and roof, where they defecate and what problems they have faced in case they lacked latrine, for the presence of anybody who advised them to construct latrine, whether they have a plan to construct latrine in the near future, the number of people using a toilet, distance of toilet from kitchen, availability of water to clean the toilet and sewerage service to clean toilet, measure (s) taken when latrine became full, source of water, treatment(s) undertaken for non-tap water before drinking and exposure to waterborne diseases. Interview was held with 40 purposively selected key informants (head of administration of town, Kebele officials, water and health sector workers) regarding their socio-demography, presence of public toilet, factors affecting latrine and water service coverage, consequences of latrine shortage, presence of plan and its target to improve the latrine and water service coverage of the town. As a key informant, the chief administration of the town was also requested for any relevant additional information that he would like to add. Questions were prepared in English and translated into local language (Afaan Oromo). Necessary orientation was provided to facilitate the process of filling out the questionnaire or responding to the interview questions. Questions were presented in exactly the same wording and in the same order to all participants

2.4. Data validity and analysis

To test the validity, questionnaires were tested on 25 purposely selected potential respondents (19 males and 6 females) and the revised version with 0.799 Cronbach’s alpha score, considered reliable according to [26], was dispatched for the sampled population. Collected data were checked for completeness, readability or errors. Quantitative data were analyzed using Microsoft Excel program. Possible answers given to open-ended questionnaire questions and interview questions were written on a sheet of paper (tally sheets). Frequencies each response were determined and their per cents were calculated using Microsoft Excel program. Frequencies of data collected via observational checklist were also determined using tally sheet and percentages were also calculated using Microsoft Excel program. Results were presented in the form frequency and percentage using tables. Parameters in observation checklist which were not possible to check for all the households at the data collection moments were simply checked for presence and compared with the household responses to related questionnaire questions.

3. Results

3.1 Demographic Characteristics of the participants

3.1.1 Demographic Characteristics of household respondents

Out of 406, 380 (93.6%) households properly filled and returned the questionnaires. Most of them were young (18-30 years), muslims (86%) and married (68%.) (Table 2). Regarding the educational status (Table 2), 118 (31.05%) respondents had never attended formal education whereas 186 (51.6%) and 44 (11.57%) respondents had attended primary (grade 1-8) and Secondary level (grade 9-12).. Only 22 (5.78%) of the respondents completed secondary school (grade 12). The majority of the household respondents (277; 59.7%) had up to 4 family members whereas 108 (28.4%) and 45 (11.8%) of them had 5-10 and over 10 family size, respectively. The respondents have engaged in different types of jobs,.They were predominantly farmers and merchants.

Table 2.Demographic characteristics of household respondents (n=380)

Administration zones	Frequency			
	Female	Male	Total	percent
Central	68	98	166	43.7
Eastern	45	81	126	33.2
Western	25	63	88	23.2
Variable				
Age (years)				
18-30	68	57	188	49.5
31-40	45	63	141	37.1
41 -80	25	22	51	13.4
Religion				
Christian	28	40	53	13.9
Muslim	110	202	327	86.1
Educational status				
No formal education	41	77	118	31.05
primary (1-8)	66	130	196	51.56
Secondary (9-12)	19	25	44	11.57
>Grade 12	12	10	22	5.78
Marital status				
Single	27	73	100	26.3
Married	111	149	260	68.4
Widow	-	20	20	5.26
Divorced	-	-	-	-
Family size				
1-4	90	137	227	59.7
5-10	26	82	108	28.42
>10	22	23	45	11.84
Occupation				
Farmer	59	117	176	46.3
Merchant	29	91	120	31.57
Government employee	28	13	41	10.78
Daily laborer	14	-	14	3.7
Other	8	21	29	7.63

3.1.2. Demographic characteristics of the key informants

Forty key informants with socio-demographic features indicated in Table 3 were properly interviewed. Most of the key informants were males, Muslims, married and diploma holders and found within age range of 18-40.

Table 3 Demographic features of the key informants

Variable	Occupation				
	Head of town	Administration	“Kebele” official	Water sector workers	Health workers
Sex					
Male	8		5	3	18
Female	1		-	-	5
Age (years)					
18-40	7		3	3	21
41-60	2		2	-	2
61-80	-		-	-	-
Religion					
Muslim	7		5	3	14
Christian	2		-	-	9
Other	-		-	-	-
Marital status					
Single	3		1	-	8
Married	6		4	3	15
Widow	-		-	-	-
Divorce	-		-	-	-
Educational status					
Grade 9-10	3		4	-	-
Grade 11-12	1		-	-	-
Certificate	-		-	-	-
Diploma	2		1	3	15
Degree	3		-	-	8
Other	-		-	-	-

3.2. Latrine coverage, associated facilities and usage

Only 45.3% of the household respondents indicated that they had latrine (Table 4). This was also confirmed by authors’ observation check list data. Latrine coverage was lesser for Eastern zone of the town compared to central and western zones. Moreover, over 60% of respondents who had latrine indicated that a latrine was used by more than 5 people.

The majority of the available toilets were built without skill and technology lacking associated facilities (Figure 1). Fifty seven (33.13%), 54 (31.4%), 18 (10.47%) and 43 (25%) of latrine owning households said that their latrines are 3-5m, 2-3m, 6m and greater than 6m away from kitchens, respectively. Data collected using observation check list revealed that higher percentage of households’ latrine (43.6%) was located at a distance less than 6m from the kitchen (Table 8) compared to the value (35.5%) obtained via questionnaire.

Figure.1 – Appearances of some latrines of the respondents of Negele town in 2018 (Photo by Girma Deboch, 2018).

More than half (52.3%) of the households replied that their latrine lacked roofs. Roughly, 50 % of households from the Central or Western zones indicated the presence of latrine roofs whereas only 38 % Eastern zone households indicated the presence of latrine roofs. Fifty three percent and 100% of the households indicated the absence of latrine doors and hole cover, respectively.(Table 4). Data pertaining to latrine roof, wall and hole cover obtained via observation (Table 8) matched with that of questionnaire. The roofs were made from sheet of metals or wood covered with grass, plastic or sheet of fertilizer sacs. Similarly, the walls were made from fenced wood or plastics or other material supported by woods (Figure 1) to prevent exposure of the users or access of animals. Residents have usually been advised by health extension workers to put a sheet of metals or wood on the small hole of the latrine (called “hole cover” in this article) to protect flies, but none of them had done it.

The entire latrine owned households pointed out the lack of water to clean their latrine (also confirmed via observation) and sewerage service to clean their latrines when they became full. The lack of sewerage service to clean full toilets had also forced the respondents to dig new toilets (70%) or drain to the environment (30%) (Table 4). Moreover, only 6 (3.48%) latrine owning households perceived their latrines as clean and good for health in contrast to 166 (96.51%) that considered their latrines as unclean, usually dirty and unsuitable for health. Authors' observation supported the latter as indicated in Figure 1.

Table.4.Responses of households of Negele town regarding latrine coverage and associated facilities.

Variable	Zones of Respondents (n=380)			Total	%
	Center	East	West		
Presence of own latrine					
Yes	82	40	50	172	45.3
No	84	86	38	208	54.7
Number of latrine users					
1-5	33	12	20	65	37.8
6-10	30	8	20	58	33.7
Greater than 10	19	20	10	49	28.5
Distance of latrine from kitchen (m)					
2-3	27	11	16	54	31.4
3-5	28	17	12	57	33.1
6	9	5	4	18	10.5
greater than 6	18	7	18	43	25
Presence of latrine roof					
Yes	41	15	26	82	47.7
No	41	25	24	90	52.9
Presence of latrine door					
Yes	39	24	18	81	47.1
No	43	16	32	91	52.9
Presence of latrine hole cover					
Yes	-	-	-	-	-
No	82	40	50	172	100
Presence of water for cleaning latrine					
Yes	-	-	-	-	-
No	82	40	50	172	100
Presence of sewerage to clean latrine					
Yes	-	-	-	-	-
No	82	40	50	172	100
Whether latrine became full and overflowed earlier or not					
Yes	36	9	12	57	33.1
No	46	31	38	115	66.9
Measures taken when latrine was full					
Digging new toilet	65	20	36	121	70.3
Drainage to Environment	17	20	14	51	29.7
Perception of one's own latrine					
Clean and good for health	5	-	1	6	3.48
Dirty and unsuitable for health	77	40	49	166	96.5

3.3. Absence of latrine and associated factors

Shortage of income and land was the reason raised by the majority of households for not having latrine (Table 5). However, most of interviewed key informants pointed out low involvement of the administration of the town, low residents' awareness/attitude related issues as the main factor that had hindered the residents from building their own toilets (Table 7). Latrine lacking households were used to defecate in open fields (56; 26.92%), in bush (54; 26%), in house compounds (80; 38.5%) or in any places as needed (18; 8.65%) (Table 5; Figure 2) as there were no public toilets as an alternate. Similarly, 100% and 43% of the key informants confirmed the absence of public toilet and the existence of open defecation practice in the town, respectively (Table 7). The authors observed no public toilets in the town during the study. Practices of open defecation in different parts of the town was also noticed by the investigators during field survey as a result of shortage of private latrine together with lack of public latrine (Figure.2). However, it was not possible to enumerate the people that practiced open defecation.. The chief administrator of the town stressed that most of the houses that lacked latrine were built by people living in the surrounding rural areas whom they found difficult to give awareness to avoid open defecation. About 50% of the households replied that they had been advised to construct toilets either by health extension workers or local leader (Table 5).

Figure.2- Some open defecation sites in Negele town (Photo by Girma Deboch, 2018)

Table 5. Defecation areas, future plans, reasons for not having latrine and problems faced by respondents of Negele town (n=208) who had no latrine prior to and during the study period

Variable	Zones of respondents (n=208)			Total	%
	Center	East	West		
Defecation areas					
open space	20	26	10	56	26.9
public toilet	-	-	-	-	-
in bush	16	29	9	54	26
in house compound	42	22	16	80	38.5
any place as needed	6	9	3	18	8.65
Reasons for lack of latrine					
no knowing the importance of latrine	-	-	-	-	-
lack of enough land	41	35	18	94	45.2
lack of enough money	36	37	12	85	40.8
other	7	14	8	29	13.9
Problems faced due to lack of latrine					
lack of safety	21	25	14	60	28.8
Infectious disease	12	31	9	52	25
pollution of living area	32	13	6	51	24.5
moving out in darkness	19	17	9	45	21.63
Person advised to construct latrine					
health extension	17	27	18	62	29.8
local leader	23	13	5	41	19.7
no body	44	46	15	105	50.5
Having plan to contact latrine					
Yes	34	25	9	68	32.7
No	50	61	29	140	67.3

Latrine lacking households expressed that they had been suffering from lack of safety, from illness, pollution of living area and moving out in dark for defecation. Similarly, 35% and 23% of the key informants expressed the prevalence of waterborne health problems and environmental pollution in the town, respectively due to lower latrine coverage (Table 7). However, 67% of toilet lacking households expressed that they had no plan to construct latrines in the near future due to income, land or information constraints as expressed earlier. The authors also noticed that most of the houses in the town were built on small plots of land without following the plan of the town and extra area to construct latrine. The chief administrator of the town, a key informant, pointed out that the administration of the town had planned to build four public toilets by 2018/2019. However, two third of the key informants had no information regarding the plan of the administration of the town at all (Table 7).

3.4. Water service coverage and associated conditions

Only 29 households, all from the Central zone of the town, replied that they had private tap water (Table 6). Few households said that they used to buy others tap water expending much of their time lining up and their energy in carrying longer distance whereas the majority of them replied that they were using unprotected water sources including ponds/rain and river; particularly Nano River travelling 3 to 5 km to the north direction of the town. These were also observed by the investigators (Figure 3) but it was not possible to count the number of people using each water source so that the numbers relied on the response of the households (Table 6)

The area of the Nano River is mountainous making it difficult to fetch water from it. Moreover, using river directly for drinking could have been created health problems as 72.6% of the respondents replied that they directly use non-tap water without boiling or chemical treatment (Table 6). Forty five percent of the households said that they had no Knowledge about the effect of impure water on health, but 51% of them said they or their families had contracted waterborne diseases.

Figure 3- "Fetching water from Nano River and transporting longer distance on the back of people (A and B) and fetching water from private tap with long waiting line (C) and transporting using horse (D) (Photo by Girma Deboch, 2018).

Table 6. Water service coverage and related conditions in Negele town in 2018

Variable	Zone of respondents(n=380)			Total	%
	Central	Eastern	Western		
Having private tap water					
Yes	29	-	-	29	7.6
No	137	126	88	351	92.4
Source of water if no one's own tap water					
Others'private tap water	39	13	4	56	16
Nano River	72	83	58	213	60.7
Pond and rain	26	30	26	82	23.4
Using protected non-tap water					
Yes	-	-	-	-	-
No	137	126	88	351	100
Treating non-tap water before deinking					
Yes, using chemicals like"Bishangari ^a or Wuhagar ^b "	15	3	3	21	6
Yes, boiling	28	26	21	75	21.4
No	94	97	64	255	72.6
Knowledge of effect of impure water on health					
Yes	82	56	55	193	55
No	55	70	33	158	45
Self or family member exposed to waterborne disease					
Yes	60	67	53	180	51.3
No	77	59	35	171	48.7

a - chlorine-based water treatment solution; b - mixture of aluminum sulphate and calcium hypochlorite solution, both are available on local markets and people are advised and encouraged to use to treat water at homes

Forty five percent of the key informants expressed non-functioning of public water pipes (Figure 4) as a factor for reduced water supply to the town. Public pipes were constructed in the town in 2010 at different places, but became non-functional since 2013 to the time of investigation.

Table 7. Key informants' response regarding latrine and water service coverage

Variable	No of Respondents=40			
	Male	Female	Total	%
Presence of public toilet				
Yes	-	-	-	-
No	34	6	40	100
Effects of lack of public toilet				
Suffering to use open defecation	15	2	17	42.5
Health problem related to waterborne diseases	13	1	14	35
Environmental pollution	7	2	9	22.5
Factors contributing to lack of latrine				
Low involvement of administration	11	2	13	30
Knowledge and attitude related problems	13	2	15	37.5
Shortage of income	5	1	6	15
Lack of enough Land	3	-	3	7.5
Lack of follow up	2	1	3	7.5
Cosequences of lack of latrine				
Moving out in the dark for defecation	18	3	21	52.5
women and girls lack safety and privacy	11	1	12	30
Suffering from bad smell when defecating around home	5	2	7	17.5
Factors hindering water service coverage				
Shortage of water from the source and lack of tanker	9	-	9	22.5
Non-function of public pipe	14	4	18	45
Low involvement of Administration	8	2	10	25
Low income of the house holds	3	-	3	7.5
Administration planned to improve latrine and tap water coverage				
yes	11	2	13	32.5
No	23	4	27	67.5
Extent to which administration planned to raise latrine and tapwater coverage				
26-50	1	-	1	2.5
51-80	6	1	7	17.5
81 &above	4	1	5	12.5
No response	23	4	27	67.5

Observational survey (Table 8) also revealed the presence of only few private taps with infrequent and insufficient water. More over all public pipes were out of function during the investigation (Figure 4). Several key informants also mentioned low involvement of the administration, inadequate amount water from the source and lack of storage tankers as contributing factors to low water service coverage of the town. However, the chief administrator of the town, also a key informant, stressed inadequacy of water as a major limiting factor for the provision of sufficient water to the town. The chief administrator also expressed that the town had planned to build water tankers and public water pipes across the town to raise its water supply coverage to about 70% by 2018/2019. Only one third of the key informants knew the existence of plan though they were not sure about planned percentage of water service coverage improvement as they put various ranges. (Table 7).

Table 8 Observational checklist used to collect data from households (n= 380)

No	What were observed (present/absent if applicable)	Yes (%)	No (%)	Remark*
1	Household latrine	172 (45.3)	208 (54.7)	
A	Latrine door	81(47.1)	91 (52.)	A to E were applied to households that owned latrine
B	Latrine roof	82 (47.7)	90 (42.3)	
C	Latrine hole cover	-	172(100)	
D	Latrine Water supply to clean	-	172(100)	
E	distance of Latrine from kitchen			
	< 6m	129 (75)		
	≥ 6m	43(25)		
2	Using public latrine	-	172 (100)	for households without latrine
3	Practicing open defecation*			Various parts of the town were observed
4	Drinking Water source (n=380)			
A	Own private tap water	29 (7.6)	351(92.4)	B to F were applied to households with no private tap water
B	Others private tap water*			
C	Public tap water		351(100)**	
D	River*			
E	Spring*			
F	Pond/rain*			

Absence or presence was checked (Figure 1. 2 and 3) but it was not possible to enumerate and calculate the percentages, ** was implicated as no functional public tap water was available in the town during the study

Figure 4-Non- functioning public pipes in study area (Photo by Girma Deboch, 2018)

Discussion

Nearly one third of the households had never attended formal education and 51.6% of them were at primary level. Over 45% were farmers. These lower formal educational levels might influence the sanitation awareness of the respondents although other sources of knowledge are there. Many people attend informal education like religion education and adult education so that they are able to read and write. Mass media, information disseminated at meeting and market places, home to home sanitation and health related information provided by health extension programs are among the various factors that can increase the awareness of the people in Ethiopia.

The key informants had better educational status, 80 % of them earned diploma (12+2) and degree (12+3 or 4) from higher education institutions. Educational status was significantly associated with use of improved water source and sanitation [10, 3]. Individuals with High school completed or above educational level demonstrated better latrine

utilization than those without formal education [15]. Possession of larger family size (5 and above by 40.2% of the households) could increase the time and energy expend to fetch water and the magnitude of open defecation when latrine and water service coverage is low as currently reported.

Latrine coverage of the town varied among its zones, being lowest in Eastern zone. The overall latrine coverage of the town (45.3%) was lower than those reported for Dukem town (70.1%; [22]), Wolaita Sodo town (91%; [10]), for Ilu Aba Bor Zone (88.2%; [17]) and the overall Oromia region (72.7%; [18]) in which Negele town is found. This difference might be due to factors like variation in awareness and socio-economic status of the people among others.

Besides lower coverage, the household respondents indicated that most of the existing latrines (64.5%) were closer than the minimum recommended distance (6m) from a kitchen according to [5]. Measurements by the authors showed that 75% of the households' latrines were nearer than 6m to the kitchen compared to household data (64.5%). The discrepancy is likely due to answering that specific question by assumption by some of the households. So, it is easy for bad odour to reach houses and for flies to carry pathogens to the kitchen where food is prepared and kept. Similarly, about 76% of respondents from Nepal indicated latrine distances from their homes were less than 6m [19].

The absence of latrine roof (52.3%), door (53%) and hole cover (100%) promotes the invasion and breeding of flies which spread diseases. Even the existing roofs were made from torn plastics or other materials which cannot protect flies or rain. Doors were also not made from good materials, not fit well and extend half the height of the latrine merely to hide the users in some cases implying the possibility of free invasion of flies. Normally, all the latrines lack hole cover and the residents did not accept or practice the usually advice of health extension workers to put sheet of metal or wood on the small hole of the latrine (called hole cover here) to protect flies and reduce bad smells. This shows the for further awareness creation and follow ups. Moreover, latrines may be filled during rainy seasons and discharged to the environment posing human health and environmental sanitary problems. Lack of cleaning water not only enhances bad odor to reach homes but also hand washing activity after using toilet. Lack of sewerage service had forced the households either to dig new toilets (70%) or drain to the environment (30%) (Table 4) that could lead to economic constraints and environmental pollution. People are not allowed to connect their latrine to wastewater pipes or channels as treatment is not practiced, but vehicles are available to withdraw wastes from latrines and dispose somewhere else in many cities or towns in Ethiopia. In areas where such facility is not available, full latrines need to be abandoned leading to land or money constrains to build new ones.

Perception of their latrine as clean, standardized and good for health (by 3.5% of the households) in the absence of good roofs and doors, and water for cleaning could be due to the household's lack of good knowledge of sanitation implying the need to raise public awareness and provide technical assistance in building latrines. In similar study, [20] reported the presence of laterine hole cover in 47.6 % of the latrines in Dembia town, northwestern Ethiopia and [13] reported that 13% of the respondents were using improved latrine in Chiro Zuria Woreda, eastern Ethiopia.

Lack of enough land and money was raised by households as the main factor that hindered them from having their own latrine letting them defecate in various sites of the environment including open fields , in bush and house compound as there was no alternative like public toilet. The investigators had also observed many open defecation sites in the town, but it was not possible to count households practicing it as many of them went out at night or early in the morning On the other hand, the key informants raised low involvement of the administration of the town, low residents' awareness/attitude related issues as the main factor that had hindered the residents from building their own toilets. This shows it is important to bring various sections of the society together to discuss and improve latrine coverage as open defecation influences environmental sanitation, human health and psychology [21]. The administration of the town and other concerned bodies should target provision of land, searching for fund and building public toilet to improve the latrine coverage of the town. Moreover, public awareness creation and mobilization should be given due

attention as 67% and 50% of latrine lacking households expressed that they had no plan and did not get advice, respectively to build latrine. [20] indicated that 88.6% of the respondents who had latrines were advised to construct latrine by health extension or community health agent personnels in a northwestern Ethiopian town, Dembia.

The plan of the administration of Negele town to build four public toilets at different part of the town by 2018/2019 may be taken as a starting step to improve sanitation of the town. But, it is not sufficient. The administration should also plan discussing with the residents and create necessary conditions for building their latrine since success cannot be achieved without public participation. Moreover, the administration should control illegal house construction whose dwellers were claimed to commonly practice open defecations due to lack of latrine.

The water service coverage (7.64%) of the town was low compared to other towns like Dukem (98.5%; [22]) and Wolaita Sodo town (68%; [10]) forcing most of the households to use unprotected Nano River without heat or chemical treatment and to suffer from waterborne diseases. Even [23] reported a 70% access to improved water of various sources (hand dug well, developed spring and rope pump) for a rural district in western Ethiopia. This shows the need to act immediately by the concerned bodies to improve water service and create awareness of the community to boil or treat water using the available chemicals like Wuha agar (chlorine-based water treatment solution) or Bishan gari (aluminum sulphate and calcium hypochlorite solution). These chemicals are available on markets and usually announced via different mass media in different languages to be used to treat water after fetching or at homes to prevent waterborne diseases in Ethiopia.

The success of the plan of administration of the town to raise its water service coverage to about 70% by 2018/2019 via building water tankers and public water pipes across the town should be encouraged. But, it should be communicated as several key informants had no information about the plan which might hold true for the other residents. The plan should also include maintaining non-functional public water pipes, developing various water sources including ground water and springs and establishing/expanding water purification and storage facilities. The plan should also target achieving the Ethiopia's plan of providing-safe water to all urban dwellers by 2020 [21 Commitment of the administration of should also be added as key informants raised its lower involvement as a cause of lower water service coverage of the town.

Generally, the latrine and water service coverage of the town was found to be much lower and showed the national Millennium Development Goal (MDG) of Ethiopia which targeted a 100% improved hygiene and sanitation 2015 [24] was not achieved though the country managed to improve sanitation coverage from just 8% (1990) to 71% (2015) and reduce open defecation from 44.3 million (1990) to 28.3 million (2015) [18]. This further indicates, the town/the country is not on track to extend safe water supply to 98% and 100% of rural and city dwellers by 2020 via Water, sanitation and hygiene (WASH) program [5] and to achieve sustainable development goal target 6.1 – universal access to safe water and 6.2 - universal access to sanitation by 2030 [2].

Conclusions

Latrine coverage of Negele town was low ($\approx 45\%$) due to shortage of land and money, low involvement of administration and residents and expansion of un-planned illegal houses. Moreover, most of the toilets of the town lacked recommended qualities. Low coverage of private toilets together with the absence of public toilets in the town had led to wide spread open defecation practices with potential and practical negative impact on the health of the community and sanitation of environment. This problem seems to continue in the near future as most toilet lacking households had no plan to construct it and the plan of the administration of the town was insufficient. The water service coverage of the town was also very low (less than 10%) due to inadequate water from sources and non-functional

existing water taps. The residents could not get potable water within reasonable quantity, time and distance besides living vulnerable to waterborne diseases.

Latrine and water service coverage of Negele town should be improved via providing land, supplying loans or searching for aids for the construction of standardized private and public toilets. Searching additional water sources like ground water and maintaining non-functional and/or constructing new water pipe should be promoted to improve the water service coverage of the town. Plan to solve shortage of latrine and water service coverage of the town should participate the residents and committed governmental and non-governmental bodies via continuous awareness creation for better outcomes, and should take the national goals and the UN Sustainable Development Goals.

Abbreviations

UNICEF - United Nation Children's Fund

WHO - World Health Organization

Declarations

Ethics approval and consent to participate

The study proposal was reviewed and approved by the ethics review committee of MaddaWalabu University, School of Computational and Natural Sciences (Permission letter number: MWU/CNCS/40/2010). Institutional permission was obtained from Negele town Administrative office before conducting the study (Permission letter number: 1397/32/7/2010). The number 2010 in the permission numbers indicates the Ethiopian calendar (EC) Which lags ten years behind the Gregorian calendar (GC). Respondents participated in the study after ensuring their consent orally and they were clearly informed of opt-out consent. Their right to withdraw from the research participation with no objection if they wish was also clearly indicated in the questionnaire. Although, formal/written consent was not taken, the participants were informed of opt-out consent. Relevant individuals encountered during field observation were also informed the purpose of the study and asked for information or taking photos after they ensured their willingness. They were ensured that the information collected would be kept confidential and used only for the research purpose.

Consent for publication

Not applicable

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Competing interests

The authors declare that they have no any sort of competing interests.

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Authors' contributions

DT identified the research problem, both authors prepared the research design. GD pretested the questionnaire, collected and analyzed data, both authors interpreted the data, wrote and approved the manuscript.

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Figures

Figure 1

Appearances of some latrines of the respondents of Negele town in 2018 (Photo by Girma Deboch, 2018).

Figure 2

Some open defecation sites in Negele town (Photo by Girma Deboch, 2018)

Figure 3

“Fetching water from Nano River and transporting longer distance on the back of people or using horse (A, B and D) and fetching water from private tap with long waiting line (C) (Photo by Girma Deboch, 2018).

Figure 4

Non- functioning pipes in study area (Photo by Girma Deboch, 2018)

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